A COMPARATIVE STUDY OF DIVERSITY AND SPATIAL COVERAGE: FIXED VS. RECONFIGURABLE ANTENNAS FOR PORTABLE DEVICES

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Simple, single antennas deployed on portable wireless data devices are usually minimally functional and limit noise immunity, battery life, and, ultimately, data throughput. This kind of limited antenna functionality could have a significant impact on performance of high-speed communication links in the future. One approach to expand system capability to meet new challenges is to develop reconfigurable antennas for portable devices. Ideally, new communication systems can then leverage this broad antenna functionality to take advantage of emerging techniques in wideband microwave circuits, signal processing, and protocols, resulting in more efficient, secure, and cost-effective high performance communication and sensing systems. While the possibility of integrating phased arrays (as proposed in S. Bellofiore et al., Proc. IEEE Antennas and Propagation Int. Symp., 1, 2001, 26-29) may be remote, an alternative is to combine a small number of reconfigurable antennas to achieve diversity, direction-of-arrival capabilities, and limited beam-forming (without phase shifters) depending on the operating environment and desired throughput.

This study investigates the performance of planar fixed and pattern-reconfigurable antennas (G. H. Huff et al., IEEE Microw. Wireless Comp. Lett., 13, 57-59, Feb. 2003) on a cubic structure which is representative of a portable device. This geometry has been chosen based on previous studies which have demonstrated a high degree of radiation pattern versatility when integrated with pattern reconfigurable elements. In conjunction with this, previous work involving a laptop computer chassis has also demonstrated improvements in diversity gain and spatial coverage when using pattern reconfigurable antennas. In this work, the broad range of radiation pattern possibilities brought forward by conformally integrating reconfigurable elements onto a cubic structure is examined by exploring possible configurations that work to deliver diversity and/or beam-forming in accordance with the device chassis itself. Since the reconfigurable antennas implemented in this work are switched between a discrete set of states, antenna placement (relative to the chassis and to one another) determines the utility and uniqueness of operating states from each set of integration positions.

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