Integrated After-Market Solar Panel Antennas with Multi-Diversity

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Cube satellites (CubeSat) are in the family of small satellites and typically a 1U CubeSat is a 10x10x10 cm3 cube. In application, 2 or 3 1U CubeSat can be stacked together to form a satellite in order to perform extended science mission that the 1U ones. As the size of a CubeSat is very small, there is an increased challenge due to the competition of solar cells and antennas for surface space. One effective method to resolve this issue is to integrate antennas with solar panels without affecting the solar cell performance. From such an integration perspective, cavity backed slot antennas become very good choice.

Although researchers have integrated slot antennas with solar panels, the diversity of the antenna function is limited. This means, one integrated solar panel antenna can only be used for one specific mission. On the other hand, if one can design a solar panel with antennas exhibiting multiple properties, then it is possible to quickly reconfigure a single solar panel for different missions. This will result in an enormous cost reduction in science missions. This paper reports our progress in investigating such an integrated multifunctional solar panel antenna. Such a multifunctional integration is very much feasible for a 2U or 3U solar panel when the antennas operate at S band or 5 GHz range, two frequency bands that are favored by CubeSat communication systems.

As achieving different circular polarization and dual band properties have been previously investigated, this study focuses on how to switch between polarizations. In addition to the two frequency bands of interest, a GPS antenna is most often needed by a satellite. Therefore, we report our study on integrating a GPS antenna on solar panel. When multiple ports or switches are employed to generate different diversity, isolation between bands, polarization, and patterns can be an issue. In addition, cavity backed slot antennas have shown relatively lower efficiency because of the loss due to the cavity. We present our progress in investigating and improving the isolation and antenna efficiency.