

A DUAL BAND RF RECTIFIER FOR ENERGY HARVESTING AT 3.5 GHz AND 5.39 GHz IN 5G AND WIFI BASED AUTONOMOUS SENSING PLATFORMS

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ABSTRACT

Autonomous sensing platforms need a continuous power source yet many units depend on batteries with limited life. Ambient radio fields from 5G and WiFi systems provide a practical alternative since these signals are present in most populated environments. This work presents a compact dual band RF rectifier designed for 3.5 GHz and 5.39 GHz. The circuit uses two HSMS2850 Schottky diodes whose low barrier and fast response support efficient conversion of weak signals. The rectifier is implemented on an FR4 substrate with relative permittivity 4.4 loss tangent 0.02 and thickness 1.6 mm. Tuned matching paths ensure effective transfer of energy to the rectifying stage. The design achieves return loss values of minus 21.633 dB at 3.5 GHz and minus 19.835 dB at 5.39 GHz which confirms proper matching. The output voltage and efficiency remain stable across input powers and loads. The efficiency exceeds 38 percent at 3.5 GHz at 10 dBm and reaches more than 22 percent at 5.39 GHz. These results show that the rectifier can support low power nodes in smart city health care and industrial settings where ambient RF energy enables long duration autonomous operation.

Keywords : *Dual band RF rectifier, Ambient energy harvesting, Wireless Sensor Networks, Schottky diode, 5G communication, WiFi sensing*

1. INTRODUCTION

Wireless sensing systems support environmental monitoring industrial safety health supervision and smart city functions yet their dependence on batteries limits long duration operation and increases maintenance cost. Ambient radio fields from cellular and WiFi systems provide a practical alternative since these signals are present across most indoor and outdoor spaces. The 3.5 GHz 5G band and the 5.39 GHz WiFi band offer consistent energy levels and a rectifier that operates at both frequencies improves harvesting reliability when one band experiences reduced field strength. Effective rectification requires low threshold conduction stable impedance matching and good sensitivity at weak input levels. Schottky diodes are suitable for this role because they respond quickly and operate with minimal forward voltage. The rapid growth of 5G and WiFi networks has increased interest in RF energy harvesting as a sustainable power source for autonomous sensing and IoT