

DESIGN AND OPTIMIZATION OF A HIGH PERFORMANCE DUAL BAND RF RECTIFIER FOR AMBIENT ENERGY HARVESTING AT 1.80 GHz AND 5.2 GHz IN WIRELESS SENSOR AND IOT PLATFORMS

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ABSTRACT

Wireless Sensor and IoT systems are moving toward autonomous operation which demands reliable sources of continuous power. Ambient radio energy presents an attractive option for long duration sensing because it removes the need for battery replacement and supports deployment in remote or dense environments. The present study introduces a compact dual band rectifier designed for 1.80 GHz and 5.2 GHz which are widely used in cellular and wireless communication links. The circuit employs two SMS7630 Schottky diodes chosen for their low barrier properties and fast response which support effective conversion of weak ambient signals. The rectifier is implemented on an FR4 substrate with relative permittivity 4.4 loss tangent 0.02 and thickness 1.6 mm. The design achieves strong impedance matching at both bands with return loss values of minus twenty-nine point four six decibel at 1.8 GHz and minus thirty point one two decibel at 5.2 GHz. The circuit produces stable voltage across the load and displays consistent performance for a set of input power levels. The peak efficiency reaches about fifty-six percent at 1.8 GHz for an input power of 0 dBm and around thirty-two percent at 5.2 GHz for the same operating condition. The results confirm the suitability of the proposed dual band rectifier for low power sensing in smart city monitoring health care and industrial supervision where ambient radio fields can support sustainable operation.

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

1. INTRODUCTION

Wireless sensor networks and IoT devices operate across diverse environments and depend on a continuous energy supply which small batteries cannot support over long periods. Ambient radio fields provide a practical alternative since cellular and WiFi systems radiate steady energy in most settings. Dual band harvesting at 1.80 GHz and 5.2 GHz increases power availability because these two frequencies are widely used in modern communication. A suitable rectifier must provide accurate impedance matching low threshold conduction and strong sensitivity under weak input levels. Schottky diodes meet these requirements due to their low forward voltage and rapid response when paired with an optimized matching network. Sustained operation of sensor networks has increased