Experimental Study on the Effect between Commercial Space Solar Cells and the Antennas Integrated on Their Cover Glass

Taha Shahvirdi* and Reyhan Baktur
Department of Electrical and Computer Engineering,
Utah State University, Logan Utah 84341, USA

As Cube Satellites have become a very important low cost tool for space explorations, integrating antennas with their solar panels is gaining increased importance. Such integration resolves two main issues for a Cube Satellite (CubeSat): (1) saving surface real estate, and (2) reduce the deployment that is needed for the traditional wire antennas. By examining the solar panel assembly, it is straightforward to see that there are mainly two possible methods for antenna integration: (1) antenna under the solar cells, (2) around solar cells, and (3) on top of solar cells. For the first two types of integration, where the antenna geometry can be either slot type or microstrip patch, there have been studies performed to assess the relation between the antennas and solar cells. For the antennas on top of solar cells, although such a design can be very versatile when the antenna is designed transparent to light, there has not yet accurate assessment on the relation of the two devices. This paper is aimed to provide such an assessment using experimental methods. The data collected from this experimental study can then be used to provide better model for future simulative studies in antenna-solar cell integration.

The study focuses on a solar panel of size 10 cm by 10 cm, which is a typical panel for a 1U CubeSat. There are two triple junction space certified commercial solar cells assembled on a printed circuit board (PCB) substrate. The cover glass of the solar cells is chosen to be as thick as possible to support an antenna at S band while still satisfying the standard requirement for space solar cells. While assessing the effect of the active solar cells on the antenna performance, both transparent and non-transparent antennas will be tested whereas the effect of antennas on solar cell's functionality will be examined through using only 95% transparent meshed patch antennas. The antennas operating at 2.4 GHz, 5 GHz, and possibly 10 GHz will be tested. The feed design will be through proximate coupling and the PCB material as a typical panel for CubeSat will be leveraged in obtaining the optimal antenna design.