

BUREAU INTERNATIONAL DES POIDS ET MESURES  
ORGANISATION INTERGOUVERNEMENTALE DE LA CONVENTION DU METRE  
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1 - Coordinated Universal Time UTC and its local realizations UTC(k). Computed values of [UTC-UTC(k)].  
From 1999 January 1, 0h UTC, TAI-UTC = 32 s.

Date 2004	0h UTC	AUG 27	SEP 1	SEP 6	SEP 11	SEP 16	SEP 21	SEP 26	
MJD		53244	53249	53254	53259	53264	53269	53274	
Laboratory k		[UTC-UTC(k)]/ns							
AOS (Borowiec)		-4.6	-1.3	3.4	-6.9	-9.9	-15.8	-22.7	
APL (Laurel)		-8.6	-9.0	-13.8	-7.4	-0.1	-9.4	-18.0	
AUS (Sydney)		-525.3	-516.5	-505.2	-502.6	-495.4	-470.5	-480.9	
BEV (Wien)		13.5	15.0	13.2	16.7	20.2	20.8	13.2	
BIRM (Beijing)		703.8	718.8	733.2	747.4	755.6	771.0	794.6	
CAO (Cagliari)		-3555.2	-3522.1	-3509.4	-3516.2	-3504.5	-3486.8	-3493.6	
CH (Bern)		-18.4	-15.9	-15.5	-17.7	-10.9	-0.5	7.9	
CNM (Queretaro)		24.4	10.9	8.1	1.1	4.5	4.2	-3.2	
CNMP (Panama)		-1221.6	-1244.6	-1278.9	-1294.8	-1315.0	-1362.1	-1380.2	
CSIR (Pretoria)		-183.6	-261.7	-337.3	-416.3	-496.9	-571.4	-636.1	
DLR (Oberpfaffenhofen)		-	-	-	-	-	-	-	
DTAG (Darmstadt)		247.0	234.1	234.1	225.2	219.5	203.8	203.7	(1)
HKO (Hong Kong)		339.5	349.8	351.6	355.1	362.2	372.8	373.3	
IEN (Torino)		42.4	38.6	38.0	39.4	29.6	23.0	16.0	
IFAG (Wetzell)		-3061.0	-3078.9	-3083.8	-3091.6	-3096.5	-3105.5	-3100.9	
IGMA (Buenos Aires)		135.7	143.4	142.4	146.1	164.2	168.1	170.8	
INPL (Jerusalem)		-10736.9	-10786.5	-10844.1	-10909.1	-10968.1	-11023.3	-11084.8	
JATC (Lintong)		-10707.0	-10697.1	-10688.1	-10680.9	-10670.0	-10665.6	-10653.7	
JV (Kjeller)		-8250.8	-8242.2	-8174.8	-8138.5	-8079.3	-8051.8	-7991.7	
KRIS (Daejon)		-19.8	4.5	12.2	10.8	17.0	23.3	23.9	
LDS (Leeds)		1018.1	1042.4	1074.8	1101.8	1120.0	1152.6	1178.2	
LT (Vilnius)		250.1	269.4	281.0	302.5	324.8	326.4	317.3	
MSL (Lower Hutt)		-120.6	-118.8	-123.3	-80.9	-70.3	-58.2	-36.9	
NAO (Mizusawa)		-206.1	-201.6	-215.0	-208.9	-207.5	-213.7	-219.2	
NICT (Tokyo)		15.8	14.9	13.7	16.4	11.1	10.2	10.0	
NIM (Beijing)		-2651.0	-2655.7	-2654.7	-2658.5	-2666.2	-2658.3	-2657.5	
NIMB (Bucharest)		-	-	-	-	-	-	-	
NIMT (Bangkok)		-1599.3	-1620.3	-1638.9	-1654.9	-1683.0	-1712.6	-1739.9	(2)
NIS (Cairo)		564.8	588.9	600.3	623.9	662.7	554.2	608.6	
NIST (Boulder)		2.4	2.5	3.7	4.7	4.2	4.1	3.6	

