28 GHz Dual Polarized Beam Steerable Transmit Array Antenna for Reliable 5G Connectivity

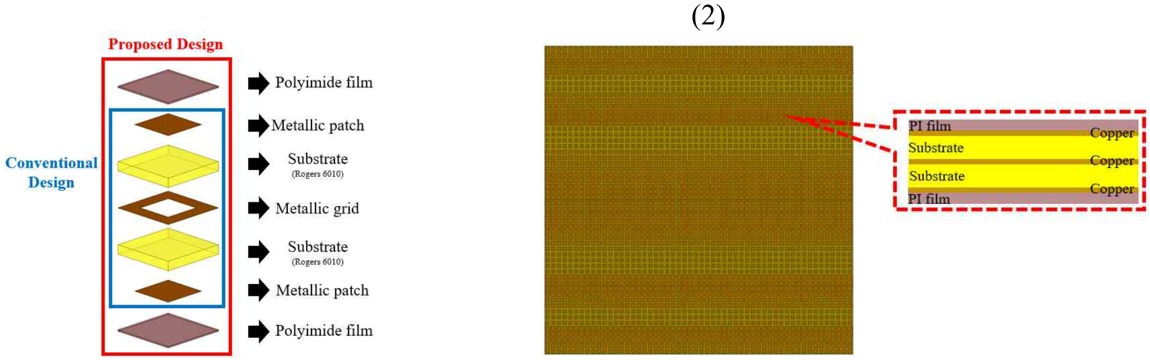
Hogyeom Kim* and Jungsuek Oh
Seoul National University, Seoul, South Korea

This paper presents a dual polarized beam steerable transmit array antenna whose unit cells coated by ultrathin polyimide film (50um). In the conventional transmit array antenna, it is shown that there is a considerable gain degradation of the transmitted TE wave steered by a dual-polarized source antenna. For this reason, the conventional transmit array antennas have a difficulty in achieving reliable beam coverage when two different polarization are excited simultaneously. It is found that this problem can be mitigated by combining ultrathin films to the bottom and top of the transmit array. Finally, it is demonstrated that the proposed transmit array antenna can achieve up to more than 2 dB gain enhancement compared to the conventional transmit array antenna.

Planar transmit array antennas can be a candidate for issues related to millimeter 5G communications such as RF losses and massive MIMO since these can transform arbitrary electromagnetic wavefronts into a desired form achieving gain enhancement. Also, beam steerable transmit array antenna has been studied for 5G outdoor customer premises (CPE) [Y. Kim, H. Kim, I. Yoon and J. Oh, *IEEE Access*, vol. 7, pp 8881-88803, 2019]. In practice, many RF systems operate with dual polarized antennas for polarization efficiency. However the conventional transmit array antennas have a significant gain degradation of the TE wave due to change of impedance versus incident angle. Impedances on the surface of the transmit array for TM and TE are shown in Eq (1) and (2) respectively. When theta is incident angle to the unit cell of the transmit array antenna, as incident angle increases, the impedances changes, consequentially leading to variation of Q-factor. Therefore, the gain degradation of the conventional transmit array antenna for TE wave occurs when incident angle increases. Fig.1 shows exploded view of the unit cell of the transmit array antenna (a) and a top view of the proposed transmit array (b). It is shown that the proposed design can significantly mitigate the gain degradation of the conventional design. Finally, fabricated transmit array antennas and measured results will be presented.

1)

(2)



(a) (b)

Figure 1. Exploded view of the proposed (RED) and conventional (BLUE) unit cell of the transmit array antenna (a) and top view of the proposed transmit array antenna (b)