Fluidic Tuning of a Microstrip Patch Antenna for ISM and GPS Bands

Hannah E. McQuilken, Brittany E. Lawrence, Rodolfo Silva, Michael Kelley,
Shuli Li, Chiwan Koo, Arum Han, and Gregory Huff
Department of Electrical and Computer Engineering
Texas A&M University, College Station, TX 77843-3128 USA

Reconfigurable antennas can provide unique trade-offs in space, cost, and overall system complexity if they functionality they provide is greater than the sum of the antennas and/or other components they are potentially replacing. These antenna systems can used in a range of applications from space exploration to defense, and have found a number of uses in cognitive radio, multiple-input-multiple-output (MIMO) systems, and adaptive communication links. These applications can require the antenna to be made of particular materials that have limitations such as expense, durability, accessibility, controllability and practicality. So in the interest of tailoring features such as tunability, accessibility and expense, it is key to develop reconfigurable antennas that can be easily controlled.

This work discusses ongoing efforts to develop a reconfigurable microstrip patch antenna that can achieve dual-band (ISM and GPS) operation. Concepts derived from tunable passive components (varactors, etc.) are be applied in these antennas to facilitate tuning. The electrical and physical lengths of the patch antenna are altered by displacing a conductive metallic fluid across gaps in the length direction. The fluid is housed in a cavity at the high band, and displaced into the fluidic network after to activate the lower band. Other fluidic material systems can also be used (e.g., dispersions of magnetodielectric particles in low loss dielectric liquids), and depending on the characteristics of the liquid the electrical length of the patch can be varied to tune the antennas resonant frequency. Measured and simulated results of a prototype system will be presented with the design of the reconfigurable antenna.