

Annular Ring Antenna for High Data Rate Space-Earth Radio Link

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In this work we present an annular ring patch antenna design for nanosatellite applications. The proposed antenna can achieve high directivity while it is easy to fabricate. It can be successfully implemented for example in Cubesat satellites that require high data rate in radio connections while preserving limited dimensions for an antenna attachment. The presented antenna is designed to fulfill Aalto-1 radio and mechanical requirements. A general cavity model is used to evaluate both excited fields and resulting radiation pattern. Based on presented theory, an optimal antenna structure for 2.4 GHz frequency is proposed. In order to evaluate radiation parameters, the device situated above Aalto-1 frame is modeled in full-wave electromagnetic simulation software (CST). Exact antenna dimensions are adjusted to obtain maximum gain. The final antenna is printed on the substrate plate with 80 x 80 x 1.75 mm size. Simulation of the device result in high gain as predicted by theory. However simulated structure has a relatively narrow bandwidth. Due to the fact that substrate thickness highly influences bandwidth, two higher antennas (2.5 and 4 mm) have been designed. All structures have been simulated and fabricated in the laboratory of the Department of Radio Science and Engineering of Aalto University. In the near future radiation parameters of produced antennas will be measured in an anechoic chamber. Based on presented theoretical study, high gain antenna with high radiation efficiency can be designed. The proposed design has the advantage of smaller physical size than traditional patch antennas with the similar parameters, making it favorable for nanosatellite applications.