Date 2004	0h UTC	AUG 27	SEP 1	SEP 6	SEP 11	SEP 16	SEP 21	SEP 26
MJD		53244	53249	53254	53259	53264	53269	53274
Laboratory	$k$	$[UTC-UTC(k)]/ns$						
NMC	(Sofiya)	-4338.8	-4349.9	-4361.6	-4386.2	-4402.2	-4411.1	-4426.8
NMIJ	(Tsukuba)	24.5	8.6	0.4	0.9	-2.5	-7.0	-12.8
NMLS	(Shah Alam)	-	-	-	-	-	-	-
NPL	(Teddington)	-26.4	-27.3	-29.3	-29.5	-30.5	-30.8	-30.7
NPLI	(New-Delhi)	8341.7	8392.4	8423.9	8458.6	8491.0	8526.7	8570.8
NRC	(Ottawa)	7.9	9.3	5.7	4.0	3.8	10.9	6.9
NTSC	(Lintong)	17.4	24.1	20.6	23.2	12.9	6.4	3.7
OMH	(Budapest)	9307.1	9341.6	9354.3	9370.4	9375.3	9406.7	9434.3
ONBA	(Buenos Aires)	-347.8	-445.2	-436.8	-365.2	-349.7	-294.2	-332.0
ONRJ	(Rio de Janeiro)	2576.3	2767.8	2997.3	3237.3	3475.3	3733.3	3958.8
OP	(Paris)	-5.3	-4.5	-0.5	-7.3	-10.6	-13.3	-10.9
ORB	(Bruxelles)	-58.1	-59.6	-61.7	-63.8	-64.2	-62.7	-59.2
PL	(Warszawa)	-48.2	-46.8	-45.9	-45.3	-41.5	-42.4	-41.5
PTB	(Braunschweig)	-9.5	-4.1	-1.8	3.4	1.9	4.7	10.9
ROA	(San Fernando)	-0.2	1.1	1.6	3.8	1.9	1.3	-3.4
SCL	(Hong Kong)	-8.4	-13.2	-20.8	-23.5	-10.6	-6.5	-7.5
SG	(Singapore)	-15.6	-20.1	-18.4	-14.8	-20.4	-6.2	-10.6
SMU	(Bratislava)	-70.9	-83.5	-102.4	-110.9	-123.1	-139.9	-156.5
SP	(Boras)	517.4	519.7	521.4	526.2	531.5	531.4	543.6
SU	(Moskva)	50.3	54.5	54.6	59.2	63.9	66.0	71.3
TCC	(Concepcion)	-8481.9	-8556.1	-8591.1	-8679.7	-8765.5	-8818.6	-8875.3
TL	(Chung-Li)	46.4	44.6	40.6	45.5	37.4	33.7	35.4
TP	(Praha)	-37.2	-28.5	-34.7	-33.8	-32.0	-31.4	-32.0
UME	(Gebze-Kocaeli)	312.8	308.6	313.1	317.3	320.1	319.3	324.6
USNO	(Washington DC)	-1.5	-1.9	-2.9	-4.5	-5.4	-5.2	-6.3
VSL	(Delft)	-77.3	-76.4	-74.5	-79.2	-71.5	-69.3	-64.7

- Notes on section 1:

(1) DTAG: Correction to *Circular T 200* note (2): No time step of  $[UTC-UTC(DTAG)]$  between MJD 53239 and 53244. Value of  $[UTC-UTC(DTAG)]$  for MJD 53244 corrected in this *Circular T*.

(2) NIMT: Corrected values /ns

MJD	$UTC-UTC(NIMT)$
53219	-1511.1
53224	-1525.3
53229	-1539.9
53234	-1561.4
53239	-1576.3

2 - International Atomic Time TAI and Local atomic time scales TA(k). Computed values of  $[TAI-TA(k)]$ .

