GNSS calibration of NMIJ receivers with respect to NICT G1 (1015-2022)

Summary

From March to June 2022, the National Institute of Information and Communications Technology (NICT) conducted a trip to calibrate GNSS equipment owned by the National Metrology Institute of Japan (NIMJ). The trip started and finished at the NICT, providing closure with respect to the NICT Group1 reference receivers NC4S and NC5S.
The operations and report of measurements are described in the report by NICT.

- **Final results for the calibrated systems**

The INTDLY values of the receivers given in Table 1 have been computed by NICT based on the results of the Group 1 trip 1001-2020 for NC4S and NC5S (GPS and Galileo) and should not be updated to reflect later changes in the conventional INTDLY values of the reference receiver.

For a P3/E3/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

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

where U_{CAL0} = 2.5 ns is the conventional Group 2 value, and where ΔU_{CAL} (generally zero) is specified for each system.

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/E1/E5a INTDLY values from the 1015-2022 exercise. Values of REFDLY and CABDLY during the calibration are also indicated for reference. All values are in ns date in YYYY/MM/DD format. “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 C1	INTDLY P1	INTDLY P2	INTDLY E1	INTDLY E5a	REF DLY	CAB DLY	Note	ΔU_{CAL}	Impl. date
NM0D	NM0D	2022/04/19	261.5	260.9	276.5	-	-	50.6	234.1	(1)	0.0	59821
NM0E	NM0E	2022/04/19	31.3	29.0	27.9	31.3	30.8	23.8	281.1	(2)	0.0	59821

Notes:

(1) Some ambiguities could not be resolved in the REFDLY measurement
(2) Receiver autocompesating for the PPSIN internal delay

- **Transfer of calibration performed by NMIJ in November 2025**

In November 2025, NMIJ calibrated a new GNSS receiver NM0F by transfer of calibration with respect to the receiver NM0D, see the report by NMIJ and the results in Table 2.

The value ΔU_{CAL} for use in equation (1) has been computed from information provided in the report. For UTC use, the ageing uncertainty will be based on the date of original calibration of NM0D.

Table 2. Final P1/P2 INTDLY values for NM0F. Values of REFDLY with respect to the indicated reference and of CABDLY during the calibration are also indicated for reference. “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	REFDLY	CABDLY	Note	ΔU_{CAL}	Impl. date
NM0F	NM0F	2025/11/13	26.6	25.5	-33.6	269.3		0.5	61033

Version history
V1.0 2022/08/02: Publication of results from V1.2 of the NICT report.
V2.0 2026/01/05: Publication of transfer of calibration by NMIJ