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The bending effects on the performance of a flexible circular microstrip antenna on rubber-carbon substrates at 2.45 GHz

(2025) *Telkomnika (Telecommunication Computing Electronics and Control)*, 23 (1), pp. 1-10.

DOI: 10.12928/TELKOMNIKA.v23i1.26042

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Abstract
In this paper, we studied the effects of bending on the performance of a flexible circular microstrip antenna on rubber-carbon substrates at the 2.45 GHz industrial, scientific, and medical (ISM) band. Several rubber compositions are analyzed which include natural rubber (no carbon filler), rubber with 20% carbon filler, rubber with 25% carbon filler, and rubber with 50% carbon filler. Four types of bending directions are applied in this work i.e., side-inward, side-outward, top-inward, and top-outward with bending radius ranging from 100-500 mm. It is observed that even though the resonant frequency of the antenna shifted a bit when bending is applied, the S11 at the intended frequency remains below -10 dB. The bandwidth and gain also maintain an acceptable performance despite all the directions and radius of the bending, due to the wide bandwidth characteristics of the antenna. With these results, the proposed antenna is shown to be usable for wearable applications at 2.45 GHz, in both flat and bent conditions. We also show that it is essential to design a flexible antenna with a wide bandwidth to guarantee that the antenna maintains optimal performance even under curved conditions.

Author Keywords
Bending effects; Flexible microstrip antenna; Industrial; Rubber-carbon substrate; scientific and medical band; Wearable antenna

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Publisher: Universitas Ahmad Dahlan

ISSN: 16936930
Language of Original Document: English
Abbreviated Source Title: Telkomnika Telecomun. Compt. Electr. Control
2-s2.0-85214254269
Document Type: Article
Publication Stage: Final
Source: Scopus