Date 2004	0h UTC	AUG 27	SEP 1	SEP 6	SEP 11	SEP 16	SEP 21	SEP 26	
MJD		53244	53249	53254	53259	53264	53269	53274	
Laboratory <i>k</i>		$[TAI-TA(k)]/ns$							
CH (Bern)		45740.2	45844.9	45947.6	46047.6	46150.3	46252.5	46352.6	
F (Paris)		169206.5	169199.8	169194.4	169187.1	169182.3	169173.9	169170.5	
IEN (Torino)		38418.6	38523.8	38640.1	38752.5	38866.0	38979.2	39094.6	
JATC (Lintong)		-35704.0	-35746.1	-35786.1	-35826.9	-35864.0	-35898.6	-35943.7	
KRIS (Taejon)		7646.8	7692.0	7722.5	7745.3	7774.9	7804.1	7828.5	
NICT (Tokyo)		191828.0	192039.4	192249.4	192460.7	192672.2	192882.5	193092.3	
NIST (Boulder)		-45268132.0	-45268328.4	-45268523.7	-45268719.2	-45268915.2	-45269110.8	-45269306.8	
NRC (Ottawa)		28915.1	28920.5	28921.7	28924.2	28928.4	28940.1	28939.5	
NTSC (Lintong)		588.8	593.7	594.1	597.7	602.5	604.8	606.0	
PL (Warszawa)		-2569.2	-2580.8	-2589.9	-2599.3	-2608.5	-2619.4	-2628.5	
PTB (Braunschweig)		-359045.1	-359034.7	-359027.0	-359017.2	-359013.6	-359005.8	-358994.4	
SU (Moskva)		27241050.3	27241054.5	27241054.6	27241059.2	27241063.9	27241066.0	27241071.3	(1)
USNO (Washington DC)		-34938022.0	-34938329.6	-34938635.5	-34938943.4	-34939250.1	-34939556.8	-34939865.2	

- Note on section 2:

(1) SU : Listed values are  $TAI-TA(SU) - 2.80$  seconds.

3 - Difference between the normalized frequencies of EAL (free atomic time scale) and TAI.

	Interval of validity	$f(EAL)-f(TAI)$	
Steering correction	53244 - 53274	$6.893 \times 10^{-13}$	(2004 AUG 27 - 2004 SEP 26)
New correction	53274 - 53309	$6.893 \times 10^{-13}$	(2004 SEP 26 - 2004 OCT 31)
New correction foreseen	53309 - 53339	$6.893 \times 10^{-13}$	(2004 OCT 31 - 2004 NOV 30)

#### 4 - Duration of the TAI scale interval.

TAI is a realization of coordinate time TT. The following tables give the fractional deviation  $d$  of the scale interval of TAI from that of TT (the SI second on the geoid), i.e. the fractional frequency deviation of TAI with the opposite sign:  $d = -y_{TAI}$ . In this section, a frequency over a time interval is defined as the ratio of the end-point phase difference to the duration of the interval. Whenever needed, the instability of EAL should be expressed as the quadratic sum of three components with  $\tau$  in days: (1) a white frequency noise of  $6.0 \times 10^{-15} / \sqrt{\tau}$ , (2) a flicker frequency noise of  $0.6 \times 10^{-15}$  and (3) a random walk frequency noise of  $1.6 \times 10^{-16} \times \sqrt{\tau}$ . The relation between EAL and TAI is given in *Circular T* and the *Annual Report of the BIPM Time Section*.

