Optically Transparent Circularly Polarized X Band Reflectarray for Solar Panel Integration

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The objective of this paper is to present our latest development in a light weight high gain antenna that does not need a mechanical deployment for CubeSats. For a high gain antenna for satellites, the solutions are typically either deployed dish antenna or reflectarray that can be integrated with solar panels. When the objective is to eliminate the deployment to reduce cost and accident, an integrated solar panel reflectarray is seen to be a more effective choice.

There can be two types of integration methods to combine a high gain antenna array with solar panel: (1) antennas integrated on the backside of the solar panel, and (2) antennas integrated on the same side with the solar panel. While the first type of solution has its own value, integrating an optically transparent reflectarray on top of solar panel opens more choices in CubeSat payload. For example, such a solution can be easily applied to cases where CubeSats are without deployed solar panel and all solar cells are mounted on the CubeSat surface.

Our recent development has demonstrated inkjet-printed 95% transparent X band reflectarray with more than 22 dB gain for a 6U CubeSat panel. In this paper, we target to achieve circular polarization and a complete testing of the antenna on functional solar panel. We will prototype the antenna by inkjet printing the geometry on a clear glass and then integrate it on the solar panel. The antenna elements are of low profile and do not require significant surface real estate, hence the optical transparency is expected to be higher than 90%. Such a reflectarray will suit a multi-unit ($\geqslant$ 3U) CubeSat that has sufficient area for solar cells (hence the antennas), or a CubeSat with deployed panels. The chosen frequency is X band for Near Earth radio, however, the design can be easily extended for Ka band to be compatible with different space applications.