Sentinel-1C_D Instrument: Improvements on internal calibration and preliminary verification results

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Abstract

The Copernicus is the most ambitious Earth Observation and Monitoring Programme worldwide. It is founded by the European Commission in partnership with ESA. The Sentinels form the backbone of the Copernicus Space Segment with the objective to deliver continuous and global high-quality remote sensing data.

Sentinel-1 (S1) in particular provides C-band SAR data with a constellation of two identical spacecraft: S1-A (launched on 3rd April 2014) and S1-B (launched on 25th of April 2016). To date, both spacecraft have accumulated more than eight years in orbit and eventually two new units will replace them: S1-C & S1-D.

The new S1 instruments will guarantee data continuity and backward compatibility with their predecessor instruments. The hardware architecture has been revisited and redesigned in order to improve the overall radiometric performance.
A brief summary on the activities done to improve the new SAR instruments will be presented together with on-ground verification results at tile level. Some of the improvements are:

• Enhanced instrument radiometric stability and accuracy.
• Redesign of the Tile Amplifier units.
• Simplification of the instrument internal calibration scheme, where the types of internal calibration pulses has been reduced from five (TxCal, RxCal, TACal, EPDNCal and APDNCal) to only three types (TxCal, RxCal and EPDNCal).
• Reduction of transmit RF hardware complexity, as the amplification stage at the output of the SES, called Transmit Gain Unit, is no longer required.
• Simplification of the trimming process for long RF harness from the SES to the tiles.
• Slight optimisation of RF levels that will bring a small improvement in the overall instrument noise figure.
• Re-organization of the interleave calibration sequences to allow better noise measurements from the rank echoes. In addition, interleaved noise measurements will be added into the imaging timelines.

Finally, the presentation will cover the current S1-C/D hardware status and the predicted radiometric stability for S1-C.

Keywords - Calibration of future missions