

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
Advanced Space Communications and Navigation Systems (2)

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DESIGN OF A HIGH-GAIN MICROSTRIP PATCH ANTENNA ARRAY WITH STRIPLINE  
COMBINERS FOR PASSIVE REFLECTOMETRY**Abstract**

PRETTY (Passive Reflectometry and Dosimetry) is a 3U CubeSat mission dedicated to Earth observation. The mission goal is to measure the Earth surface by the use of passive reflectometry. Direct and reflected GNSS signals are correlated to perform height measurements of the Earth surface, especially in polar regions. In addition, a miniaturized dosimeter payload quantifies the total ionizing dose as well as the linear energy transfer in the corresponding low earth orbit.

This paper presents the design of the microstrip patch antenna array for GNSS-R passive reflectometry on the PRETTY CubeSat mission. The antenna allows detection of both, the direct signal and the reflected signal. Its antenna pattern is hence designed to have a high vertical aperture angle. To maximize the measurement performance, the perturbations and reflections outside the main lobe have to be kept as low as possible. Given these constraints a 2x4 patch antenna array is used. The high gain of a patch array is required to provide sufficient amplification of the very weak GNSS-R signals, especially for the reflected ones. Based on the analysis results, a single element as well as a 2x4 patch array were designed with FEM simulation tools. Prototypes are manufactured and compared to the simulation results in terms of s-parameters, bandwidth, and gain. The results have shown a gain of over 13dB in the expected L1 frequency range and a bandwidth of about 10MHz.