60 GHz Circularly Polarized Antipodal Fermi Tapered Slot Antenna with *Sin*- Corrugation

Zouhair Briqech* [(1)], Abdelrazik Sebak[(1)], and Tayeb A. Denidni[(2)]

(1) Electrical and Computer Engineering, Concordia University, Montreal, QC, Canada, H3G 2W1, http://www.ece.concordia.ca
(2) INRS, Wireless Communications, Montreal, Quebec, Canada, H5A 1K6

A novel 60 GHz circularly polarized antipodal Fermi tapered slot antenna with sin-corrugation (AFTSA-SC) is presented in this work. The tapered slot antenna is a class of endfire antennas, with radiation patterns capable of high directivity while maintaining a wide bandwidth. The circularly-polarized antenna element consists of a pair of AFTSA-SC antennas. These two AFTSA-SC antennas are aligned orthogonally to each other. Both the horizontal and vertical elements are fed by a single microstrip line with a 50 Ω input impedance. The circular polarization is achieved using slotted cut-outs in the center of each substrate to satisfy the 90^o phase delay between the horizontal and vertical elements.

The antenna structure is designed by a full wave analysis in the time-domain solver of CST Microwave Studio 2014. It is designed as follows. The circularly polarized AFTSA-SC is simulated on Rogers RT/Duriod 6002 substrate with ε_r = 3.55, tan δ = 0.0027@ 10 GHz, thickness = 0.221 mm. The overall antenna size is 51.5 *mm* × 13 *mm.*

The simulation results show the antenna has a high realized gain performance of 18.5dB and a total radiation efficiency of 90% at 60 GHz, including an impedance bandwidth of <-20dB over a frequency band of 55 – 62 GHz. The HPBW reaches 15.4° and 18.7° in the H–plane and E–plane, respectively. Moreover, front-back-ratio is 24.3dB at 60 GHz, and 36.8 dB at 62 GHz. An axial ratio bandwidth of < 3dB is maintained from 59 to 63 GHz. Furthermore, the AFTSA-SC is modeled to radiate in the right-hand circularly polarized antenna (RHCP) wave and modeled as well for the left-hand circularly polarized (LHCP) wave. Therefore, this novel integrated antipodal Fermi tapered slot antenna with sin-corrugation may have good applications in millimeter wave (MMW) systems, such as in MMW radars, 5G wireless communications and imaging systems.