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Abstract

A Near-Field Split-Ring Resonator-Based Monopole Sensor for Permittivity Characterization †

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Many passive electromagnetic sensors have been recently studied. One of their advantages is that they can be easily merged with antennas, resulting in wireless and cheap devices. For instance, these sensors can be used for the characterization of the dielectric permittivity, with application in industry, biology or medicine, among others. In this work, a low-cost passive monopole sensor is designed and manufactured. The structure is composed of two Split-Ring Resonators (SRRs) coupled to a short-circuited printed monopole antenna. The permittivity of the dielectrics that are placed over the sensor is characterized within a near-field link between the sensor and a wireless reader, avoiding the use of wired connections. The sensing principle is based on the reader detection of the notch introduced by the SRRs in the power reflected by the sensor. Specifically, when the sensor is covered with a material, the change in the effective permittivity produces a frequency shift of the notch detected by the reader. It is shown that the system can reliably estimate the permittivity of the materials over a reading distance of 1 cm by means of a linear approximation with a small error. As future work, this sensor could be monitored with novel Internet-of-Things readers.