In the first table,  $d$  is obtained, on the given periods of estimation by comparison of the TAI frequency with that of the given individual Primary Frequency Standards (PFS). In this table:  $u_A$  is the uncertainty originating in the instability of the PFS,  $u_B$  is the combined uncertainty from systematic effects, Ref( $u_B$ ) is a reference giving information on the stated value of  $u_B$  or is the Circular T where this reference was first given,  $u_{1/Lab}$  is the uncertainty in the link between the PFS and the clock participating to TAI, including the uncertainty due to the dead-time,  $u_{1/TAI}$  is the uncertainty in the link to TAI,  $u$  is the quadratic sum of all four uncertainty values. All values are expressed in  $10^{-15}$ .

Standard	Period of Estimation	$d$	$u_A$	$u_B$	Ref( $u_B$ )	$u_{1/Lab}$	$u_{1/Tai}$	$u$	Note
PTB-CS1	53244 53274	-4.6	5.0	8.0	T148	0.0	1.0	9.5	(1)
PTB-CS2	53244 53274	-3.0	3.0	12.0	T148	0.0	1.0	12.4	(1)

#### Notes:

(1) Continuously operating as a clock participating to TAI.

The second table gives the BIPM estimate of  $d$ , based on all available PFS measurements over the period MJD 52884-53274, taking into account their individual uncertainties and characterizing the instability of EAL as noted above.  $u$  is the computed standard uncertainty of  $d$

Period of estimation	$d$	$u$
53244-53274	$2.1 \times 10^{-15}$	$2.5 \times 10^{-15}$ (2004 AUG 27 - 2004 SEP 26)

5 - Relations of UTC and TAI with GPS time and GLONASS time.

$$\begin{aligned}
 [\text{UTC-GPS time}] &= -13 \text{ s} + C_0, & [\text{TAI-GPS time}] &= 19 \text{ s} + C_0, & \text{global uncertainty is of order } 10 \text{ ns.} \\
 [\text{UTC-GLONASS time}] &= 0 \text{ s} + C_1, & [\text{TAI-GLONASS time}] &= 32 \text{ s} + C_1, & \text{global uncertainty is of order hundreds ns.}
 \end{aligned}$$

The  $C_0$  values are obtained using the values  $[\text{UTC-UTC(OP)}]$  and the GPS data taken at the Paris Observatory, corrected for IGS precise orbits, clocks and ionosphere maps. The  $C_1$  values are obtained using the values  $[\text{UTC-UTC(VSL)}]$  and the GLONASS data taken at the NMi Van Swinden Laboratorium (VSL).  $N_0$  and  $N_1$  are the numbers of measurements. The standard deviations  $\sigma_0$  and  $\sigma_1$  characterize the dispersion of individual measurements. The actual uncertainty of user's access to GPS and GLONASS times may differ from these values. For this circular,  $\sigma_0 = 1.9 \text{ ns}$ ,  $\sigma_1 = 28.0 \text{ ns}$

Date 2004	Oh UTC	MJD	$C_0/\text{ns}$	$N_0$	$C_1/\text{ns}$	$N_1$
AUG 27		53244	-10.2	39	310.0	67
AUG 28		53245	-13.2	37	298.1	51
AUG 29		53246	-14.8	40	294.9	68
AUG 30		53247	-14.8	40	313.2	33
AUG 31		53248	-13.4	39	312.9	7
SEP 1		53249	-14.6	37	304.1	79
SEP 2		53250	-15.7	41	299.4	81
SEP 3		53251	-14.0	39	300.4	69
SEP 4		53252	-12.7	36	303.1	55
SEP 5		53253	-13.1	37	301.0	57
SEP 6		53254	-11.6	36	304.1	55
SEP 7		53255	-9.6	39	315.5	62
SEP 8		53256	-8.3	41	308.0	65
SEP 9		53257	-8.2	40	294.7	79
SEP 10		53258	-14.4	39	287.3	77
SEP 11		53259	-17.1	39	274.8	83
SEP 12		53260	-19.1	37	283.5	71
SEP 13		53261	-20.8	38	299.9	61
SEP 14		53262	-22.4	32	300.9	65
SEP 15		53263	-24.5	41	299.7	64
SEP 16		53264	-22.6	40	304.8	68
SEP 17		53265	-20.0	23	301.5	71
SEP 18		53266	-16.9	39	297.7	75
SEP 19		53267	-17.0	41	288.4	72
SEP 20		53268	-18.5	41	290.5	68
SEP 21		53269	-18.6	40	305.0	55
SEP 22		53270	-16.0	38	299.1	62
SEP 23		53271	-13.2	40	302.9	53
SEP 24		53272	-15.7	40	288.1	64
SEP 25		53273	-16.1	41	287.5	76
SEP 26		53274	-15.4	41	282.9	71

