

The In-Orbit Calibration Procedure of TerraSAR-X

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Abstract

As TerraSAR-X, due for launch in October 2006, will be an operational scientific mission with commercial potential, product quality is of paramount importance. The success or failure of the mission is essentially dependent on the calibration of the TerraSAR-X system ensuring the product quality and the correct in-orbit operation of the entire SAR system.

The in-orbit calibration procedure of TerraSAR-X is based on a novel antenna model approach because of the multitude of different operation modes and the corresponding huge number of different antenna beams. TerraSAR-X is a versatile X-Band SAR satellite operating in Stripmap, Spotlight and ScanSAR modes with selectable or dual polarisation. Additionally, experimental modes are optional, like wide bandwidth operation providing even higher resolution, or the dual receive antenna mode (DRA) providing quad polarisation or along track interferometry (ATI). Furthermore by a rotation of the satellite the instrument can be operated as left or right looking radar. Consequently a cost effective in-orbit procedure for a successful calibration of TerraSAR-X is mandatory ensuring a short duration of the commissioning phase for early product release.

For this purpose, the novel antenna model developed and validated on ground, is verified in orbit by measuring only a number of selected beams using deployed ground receivers and natural targets (e.g. the rain forest).

Absolute calibration, yielding an absolute calibration factor by measuring the radar system against reference ground targets, requires precise and sophisticated ground equipment.

To account for the restricted time of calibration campaigns the number of passes and places of test sites is optimised versus cost and time effort by calibrating several beams and polarisation modes with the same test site.

The paper describes the in-orbit calibration procedure performed during the TerraSAR-X commissioning phase and discusses their implementation. The concept is applicable to other advanced SAR sensors coping with a multitude of operational modes as well as subsequent calibration campaigns.