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Wearable Inkjet-Printed Antenna Performance for Medical Applications at 868/915 MHz

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The use of biosensors attached to the body for health monitoring is now readily accepted, and the merits of such systems and their potential impact on healthcare receive much attention. Wearable medical systems used in clinical applications to monitor vital signs must be comfortable to wear, yet have robust performance to ensure reliable communications links. Additionally, and vital to the success of these innovations, is that these solutions are disposable to avoid risk of patient infection and this means that they must be ultra-low cost. Antennas optimized for printing using conductive inks offer new exciting advances in making a truly disposable solution.

This research work investigates the performance of wearable ink-jet printed antennas suitable for integration into wireless medical sensor systems. The conductive ink antennas were characterized on a novel human tissue phantom test-bed (Figure 1). The proposed phantom concept is a layered tissue design, comprised of three tissue layers (G.A. Conway, IEEE APS 2013). By adjusting the thickness of these layers, the antenna performance bounds were established, which is representative of the performance on different test subjects with different tissue morphologies. The Lean-Side (LS) and the Thick-Side (TS) of the phantom gave maximum deviation in both return loss and radiation efficiency.

The total radiation efficiency (i.e., inclusive of mismatch losses) of the conductive ink dipole antennas were measured on the physical tissue phantom and compared to the same antennas comprised of copper, spaced 5 mm from the phantom using Rohacell foam (Figure 2). The measured radiation efficiency is between 5-24 % (-12.6 to -6 dB). The difference in wearable radiation performance of the antennas prototyped using conductive ink in comparison to copper is less than 0.5 dB. These results show that conductive ink can be used for antennas at the 868/915 MHz band using simple ink-jet manufacturing processes.



Fig. 1. Tissue Phantom

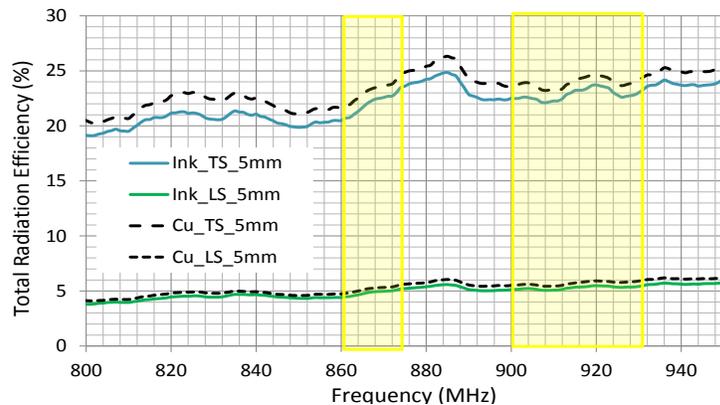


Fig. 2. Measured wearable performance