6 - Time links used for the computation of TAI and their uncertainties.

The time links used in the elaboration of this Circular T are listed in this section. The technique for the link is indicated as follows: GPS SC for GPS common-view single-channel C/A data; GPS MC for GPS common-view multi-channel C/A data; GPS P3 for GPS common-view multi-channel dual-frequency P code data; GPS GT for 'GPS time' observations; INT LK for internal cable link and TWSTFT for two-way satellite time and frequency transfer data.

For each link, the following uncertainties are provided:  $u_A$  is the statistical uncertainty evaluated by taking into account the level of phase noise in the raw data, the interpolation interval between data points and the effects with typical duration between 5 and 30 days.  $u_B$  is the uncertainty on the calibration, estimated by the BIPM.

The calibration type of the link is indicated as: GPS EC for GPS equipment calibration; TW EC for two-way equipment calibration; LC (technique) for a link calibrated using 'technique'; BC (technique) for a link calibrated using 'technique' to transfer a past equipment calibration through a discontinuity of link operation.

The calibration dates indicate: the most recent calibration results for the two laboratories in the case of EC and the most recent calibration of the link in the case of LC and BC, NA stands for not available, in this case estimated values are provided

Link	Type	$u_A$ /ns	$u_B$ /ns	Calibration Type	Calibration Dates
AOS /PTB	GPS MC	1.5	5.0	GPS EC /GPS EC	2003 Sep/2003 Aug
APL /USNO	GPS MC	1.5	5.0	GPS EC /GPS EC	2003 Dec/2003 Dec
AUS /NICT	GPS MC	3.0	5.0	GPS EC/GPS EC	2002 Sep/2003 Nov
BEV /PTB	GPS MC	1.5	5.0	GPS EC/GPS EC	2001 Dec/2003 Aug
BIRM/NICT	GPS MC	2.5	20.0	NA /GPS EC	NA /2003 Nov
CAO /PTB	GPS SC	7.0	20.0	NA /GPS EC	NA /2003 Aug
CH /PTB	GPS P3	0.7	5.0	GPS EC/GPS EC	2001 Feb/2003 Aug
CNM /NIST	GPS SC	5.0	20.0	NA /GPS EC	NA /2003 Dec
CNMP/USNO	GPS MC	4.0	7.0	GPS EC/GPS EC	2002 Oct/2003 Dec
CSIR/PTB	GPS MC	3.0	20.0	NA /GPS EC	NA /2003 Aug
DLR	NA				
DTAG/PTB	GPS SC	3.0	10.0	GPS EC/GPS EC	1998 May/2003 Aug
HKO /NICT	GPS MC	3.0	5.0	GPS EC/GPS EC	2004 Apr/2003 Nov
IEN /PTB	TWSTFT	1.0	1.0	LC (TWSTFT)	2003 Jun
IFAG/PTB	GPS P3	0.7	5.0	GPS EC/GPS EC	2003 Jun/2003 Aug
IGMA/USNO	GPS MC	5.0	20.0	NA /GPS EC	NA /2003 Dec
INPL/PTB	GPS SC	4.0	10.0	GPS EC/GPS EC	1987 Jun/2003 Jun
JATC/NTSC	INT LK	0.2	20.0	NA	NA
JV /PTB	GPS GT	5.0	20.0	NA /GPS EC	NA /2003 Aug
KRIS/NICT	GPS MC	2.5	5.0	GPS EC/GPS EC	2003 Oct/2003 Nov

