

Common estimation of the frequency bias of DORIS Jason2's oscillator, with T2L2 and DIODE onboard instruments

N. Martin¹, P. Exertier¹, C. Jayles², A. Auriol², and P. Guillemot²

¹CNRS – Centre National de la Recherche Scientifique, Sophia Antipolis, Valbonne, France

²CNES – French Space Agency, Toulouse, France

In orbit since June 2008 the Jason-2 satellite embarks several instruments dedicated to oceanography and precise altimetry, among them the T2L2 for Time Transfer by Laser Link experiment based on Satellite Laser Ranging (SLR), and the real-time navigation system DIODE (“Détermination Immédiate d'Orbite par Doris Embarqué”) based on Doppler effect measure by DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite). Both are synchronized by an ultra stable quartz oscillator called USO embedded in the Jason-2 DORIS receiver.

The T2L2 mission has been jointly developed by the Observatoire de la Côte d’Azur (OCA) and CNES, its main objective is to synchronize remote clocks at a sub nanosecond level using laser ranging technique. As a result, it is thus possible to determine the frequency bias of the USO independently of the tracking system itself. At a laser observatory equipped with an ultra stable clock (hydrogen maser), we estimate the frequency bias with an error of a few 10^{-13} Hz for each flight of the satellite above, and up to $5\text{-}7\cdot 10^{-14}$ Hz in specific common view configuration.

On the other hand, the DIODE navigation system was designed by CNES in 1991 and for the first time in operation in 1998 on SPOT-4 satellite. It is used as a support to the precise real-time orbitography of a space vehicle with DORIS beacons network. The performance of the orbit determination depends greatly on the ability of the DORIS system to monitor the frequency of the USO. After many improvements, DIODE is now able to identify the frequency bias to his best at $1\text{-}1,5\cdot 10^{-12}$ Hz.

In order to better understand the respective limits of both T2L2 and DORIS techniques, a specific configuration has been set up at OCA's SLR station on the heights of Grasse, with laser station and DORIS beacon connected to the same hydrogen maser. In this paper, we will present the latest developments in terms of restitution of the USO frequency by the two systems.