Inkjet-Printed RFIDs for Wearable Applications

McKenzie E. Piper*[(2)], Tania Dobrescu[(1)], James Forsberg[(1)], and Erdem Topsakal[(1)]
(1) Department of Electrical and Computer Engineering
(2) Department of Biomedical Engineering, Virginia
Commonwealth University, Richmond, Virginia, USA

Fabrication of wearable technology including radio frequency identification (RFID) often includes depositing conductive ink onto a flexible substrate. Flexibility of these materials is integral to their function as wearable devices, as rigidity impacts user comfort, as well as long-term usability and data extraction. Popular methods to accomplish this are embroidery, screen printing, and inkjet printing. Embroidering conductive thread onto fabric materials as a means of incorporating wearable sensors requires areas of high thread concentration that reduce flexibility and conformity to the body. Secondly, screen printing conductive inks onto fabric substrates produces low resolution outcomes because of the lack of uniformity and ink layer thickness control during fabrication. Inkjet printing, however, does not share these drawbacks. Using a high resolution inkjet printer (Dimatix Materials Printer) allows maximum precision for small and/or intricate antenna topologies. This method has yielded promising results using silver conductive ink to fabricate wearable electronics such as RFIDs. Applications for these antennas include motion tracking capabilities.

In this study, readability of inkjet-printed flexible RFIDs is presented. The DMP-2850 printer is utilized for RFID fabrication with conductive inks on materials of various fiber compositions. Once fabricated, an analysis of transmission of data is investigated including varying distances and angles between the RFID and the reader. Parametric studies of the sensor's functionality are presented with consideration of obstacles between the tag and reader, various surrounding environments, as well as different placement locations of the RFID on the body. The flexible fabric antenna is compared to a traditional non-integrated RFID.