

GPS calibration of NTSC and BIRM equipment with respect to NIM G1 (1016-2018)

Summary

Over December 2018 to May 2019, the National Institute of Metrology, China (NIM) conducted a trip to calibrate GNSS equipment owned by the National Time Service Center, Chinese Academy of Science (BIPM acronym NTSC) and by the Beijing Institute of Radio Metrology and Measurement, China (BIPM acronym BIRM). The trip started and finished at the NIM, providing closure with respect to NIM Group1 reference receiver IM06.

The operations and report of measurements are described in in the [report by NIM](#).

• Final results for the calibrated systems

The INTDLY values of the NTSC and BIRM receivers given in Table 1 have been computed by NIM based on the results of the [1001-2018](#) Group 1 trip for IM06 and should not be updated to reflect later changes in the conventional INTDLY values of the reference receivers.

For a P3/PPP UTC link A-B involving any Group 1 and any receiver in this trip, the uncertainty resulting from the calibration, $U_B(A-B)$, is computed as

$$U_B(A-B) = (U_{CAL0}^2 + \Delta U_{CAL}(A)^2 + \Delta U_{CAL}(B)^2)^{1/2} \quad (1)$$

where $U_{CAL0} = 2.5$ ns at the time of calibration, as given conventionally to Group 2, and where ΔU_{CAL} (generally zero) is specified for each system.

For single frequency C1 links, U_{CAL0} is 2.5 ns but could be complemented by an additional component to represent systematic errors in the ionospheric model.

Changes in the set-up of the receivers after the calibration must be accounted for as described in section A.3.6 of the most recent Calibration guidelines in <ftp://ftp2.bipm.org/pub/tai/publication/gnss-calibration/guidelines/>.

Table 1. Final P1/P2/C1 INTDLY values from the 1016-2018 trip. Values of REFDLY with respect to UTC(k) and of CABDLY during the calibration are also indicated for reference as available. All values are in ns. “Meas. Date” refers to the first day of the differential calibration, to which the calibration results can be applied. “Impl. Date” is the MJD when the results should be implemented in the receiver.

System	BIPM	Meas. date	INTDLY P1	INTDLY P2	INTDLY C1	REFDLY	CABDLY	Note	ΔU_{CAL}	Impl. date
NTP1	NTP1	2019/01/03	53.6	52.3	N/A	373.8	209.0		0.0	58696
NTP2	NTP2	2019/01/03	53.4	51.4	N/A	378.0	221.0		0.0	58696
NTP3	NTP3	2019/01/03	50.9	49.4	N/A	196.1	209.0		0.0	58696
JA01	JA01	2019/01/25	231.0	227.7	N/A	338.6	N/A	(1)	0.5	58696
BI01	BI01	2019/03/06	-41.7	-44.0	-39.9	6.1	218.9		0.0	58696
BI22	BI22	2019/03/06	24.0	23.9	24.6	25.1	220.2		0.0	58696
BI41	BI41	2019/03/06	23.2	24.5	23.9	24.8	220.7		0.0	58696

Notes:

(1) Results are SYSDLY values. $\Delta U_{CAL} = 0.5$ ns reflects a somewhat larger instability in some CCD measurements for JA01.

- **Transfer calibration at NTSC**

Over September 2021 the National Time Service Center (NTSC) conducted a transfer calibration from receiver NTP3 to receivers NT02, NT03, NT04 and NT05.

The operations and report of measurements are described in the [report by NTSC](#).

The final values for the transfer calibration are reported in Table 2.

The value ΔU_{CAL} for use in equation (1) has been set accordingly to the value reported by the NTSC report. For UTC use, the ageing uncertainty will be based on the date of original calibration of NTP3 i.e., 2019/01/03.

Table 2. Final P3 TOTDLY values from the transfer calibration. All values are in ns. “Meas. Date” refers to the first day of the differential calibration, to which the calibration results can be applied. “Impl. Date” is the MJD when the results should be implemented in the receiver.

System	BIPM	Date	TOTDLY P3	ΔU_{CAL}	Impl. date
NT02	NT02	2021/09/10	76.4	0.6	59482
NT03	NT03	2021/09/10	81.9	0.6	59482
NT04	NT04	2021/09/10	20.2	0.8	59485
NT05	NT05	2021/09/10	45.6	0.5	59481

Version history

V1.0 2019/07/25: Publication of results from V2.9 of the Calibration report, to be implemented in the receivers.

V2.0 2022/07/20: Transfer calibration performed at NTSC added.