

Impact and Characterization of the Microwave Oven Power Leakage on 802.15.4 Networks

Peio López Iturri⁽¹⁾, Juan Antonio Nazábal⁽¹⁾, Leire Azpilicueta⁽¹⁾, Carlos Fernández⁽¹⁾ and (*)Francisco Falcone⁽¹⁾

(1) Dep. de Ingeniería Eléctrica y Electrónica, UPNA, Pamplona, Navarra, Spain

The use of wireless communication devices is growing rapidly in industrial, scientific and building and home automation environments. This paper focuses on Wireless Sensor Networks based on the 802.15.4 standard. Typically, the frequency band used is the 2.4 GHz ISM, which in addition to wireless sensor networks, a wide variety of technologies and devices operate there, which are potential sources of interference in the deployment of a Wireless Sensor Network. The microwave oven is one of those devices. In this paper, the impact of radiofrequency radiation leakage from microwave ovens on XBee Pro ZigBee wireless modules working in the 2.4 GHz ISM band is analyzed. By means of equivalent radiation sources applied to in-house 3D ray launching algorithm as well as analytical modeling, estimation of leakage is obtained. The magnitude and the variable nature of the interference are analyzed (fig. 1a shows the spectrogram of the oven leakage for 5 minutes, with an inset of the created model used for simulations) and the impact in the radio link quality is measured by means of the PER (Packet Error Rate, which is showed in fig. 1b for different 802.15.4 radio channels). Ray tracing simulation as well as measurement results show good agreement, indicating the presence of interference levels within the operation region of the Wireless Sensor Network. The analysis of this potential interference source taking into account the topology and morphology of complex indoor scenarios can aid in the optimal deployment strategies of Wireless Sensor Networks, coexistent with other wireless elements, in order to minimize energy consumption while enhancing performance in terms of quality as well as overall throughput.

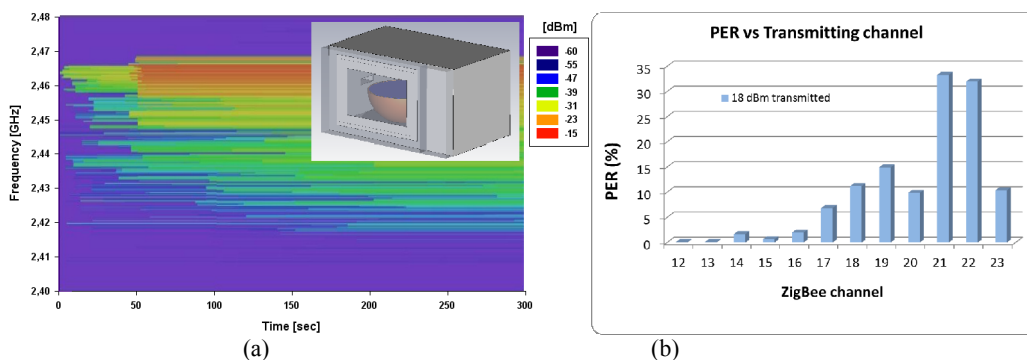


Figure 1: a) Measured spectrogram of RF power leakage from a conventional microwave oven b) Measured impact on PER values for a deployed ZigBee wireless sensor network.