A Double Sided Bow-tie Antenna Array for Broadband Communications and Performance Study of Controlling Ground Plane

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For getting adapted to the various national spectral regulatory authorities, it is preferred to have a design of antenna that can be easily modified to be compatible with the different requirements. In certain cases, the focus of the antenna design might be the bandwidth so that high data transfer rate can be availed and in some other cases, radiation pattern and gain of the antenna can be the main concern. This study primarily proposes a double-sided bow-tie antenna that can be made suitable for different bandwidth requirements and directivity by altering a single parameter.

To fulfill the demand of the integrated RF front-end system, a double-sided bow-tie antenna operating within the Ku band is investigated in this project. This antenna consists of two modified bow-tie structures patched on both sides of the substrate, where the lower one acts as a ground plane. It is composed on TSM- DS3M substrate (ε_r=2.94, loss tangent=0.0011) and has a size of 17.8 x 14.2 x 0.51 mm^3. The partial ground plane shows a significant effect on the antenna characteristics such as the radiation pattern and the bandwidth. From the simulation results, it is seen that for a lower value of the length of the partial ground, the radiation pattern is omnidirectional in a certain plane. However, when the length is increased, this omnidirectional characteristic is lost and instead, for the wider partial ground plane, the pattern shows a directional attribute. Effect of ground plane can also work for various wideband technologies because the antenna bandwidth can be easily switched from 32.4% to 72.46% by changing the length of the partial ground plane. The change of the bandwidth, radiation pattern, and gain based on the length of the partial ground will be presented. In addition, the overall system performance of this model is improved by investigating different array configurations. Two, four, and eight element arrays have been designed in this research. Results regarding array parameters such as beam-steering characteristics, mutual coupling, S-parameters, radiation pattern, and gain will be presented for various array configurations.