Simulation and Characterization of Wearable, Flexible, Conductive Fabric based Antenna System

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Various antenna geometries and configurations for systems operating in the 2.4-2.5 GHz frequency band using unique flexible materials are investigated. All antenna systems rely on some degree of rigidity due to the stringent dimensional requirements imposed by the operating wavelength of the antenna. The objective of this work is to determine the limits of geometric distortion acceptable for an antenna system composed of flexible fabrics in comparison to a more traditional rigid antenna system of similar design. This design seeks to aid in the development of an antenna system for use in the medical/fitness device and body area network (BAN) regimes capable of providing data link capability to wearable sensors and other devices.

Flexible materials hold several unique challenges to Antenna designers, not only do flexible structures change propagation characteristics due to deformation of structures, but the density of the conductive material can become an issue as the conductive fibers are pulled and stretched making the effective conductive surface area change from position to position. Simulations using CST Microwave Studio under many different conditions and material parameters will be presented, as well as test data collected on a prototype model constructed from NCPB15 conductive fabric from Marktek. The ultimate goal of the current investigation is to determine how feasible these types of materials are for construction of antennas operating in the 2.4-2.5 GHz ISM band.