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High Efficiency Double-Band Printed Rectenna Model for Energy Harvesting

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Abstract : The concepts of energy harvesting and wireless energy transfer have been widely discussed in recent times. There are some ways to create autonomous systems for collecting ambient energy, such as solar, vibratory, thermal, electromagnetic, radiofrequency (RF), among others. In the case of the RF it is possible to collect up to 100 μW / cm². To collect and/or transfer energy in RF systems, a device called rectenna is used, which is defined by the junction of an antenna and a rectifier circuit. The rectenna presented in this work is resonant at the frequencies of 1.8 GHz and 2.45 GHz. Frequencies at 1.8 GHz band are e part of the GSM / LTE band. The GSM (Global System for Mobile Communication) is a frequency band of mobile telephony, it is also called second generation mobile networks (2G), it came to standardize mobile telephony in the world and was originally developed for voice traffic. LTE (Long Term Evolution) or fourth generation (4G) has emerged to meet the demand for wireless access to services such as Internet access, online games, VoIP and video conferencing. The 2.45 GHz frequency is part of the ISM (Instrumentation, Scientific and Medical) frequency band, this band is internationally reserved for industrial, scientific and medical development with no need for licensing, and its only restrictions are related to maximum power transfer and bandwidth, which must be kept within certain limits (in Brazil the bandwidth is 2.4 - 2.4835 GHz). The rectenna presented in this work was designed to present efficiency above 50% for an input power of -15 dBm. It is known that for wireless energy capture systems the signal power is very low and varies greatly, for this reason this ultra-low input power was chosen. The Rectenna was built using the low cost FR4 (Flame Resistant) substrate, the antenna selected is a microfita antenna, consisting of a Meandered dipole, and this one was optimized using the software CST Studio. This antenna has high efficiency, high gain and high directivity. Gain is the quality of an antenna in capturing more or less efficiently the signals transmitted by another antenna and/or station. Directivity is the quality that an antenna has to better capture energy in a certain direction. The rectifier circuit used has series topology and was optimized using Keysight's ADS software. The rectifier circuit is the most complex part of the rectenna, since it includes the diode, which is a non-linear component. The chosen diode is the Schottky diode SMS 7630, this presents low barrier voltage (between 135-240 mV) and a wider band compared to other types of diodes, and these attributes make it perfect for this type of application. In the rectifier circuit are also used inductor and capacitor, these are part of the input and output filters of the rectifier circuit. The inductor has the function of decreasing the dispersion effect on the efficiency of the rectifier circuit. The capacitor has the function of eliminating the AC component of the rectifier circuit and making the signal undulating.

Keywords : dipole antenna, double-band, high efficiency, rectenna
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