Paper ID: 45428
oral
student

25th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Earth Observation Missions (4)

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A COMPACT C-BAND CP-SAR MICROSATELLITE ANTENNA FOR EARTH OBSERVATION

Abstract

Synthetic Aperture Radar (SAR) technology has been widely used in Earth Observation (EO) applications, as it can provide unique ground information independent of cloud coverage and during night time. Currently, there is a strong socio-economical demand to realize small and affordable SAR satellites for fast responses and all-weather monitoring, especially in the Pacific Asian countries, usually covered by clouds, hence with limited coverage by optical satellites. EO spaceborne SAR systems are conventionally linearly-polarized (LP), despite many benefits of circularly-polarized SAR (CP-SAR) sensors, such as minimizing Faraday rotation effects and reducing antenna misalignment.

With the recent miniaturization of technological components, it is nowadays possible to achieve significantly reduced size of payload and bus systems. However, when it comes to spaceborne SAR, due to mostly the large antenna sizes and high transmission power required, reducing the total spacecrafts mass becomes a very challenging task, especially in the low microwave frequencies. Consequently, the bulky payloads and high costs result in SAR missions being commonly sponsored by governmental space agencies. Therefore, up to this date, the number of compact SAR missions are very limited and stricted to high frequencies.

Currently, Center for Environmental Remote Sensing, Chiba University, Japan, and the Indonesian National Institute of Aeronautics and Space are developing a C-band CP-SAR microsatellite for EO, ChibaSat, as part of a technology demonstrator for small spaceborne SAR systems. A new concept of a 150-kg class microsatellite SAR is proposed, based on a lightweight deployable parabolic mesh antenna, allowing for piggy-back launch opportunities for the mission. The antenna is a wrap-rib center-fed parabolic reflector with dedicated receiving and transmitting feeds. Antenna requirements are: gain better than 30 dBic, center frequency of 5.3 GHz with bandwidth of 28 MHz, axial ratio <3 dB. The current work describes the development of a compact CP-SAR C-band antenna system and the design considerations suitable for small spacecrafts. Antenna simulation of the parabolic reflector was performed, and the engineering model was constructed. Near-field antenna measurements are scheduled to take place at JAXA radiowave test facilities for antenna validation in July 2018.