Characterization of Screen-Printed Fabric and Ink Antennas

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In the world of connected devices an active area of research is functional fabrics. This includes research into conductive fabrics and thread, temperature regulating fabrics, and antennas that can be used for medical device telemetry and biometric sensors. A common problem researchers face, when trying to design new technologies is the type of fabric and the material used as conductive ink. It is often an arduous task to determine the properties of a given ink as a function of curing method, curing temperature, fabric used and screen resolution. Properties such as conductivity and average thickness of the conductive layer as well as the change of these properties in normal use are vital knowledge to appropriately design and model antennas and circuitry for functional fabrics.

To address this problem, we have conducted a comprehensive study on a variety of fabrics and conductive inks. Fabrics were grouped by their composition and sheet resistances were tested for all fabrics using different curing methods, inks, and screen resolutions. Material thickness was measured at several points in the printed region of each fabric to determine average thickness and uniformity. A thermal camera was used to determine the uniformity of current within each material. A wash study was conducted with different detergents to determine changes in characteristics of the material and pictures were taken of each material under a microscope before and after every wash. These results were used to design and simulate an antenna. Finally the most conductive and stable combinations were chosen for fabrication and testing of the antenna. Experimental results were presented along with the simulations.