RF harvesting circuit with application in wireless sensor nodes

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Nowadays, energy harvesting is an emerging topic that electronic researchers are increasingly interested in. It is based on collecting very small amounts of energy from the environment using small scale transducers. The harvested energy is used to feed low power circuits such as wireless sensor nodes (WSNs) and internet of things (IoTs). Although a lot of wireless systems broadcast into the environment, the power density of ambient RF energy is very low which makes it challenging to design an RF to DC rectifier for harvesting a sufficient amount of energy. We designed an RF to DC rectifier for an RF harvester system that works on 2.4 GHz frequency band to leverage the ubiquity of energy that is produced by Wi-Fi, Bluetooth, and other devices. In order to harvest with high conversion efficiency, our harvester circuit includes four parts: i) a low-profile and wide-band receiving antenna, ii) an impedance matching circuit, iii) a voltage doubler circuit which consists of a peak rectifier and a voltage clamper, iv) a load resistance. For the antenna, we designed a rectangular stacked microstrip antenna to provide a wide-band frequency response. The rectifier is based on the voltage doubler topology to convert RF signal to DC signal. In the rectifier circuit, we selected two high sensitivity Schottky diodes in a parallel combination to act as a small signal detector since they show a low forward voltage drop and a very fast switching action. We achieved 18% and 32% conversion efficiency for input power of -20 dBm and 0 dBm, respectively.