

# A contactless dielectric constant sensing system based on a split-ring resonator-loaded monopole

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**Abstract—** In this paper, a low-cost contactless passive sensor is designed and manufactured. The structure consists of a short-circuited printed monopole antenna coupled to two split-ring resonators. The permittivity of the materials under test is characterized within a near-field link between the sensor and a contactless reader. Concretely, the reader has been implemented by using a broadband patch antenna. The sensing principle relies on the reader detection of the notch introduced by the resonators in the power reflected by the sensor. Specifically, when a sample is placed over the sensor, the change in its effective permittivity produces a frequency shift of the notch detected in the reflection coefficient of the reader. A complete equivalent circuit model of the whole system is proposed. Moreover, the results are corroborated through full-wave simulations. Finally, the whole system is manufactured and measured. It is shown that the system can reliably detect the permittivity of the materials placed over the sensor at a distance between the reader and the sensor equal to 9.52 mm.

**Index Terms—** Contactless system, near-field link, passive electromagnetic sensor, permittivity characterization, printed monopole antenna, split-ring resonator (SRR).

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