Polarization and Spatial Diversity for Wearable Antennas

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Currently, body wearable antenna systems are being designed under the Tactical Networking Communications Antennas for the Land Warrior/Ground Soldier Systems Soldier ensembles to support wideband (225-1000 MHz) and broadband (1350-2700MHz) communications. These frequency bands are particularly vulnerable to signal cancellations due to multipath. Diversity techniques employed with these antennas may decrease multipath and thereby increase the overall link system gain.

Enhanced data-throughput is achieved by either combining the received signals from multiple antennas to increase diversity gain or by establishing parallel subchannels (each polarization can be thought of as a channel) if the correlation between fading of the transmitter-receiver (Tx-Rx) pairs is sufficiently low. Polarization diversity has also been paralleled to multiple channels and has been exploited to increase throughput. Statistical independence among antennas is a paramount component for best diversity. Many studies showed that mutual coupling among antennas lead to statistically correlated antennas. Therefore, antenna location and orientation on the human body are critical to achieving diversity gain.

In this paper, EM and Optimization tools along with measurements are used for characterization and optimization of the mutual coupling among antennas on a human phantom. These tools will be primarily used to explore how system gain can be increased with reduced mutual coupling in the frequency bands of interest; that is, 225-1000 MHz and 1350-2700 MHz. Figures 1 and 2 show simulation and measurement setups for a body-worn antenna system comprised of two identical antennas placed in the front and back. Such simulations will be used to evaluate optimum antenna location, orientation and feeding mechanism.

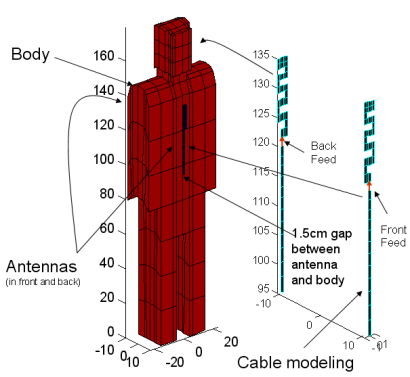

Figure 1: Body Wearable Antenna model on a human body.

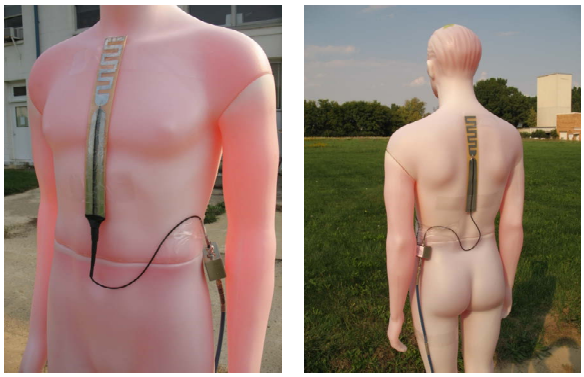

Figure 2: Spatial diversity characterization measurement using human body phantom.