A Microfluidically Controlled Spatially Adaptive Antenna Array For Mm-Wave Wireless Channel Control

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Microfluidically reconfigurable RF devices attract interest due to their capability to provide wide frequency tuning, high power handling, high efficiency and low cost. Consequently, microfluidics has been demonstrated in various applications such as RF filters, reconfigurable antennas, and RF switches. More recently, a microfluidically repositionable (i.e. spatially adaptive) antenna array concept has been introduced to increase the capacity of mm-wave communication systems (M. H. Yılmaz, E. Güvenkaya, G. Mumcu and H. Arslan, "Millimeter-Wave Wireless Channel Control Using Spatially Adaptive Antenna Arrays," in IEEE Communications Letters, vol. 21, no. 3, pp. 680-683, March 2017). Specifically, the conceptual system utilized a 5x1 patch antenna array at 28 GHz with beam-steering capability. In addition, this array was capable of repositioning itself within a 4.5λ spatial range. In a multipath environment, this configuration was shown to increase the wireless channel gain beyond what could be achieved by a stationary antenna array.

This presentation will aim to introduce an improved patch antenna array for spatial adapting applications. As compared to the design of the previous work, a new layout is proposed to offer 50% length reduction for the identical 4.5λ spatial adaptation range. This is accomplished by introducing a new CPW based feed network and an antenna matching technique that eliminate the need of shorting posts utilized in the previous work to prevent feed line resonances. The fabrication and experimental verification of this layout is currently been carried out. Design details and RF characterizations will be discussed at the time of the conference. In addition, the performance of the array in a multipath wireless channel scenario will also be demonstrated.