Link	Type	$u_A$ /ns	$u_B$ /ns	Calibration Type	Calibration Dates
LDS /PTB	GPS SC	3.0	20.0	NA /GPS EC	NA /2003 Aug
LT /PTB	GPS MC	1.5	5.0	GPS EC/GPS EC	2001 Nov/2003 Aug
MSL /NICT	GPS P3	1.5	20.0	NA /GPS EC	NA /2003 Oct
NAO /NICT	GPS SC	3.0	20.0	NA /GPS EC	NA /2003 Nov
NICT/PTB	GPS P3	1.5	5.0	LC(GPS MC)	2004 May
NIM /NICT	GPS SC	3.0	20.0	NA /GPS EC	NA /2003 Nov
NIMB	NA				
NIMT/NICT	GPS P3	1.5	20.0	NA /GPS EC	NA /2003 Oct
NIS /PTB	GPS MC	3.0	20.0	NA /GPS EC	NA /2003 Aug
NIST/PTB	TWSTFT	0.5	5.0	LC(GPS SC)	2003 Sep
NMC /PTB	GPS GT	5.0	20.0	NA /GPS EC	NA /2003 Aug
NMIJ/NICT	GPS SC	2.5	5.0	GPS EC/GPS EC	2002 Apr/2003 Oct
NMLS	NA				
NPL /PTB	TWSTFT	0.5	5.0	LC(GPS SC)	1999 Nov
NPLI/PTB	GPS SC	3.0	20.0	NA /GPS EC	NA /2003 Aug
NRC /USNO	GPS SC	3.0	15.0	GPS EC/GPS EC	1982 /2003 Dec
NTSC/NICT	GPS MC	2.5	5.0	GPS EC/GPS EC	2002 Aug/2003 Oct
OMH /PTB	GPS SC	2.5	20.0	NA /GPS EC	NA /2003 Aug
ONBA/USNO	GPS MC	5.0	7.0	GPS EC/GPS EC	2000 Oct/2003 Dec
ONRJ/NIST	GPS SC	5.0	20.0	NA /GPS EC	NA /2003 Dec
OP /PTB	GPS SC	2.5	5.0	GPS EC/GPS EC	2004 Jan/2003 Aug
ORB /PTB	GPS P3	0.7	5.0	GPS EC/GPS EC	2003 Jul/2003 Aug
PL /PTB	GPS MC	1.5	5.0	GPS EC/GPS EC	2001 Oct/2003 Aug
ROA /PTB	TWSTFT	1.0	5.0	LC(GPS SC)	2001 Dec
SCL /NICT	GPS SC	4.0	10.0	GPS EC/GPS EC	1993 May/2003 Nov
SG /NICT	GPS MC	3.0	20.0	NA /GPS EC	NA /2003 Nov
SMU /PTB	GPS SC	5.0	20.0	NA /GPS EC	NA /2003 Aug
SP /PTB	GPS SC	3.0	10.0	GPS EC/GPS EC	1997 Oct/2003 Aug
SU /PTB	GPS SC	3.0	5.0	GPS EC/GPS EC	2003 Apr/2003 Aug
TCC /NIST	GPS SC	5.0	20.0	NA /GPS EC	NA /2003 Dec
TL /NICT	TWSTFT	1.5	5.0	LC(GPS SC)	2001 Oct
TP /PTB	GPS SC	2.5	5.0	GPS EC/GPS EC	2001 Oct/2003 Aug
UME /PTB	GPS SC	15.0	20.0	NA /GPS EC	NA /2003 Aug
USNO/PTB	TWSTFT	0.5	3.0	BC(GPS P3)	2003 Sep
VSL /PTB	TWSTFT	1.0	5.0	LC(GPS SC)	1999 Dec