# Directivity Enhancement in FSS-Based Reconfigurable Antenna

Ghada Hussain Elzwawi, Muhammad M. Tahseen, and Tayeb A. Denidni
Institut National de la Recherche Scientifique
University of Quebec
Montreal, Canada

The reconfigurable antenna is a type of antenna that has a capability to modify its radiation properties, and provides additional levels of functionality to improve wireless communication systems. This antenna is classified according to the antenna parameter that is dynamically adjusted, which typically is operation frequency, radiation pattern, or polarization. The principle key in the frequency reconfigurable antenna is changing the effective electrical length of the radiator. This changing can be controlled electrically or mechanically. The pattern reconfiguration can be realized by changing the amplitude and phase of the electric or magnetic currents of the radiating structure. This can be done by controlling the material properties, or by using parasitic elements around the primary antenna. The polarization reconfiguration can be achieved by managing the direction of current distribution. This approach can be achieved by changing the antenna structure, feed configuration, or changing the material properties.

This paper presents a new technique to modify the directivity of the reconfigurable antenna, using active frequency selective surfaces (AFSS). AFSS consists of frequency selective surfaces (FSS) and pin-diodes (GMP4202-GM1). The FSS is used as a partially reflecting / transmitting surface. A CST Microwave Studio has been used for full wave analysis. Pin-diodes are one of the most commonly used active elements applied to reconfigure the electromagnetic waves (EMW) response of an FSS. The proposed antenna consists of a dipole as a source of the EMW, and two AFSS screens that are arranged at the same side of that dipole. Each screen has a size of 61.6 x 63.8 $mm^2$, and consists of two circular patches AFSS elements. One of the analysis performed in this research and found effective, is the environment where the elements of the screen 1 (the closest surface to the dipole) are directed toward each other by an angle $\theta_1$, and the elements of the other surface are also directed toward each other by an angle $\theta_2$ (making V-shaped AFSS).

The effect of different parameters on the antenna directivity: the distance between the dipole and the AFSS screens (feed space), the space between the two screens, and the angles $\theta_1$ and $\theta_2$, have been analyzed and optimized. The proposed antenna provides a maximum directivity of 9.25 dBi, when the feed space is $\lambda/2$, the space between the two screens is $\lambda/4$, $\theta_1 = 0^0$, and $0_2 = 60^0$. The antenna performance has been evaluated at 5.8 GHz.