

IAF EARTH OBSERVATION SYMPOSIUM (B1)
Future Earth Observation Systems (2)

Author: Mr. Luca Fasano
Italian Space Agency (ASI), Italy

Mr. Rino Lorusso
Italian Space Agency (ASI), Italy
Dr. Claudia Facchinetti
Italian Space Agency (ASI), Italy
Mr. VALERIO GRIMANI
Thales Alenia Space Italia, Italy
Mr. Alessandro Cricenti
Thales Alenia Space Italia, Italy
Mrs. Flavia Carnevale
Thales Alenia Space Italia, Italy
Mr. Matteo Turi
Thales Alenia Space, Italy
Mr. Guido Palaia
Thales Alenia Space, Italy
Dr. Giancarlo Natale Varacalli
ASI - Italian Space Agency, Italy

COSMO-SKYMED SECOND GENERATION CALIBRATION APPROACH AND FIRST RESULTS

Abstract

COSMO-SkyMed Second Generation (CSG) System can be defined as the follow-on mission to COSMO-SkyMed (CSK) currently operating in orbit, aimed at assuring operational continuity and performance improvement in supplying the SAR imaging services through data and image products, such to preserve and enhance the ability of Customers and operational Users to fulfil their mandates.

CSG follows the track of the first generation CSK, maintaining its main characteristic of dual-use, but much more performing through key technology advances that enlarge the applicative range of SAR imagery. CSG first satellite was launched on 18 October 2019 from Kourou Space Centre, in French Guyana and today is in Commissioning Phase.

The paper describes COSMO-SkyMed Second Generation end-to-end calibration approach that used during the commissioning and operational phases, providing an overview of the first results.

The process can be distinguished between “calibration”, that aims to improve the SAR image quality by align the SAR Processor output data to the actual backscattering and geometric characteristics of the sensed area (i.e. cali-bration and geometric constants) and “characterization”, that provides information relating to the instrument it-self by the measurement of a set of parameters useful to reach the final calibration scope (i.e. Antenna Pattern Look Up Table and SAR antenna TR module health status - TRCAL). A verification/validation activity aiming to evaluate the performance of the end-to-end system completes the overall process. The object of the verification is to retrieve image quality parameters, to compare them with the mission requirements in order to validate the System performance. Possible outcome of this process is to provide feedbacks to the calibration process itself, if needed.

CALVAL is the System Tool that is dedicated to coordinate and perform all the activities above described. The paper traces its context diagram, outlining its interactions with the external entities and the way they interact with it and the data/information exchanged with the stakeholders. Due to the Customer requirement related to maximum reuse of CSK items, together with a strong know-how on calibration aspects inherited from CSK experience, the CALVAL design follows what already developed in first generation. In this framework the paper details CALVAL elements, like CSG System Engineering Calibration Facility (SECF) and calibration scenarios (point targets and distributed target). SECF is the operational core of CALVAL for the analysis and the assessment of the image quality parameters and the update of the parameters for the tuning of the on-ground processors in order to produce calibrated instrument products. Calibration scenario are defined and selected with the aim to contain point targets (e.g. trihedral corner reflectors or opportunity targets) or distributed targets with homogeneous backscattering properties (e.g. Amazon forest) depending on measurements to be performed.

In addition commissioning calibration activities (Radiometric, Geolocation, Pointing calibrations) are described, outlining their purpose, process and their set of parameters, directly retrievable by image quality analysis together with available a-priori information, that are measured in order to verify the correct calibration effectiveness.

For each calibration activity an overall outline is reported. Pre-flight, initial In-Flight checks, commissioning calibration activities and operational phases are deeply described, reporting the flowchart of each stage. In the end, the first calibration results obtained in the Commissioning phase are provided.