

Calibration of DCBs in timing GNSS stations

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Abstract— This paper presents a study of the consistency of the GNSS inter-frequency hardware delays (DCBs) determined by calibration in GNSS stations dedicated to time transfer and belonging to the network of time laboratories used for the realization of the Universal Time Coordinated (UTC). The calibration of GNSS time transfer equipment consists in determining for each GNSS signal the electric delay accumulated between the antenna phase center and the internal timing reference of the receiver. Either absolute or relative calibration can be realized to reach that goal. The principle of the absolute calibration is to use simulated signals and determine the hardware delays from the receiver (or complete chain) measurements on the simulated signals. The relative calibration, more classically used, consists in a comparison of pseudorange measurements collected by the local receiving chain and a reference receiving chain traveling from laboratory to laboratory.

The consistency of DCBs determined by calibration is analyzed using the ionospheric maps of the IGS to determine the receiver P1-P2 and to compare it with the results from calibration. Our results show that the stability of the P1-P2 delays stays at the ns level for the major part of receivers, only some receivers show more significant variations. We then show that the ionospheric maps contain biases which prevent their use for the calibration validation at the ns level. For time laboratories of which the GNSS station is also included in the IGS network, a comparison of the relative DCBs determined by the IGS analysis centers in the ionospheric map computations, and those determined by the time laboratories in calibration exercises is proposed.