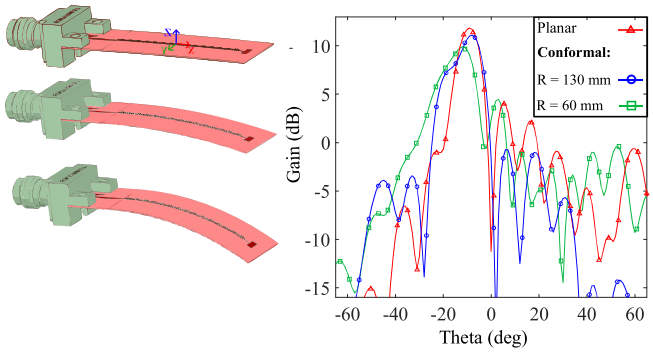
Flexible Electromagnetic Interfaces for Wearable Sensors

G. Sacco, P. Vadher, and D. Nikolayev
Univ Rennes, CNRS, CentraleSupelec, Nantes Université, IETR UMR 6164, F 35000 Rennes

In the last years on-body wireless sensors have been prevailing over wired sensors for the continuous monitoring of anatomical parameters (e.g., heart and breath rate, blood pressure). However, many of the available solutions are rigid, cumbersome, and do not conform well over the body surface. To this end, it seems crucial to go towards a new paradigm of wearable devices designed on flexible substrates that can be easily conformed on one or multiple body parts. Since many of these devices require to communicate with other sensors placed on the body or in its near proximity, the antenna is one of the fundamental elements. Over the years several wearable antennas have been proposed at microwaves [1], with only a few examples in the millimeter-wave (mmW) range [2]. Compared to lower frequencies, mmWs offer the advantages of smaller dimensions, higher data rates, larger bandwidths, and low impact of the bending on the antenna performance. For these reasons, the unlicensed band around 60 GHz is a good candidate for these applications.

This paper proposes a low profile, reconfigurable, fast-scanning leaky wave antenna (LWA) operating in the 57–66 GHz range for conformal on-body applications. To maximise the angular scanning range, the antenna is designed to operate in the n = -2 spatial harmonic. Since the LWA needs to be positioned on the body, the impact of the curvature radius of the body surface on the antenna performance is investigated. For this reason, we considered the planar configuration, and curvature radii of 60 mm and 130 mm, representing the wrist and the knee, respectively (see Figure 1a). The radiation pattern represented in Figure 1b at 60 GHz shows a modification of the realized gain of at most 2 dB when compared with the planar case. The variations among the configurations in the main beam pointing direction and the −3 dB beamwidth are limited to 3° and 4°, respectively.



(a) (b)

Figure 1: (a) Designed antenna in planar and bent configuration and b ralised gain as a function of the curvature radius of the surface at 60 GHz.

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References

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