HIGH EFFICIENCY DUAL BAND RF RECTIFIER AT 3.6 GHz AND 5.8 GHz FOR DATA ACQUISITION IN WIRELESS SENSOR NETWORKS

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ABSTRACT

Wireless Sensor Networks require steady power for reliable data acquisition yet most nodes depend on batteries that limit long term operation. Ambient radio fields from modern communication systems provide a practical alternative for continuous energy supply. This work presents a compact dual band RF rectifier designed for 3.6 GHz and 5.8 GHz which are key frequencies in 5G and WiFi networks. The circuit uses HSMS2850 Schottky diodes and is built on an FR4 substrate with relative permittivity 4.4 loss tangent 0.02 and thickness 1.6 mm. A set of microstrip lines forms the matching network that guides energy efficiently into the rectifying stage. The rectifier achieves return loss values of minus 98.91 dB at 3.6 GHz and minus 78.31 dB at 5.8 GHz which confirms accurate matching at both bands. The output voltage rises with input power and remains stable for a 1 kΩ load. The efficiency reaches 36.768 percent at 5.8 GHz at 0 dBm and attains a peak of 40.682 percent at 2 dBm. These results show that the proposed design can support low power data acquisition in Wireless Sensor Networks that depend on ambient radio energy.

Keywords: Dual band RF rectifier, Ambient energy harvesting, Wireless Sensor Networks,5G communication, WIFI systems, Data acquisition

1. INTRODUCTION

Wireless sensor networks support data driven systems in smart infrastructure health monitoring industrial control and environmental observation yet many nodes still rely on batteries that restrict long term activity. Ambient radio fields offer a steady source of energy because modern 5G and WiFi systems radiate significant power in most environments. The 3.6 GHz 5G band and the 5.8 GHz WiFi band provide consistent field strength and a rectifier that operates at both frequencies improves harvesting reliability. Schottky diodes are suitable for this work due to their low threshold and fast response and an optimized matching network enables effective power transfer for low power sensor nodes. The increased use of wireless sensor networks has created strong interest in sustainable and maintenance free power systems [1]. RF energy harvesting supports this need by converting ambient electromagnetic energy into usable DC power and reducing dependence on batteries [2]. Dual band