Wraparound S-Band and GPS Antenna Arrays for Sounding Rocket Sub-Payload

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The objective of this study is to determine a reliable and relatively simple antenna solution for a sounding rocket sub-payload. The sub-payload is a cylinder with a diameter of 6 inches and a height of 4 inches. The communication system requires S band and GPS antennas. In order to enable the payload to spin stably after launching, it is desirable to have both antennas conformal to the payload surface. Both antennas are required to provide a smooth omni-directional pattern, and therefore creating challenges as one needs multiple antennas to achieve the requirement on the limited payload surface area. Another challenge is to create a reliable circular polarized antenna that will be used as GPS antenna on the cylindrical surface.

An extensive literature search for cylindrical circularly polarized antenna yielded complex antenna geometry, and are not suitable for the payload. On the other hand, a microstrip patch antenna with a simple feed is a better solution. We present the design method of such a circularly polarized GPS antenna array. Although the GPS antenna bandwidth (1.52%) is not required to be high, the polarization bandwidth from microstrip antenna geometry is still too narrow. Our study intends to find proper methods to enhance the bandwidth.

Due to the limited surface real estate, when placing microstrip feed-lines and antennas on the same plane, the radiation patterns of the antennas are severely affected by the feed-lines. Therefore, we have decided to separate the feed layer and antenna layer. In addition to all the mentioned challenges, the two antennas are required to have at least a 40 dB isolation. Such isolation cannot be achieved by spacing the two antennas because of the limited payload size. A possible solution is to consider filters built in to the feeding layer.

We report the latest progress in design, prototyping, and testing in this study.

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