Advancements in system configuration, realization and characterization of EOS-04 SAR over its predecessor RISAT-1

Ch. V. N. Rao*, Jolly Dhar, Partha Sarathi Nandy, Arup Hait, Sanjeev Kulshrestha, Vinay Kumar, Piyush Sinha, Nikhil Desai, Swati Shukla, Ravi Khatri, Nidhi Singh, Devendra Sharma, Rinku Agrawal, Madhav Das and Ajay Kumar Singh

Space Applications Centre, Indian Space Research Organisation, Ahmedabad 380 015, India

The C-band Synthetic Aperture Radar (SAR) payload of Earth Observation Satellite (EOS-04), is a follow-on mission of Radar Imaging Satellite (RISAT-1). Though the overall configuration of the C-Band SAR payload has been retained from its predecessor, EOS-04 boasts of incorporating features, which target to keep up with the technological strides, and to improve the data quality. All the major modes of RISAT-1 are retained in EOS-04 whereas fine resolution stripmap-2 mode, which was quad-polarization mode earlier, is upgraded to full-polarization mode. The payload also has better repeat cycle with improved systematic coverage mode. This article covers system level advancements, and radio frequency and digital electronics hardware, implemented in EOS-04. The satellite was launched on 14 February 2022 and since then all the major imaging modes are being operated successfully.

Keywords: CATF, EOS-04, full-polarization imaging, HRS, LTCC, NESO, RISAT-1, SAR, ScanSAR, Stripmap, TRiM.

Stripmap configuration and wide swath ScanSAR configuration.

EOS-04 provides continuity of the services of its predecessor RISAT-1 (refs 1, 2). It covers 100 to 650 km range in the off-nadir direction with incidence angle ranging from 12° to 55° and is operated in both ascending and descending passes with left and right looking capability. It has single/dual/hybrid/full-polarization and multi-mode imaging capability[3,4].

There has been a paradigm shift in the hardware technology of microwave regime since the times of RISAT-1, owing to which, EOS-04 is better equipped in many aspects over RISAT-1. Miniaturization of transmit receive (T/R) modules using low temperature co-fired ceramic (LTCC) technology is one of such prime changes in EOS-04; each unit includes horizontal (H) and vertical (V) polarization T/R module along with its control electronics. Miniaturization in the T/R modules due to usage of LTCC technology has led to reduction in payload mass by more than 100 kg. As per system configuration, several important developments were carried out, such as introduction of full-polarization mode of imaging, on-board active antenna