

Microfluidically Frequency Switchable Compact Substrate-Integrated-Waveguide Antenna

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Since mobile wireless communication has been rapidly developed, the demand for high efficient and compact antennas has steadily increased. In the meantime, substrate-integrated-waveguide (SIW) has been highlighted due to its low profile and printed-circuit-board (PCB) compatibility while keeping high performances of conventional bulky waveguides. Especially, a recently proposed eighth-mode SIW (EMSIW) antenna is a good candidate requiring compactness because it occupies only 1/8 of the SIW structure. In order to allow frequency tunability for the EMSIW antenna, electronic components such as varactor diodes have been employed.

In this paper, we present a novel frequency switchable SIW antenna. Instead of electronic tuning components, a microfluidic channel is introduced as a tuning component. The microfluidic channel is developed on polymethylmethacrylate (PMMA) and loaded on the open side in order to generate perturbation in fringe field. Frequency switching capability can be achieved with small amount of water and no DC power consumption. The bias network is not required as well in the microfluidically switchable antenna.

Figure 1 illustrates its geometry. The full-wave simulated s-parameters are shown in Fig. 2 when the microfluidic channel is empty and filled with water. When it is empty, the resonant frequency is 4.76 GHz. After filling with water, the frequency is decreased to 4.34 GHz. The peak gain is 5.4 dBi and 4.3 dBi for empty and water-filled state, respectively. Due to loss tangent of water, the proposed antenna with the water-filled microfluidic channel shows lower peak gain than that with the empty microfluidic channel.

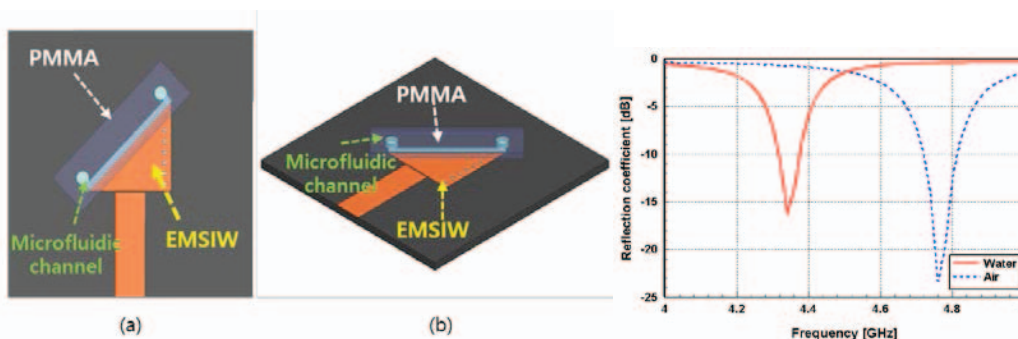


Figure 1. (a) Top view and (b) Side view of proposed antenna.

Figure 2. Simulated reflection coefficient of results.

Acknowledgment

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (No.2014R1A2A1A11050010).