Effect of Antenna Deformation on Performance

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Abstract

Ubiquitous, unobtrusive wearable computing has tremendous potential for impacting many applications including medical, personal entertainment and surveillance. Advances in the underlying technology have allowed for consistent reduction in the size and weight of emerging solutions, with increasing subsystem integration. A key component for the realisation of these systems is the short and long range wireless communication system, in particular the antenna subsystem. Given the many challenges associated with wireless systems, the design of the antenna for wearable computing poses an even greater hurdle since there are added concerns about robustness, human safety and deterioration of the antenna performance as the wearer moves [1-3].

Considerable work by other researchers has been conducted into the construction and testing of antenna structures which have been built using flexible materials [2, 4]. However these studies have been limited in terms of the degree of structure distortion examined. To the best of the authors' knowledge there is limited work on the impact of antenna flexibility on the antenna performance. This study considers a traditional Planar Inverted-F Antenna (PIFA) antenna structure which has been adapted to a flexible structure which undergoes deformation during use. PIFA have been increasingly used in mobile devices, due to their ability to be tuned to for multiple bands to support technologies such as GSM, GPS, and BT, among others.

For the purposes of examining the behaviour of the PIFA antenna structure under the various states of distortion a 3D model of the sensor was constructed. The RF Module of the COMSOL Multiphysics® software was used to evaluate the wearable antenna performance under various levels of distortion introduced through user movement scenarios. Changes in antenna form due to the flexibility of the wearable antenna were modelled. Antenna radiation patterns, bandwidth, beamwidth and impedance were examined between 700MHz to 6GHz. For each of the testing scenarios the results indicated that the antenna performance varied considerably due to the varying degrees of distortion. The results serve to highlight the significant challenges inherent in designing flexible antenna structures which must accommodate for deformation during user activity. The results can serve to inform future works on the design of flexible antenna structures.

Reference

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Figures used in the abstract

Figure 1

Figure 2

Figure 3

Figure 4