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DESIGN OF SAR OPERATION AND OBSERVATION MODES OF CAS500-5

Abstract

The Korean government is carrying out the next-generation medium-sized satellite project named Compact Advanced Satellite 500 (CAS500) to respond to the development of the satellite industry and the increasing demand for satellites. In this project, a standard satellite bus weighing 500kg will be developed under the supervision of the Ministry of Science and ICT, and the payloads of each series are developed by other Korean Ministries. CAS500-1 was launched in March 2021 and is currently in operation. The Korean government has confirmed a plan to develop CAS500-3, -4, and -5 as the Phase 2 (Phase 1 is CAS500-1 and -2), and this paper introduces the operation modes of CAS500-5 which is being developed under the supervision of the Ministry of Environment for water resource management and is equipped with a SAR payload. This satellite is used to monitor natural disasters such as soil moisture, river flow, floods, and droughts by measuring soil moisture in domestic and foreign territories. Due to the size and weight of antennas and amplifiers, etc., SAR payloads are generally used by being mounted on large satellites of 1.2Ton or more, but CAS500-5 installing a C-band (5.4GHz) SAR is a 500kg satellite. It is equipped with a large, but light reflector antenna, and the weight of the payload is limited to around 150kg. This allocated weight even includes the weight of the payload data transmission subsystem (PDTS), it is difficult to develop a pure radar device with a weight of around 100kg including antennas. In this paper, the operation mode of CAS500-5 is described, and then the technical features and specifications of the observation mode are compared and analyzed with those of Sentinel-1A and -1B, which have similar missions to CAS500-5. CAS500-5 features a challenging payload technology that facilitates soil moisture observation by keeping an equal NESZ with a relatively small weight and power consumption compared to Sentinel, which has large weight and power consumption. Compared to Sentinel -1A and -2A, which have four modes, the CAS500-5 has a WideSwath mode with swath over 120km, resolution below 10m, NESZ below -20dB. In addition, a StripMap mode with swath over 30km, resolution below 3m, NESZ below -18dB is additionally used. Although only the two modes are used, they are considered appropriate for Korea's water resource observation mission. Wideswath mode applied the ScanSAR concept, which scans by transmitting multiple subband chirp signals to meet this major development goal.