

Absolute calibration for BDS time transfer receiver with below 1 ns uncertainty

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Since the end of 2020, the global constellation of BD-3 system for BDS has been completed. This, combined with the rapid development of BDS, has prompted feasibility studies on BDS time transfer at various sites, towards coordinated universal time (UTC) contribution. This introduces great interest on the evaluation of BDS time transfer for UTC contribution.

One of the most significant steps for accurate BDS time transfer is to measurement the hardware delay of the time transfer link for accurate time transfer, which is called time transfer link calibration. The uncertainty of GNSS time transfer link is mainly from time transfer link calibration. For now, there are only differential calibration results with the uncertainty of about 1.5 ns ~ 2.5 ns for GPS and the European Global Navigation Satellite System (Galileo) signals in BIPM database. Thus, the study on BDS time transfer link calibration including BD-3 signals is necessary. Most works on the BDS time transfer link calibration is from the absolute calibration of BDS time transfer receivers for B1I and B2I signals by CNES¹ and ESA².

In this paper, we have developed a modified absolute calibration method for the whole time transfer receiver with a mobile anechoic chamber and a GNSS simulator. The BDS time transfer receiver could be calibrated as a whole unit including the receiver antenna, the receiver master, and the receiver antenna cable. Some results for several types of GNSS time transfer receivers with BD-3 signals including B1I, B3I, B1C and B2a signals have been acquired and verified successfully with the different methods, such as the differential calibration method. The calibration uncertainty has been studied and evaluated as less than 1 ns.

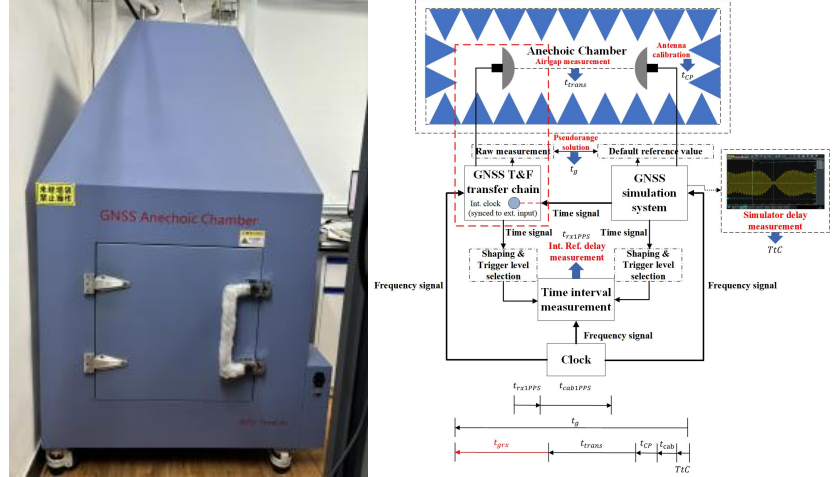


Fig. 1: Anechoic chambers and absolute calibration scheme for the GNSS time transfer receiver as a whole unit

¹ Valat D ,Jérme Delporte.Absolute calibration of timing receiver chains at the nanosecond uncertainty level for GNSS time scales monitoring[J].IOP Publishing, 2020(2).

² Manfredini E G , Defraigne P , Krystek P ,et al.Absolute calibration of GNSS timing stations and its applicability to real signals[J].Metrologia, 2018, 56(1).