

Design of a 2.4 GHz Interrogator for a Rectenna-Based Sensor System

Abstract— This paper presents a design for an interrogator for a new class of wireless sensors. The sensors are entirely passive and intended for deeply embedded structural health monitoring. As such, the interrogator must both transmit a signal to elicit a response from the sensor and be able to monitor that response. The interrogator considered transmits in the 2.40-2.48 GHz ISM band and monitors the 2nd harmonic response created by the sensor. The interrogator employs two fractional-N PLLs, one for frequency synthesis of the interrogating signal and one for a reference at a fixed frequency offset. The received signal lies in the 4.80-4.96 GHz band and is down converted to a constant frequency (70 MHz). The output frequency of the two PLLs is controlled by a single FPGA. The interrogator is designed to either sweep across the transmit band or to transmit at a fixed frequency within the band depending on whether the sensed parameter is static or dynamic, respectively, in nature.