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BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 81 (1994 October 25)

1 - Coordinated Universal Time UTC. Computed values of UTC-UTC(k) (1).

(From 1994 July 1, 0h UTC, TAI-UTC = 29 s)

Date 1994 0h UTC	Aug 25	Sep 4	Sep 14	Sep 24
MJD	49589	49599	49609	49619
Laboratory k	UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)	-1.492	-1.516	-1.446	-1.249
APL (Laurel)	1.056	0.920	0.778	0.782
AUS (Canberra)	0.116	0.085	0.016	-0.041
BEV (Wien)	-	-	-	-16.48
CAO (Cagliari)	-2.106	-2.277	-2.515	-2.757
CH (Bern)	0.252	0.090	-0.062	-0.121
CRL (Tokyo)	1.672	1.648	1.627	1.597
CSAO (Lintong)	-0.361	-0.427	-0.383	-0.406
CSIR (Pretoria)	-3.585	-3.125	-2.749	-2.459
FTZ (Darmstadt)	0.157	0.160	0.134	0.109
GUM (Warszawa)	0.517	-0.151	-0.541	-0.328
IEN (Torino) (2)	0.763	0.611	0.596	0.590
IFAG (Wettzell) (3)	3.946	0.320	0.132	-0.193
IGMA (Buenos Aires)	-3.17	-3.20	-3.22	-3.19
INPL (Jerusalem)	-0.390	-0.263	-0.113	0.018
JATC (Lintong)	0.291	0.586	0.625	0.360
KRIS (Taejon)	-0.189	-0.189	-0.212	-0.242
LDS (Leeds)	-0.507	-0.531	-0.529	-0.530
MSL (Lower Hutt)	-1.540	-1.617	-1.862	-1.972
NAOM (Mizusawa)	-1.633	-1.603	-1.602	-1.597
NAOT (Tokyo)	-2.141	-2.184	-2.204	-2.179
NIM (Beijing)	8.18	8.25	8.27	8.24
NIST (Boulder)	-0.008	-0.005	-0.016	-0.023
NMC (Sofiya)	-	-	-	-
NPL (Teddington)	-0.026	-0.037	-0.043	-0.052
NPLI (New-Delhi)	-	-	-	-
NRC (Ottawa)	5.994	5.922	5.847	5.769
NRLM (Tsukuba)	-12.666	-12.498	-12.324	-12.174
OMH (Budapest)	6.616	6.592	6.541	6.600
ONBA (Buenos Aires)	1.03	0.41	0.13	0.27
ONRJ (Rio de Janeiro)	-20.418	-20.664	-20.959	-21.147
OP (Paris)	-0.029	-0.037	-0.040	-0.055
ORB (Bruxelles)	-0.184	-0.177	-0.207	-0.193
PTB (Braunschweig)	2.627	2.615	2.601	2.596
RC (Habana)	-	-	-	-
ROA (San Fernando)	2.114	2.053	1.958	1.944
SCL (Hong Kong)	-0.267	-0.263	-0.257	-0.347
SNT (Stockholm)	0.179	0.144	0.140	0.146
SO (Shanghai)	2.04	2.04	2.04	2.07
SU (Moskva)	-4.685	-4.779	-4.869	-4.962
TL (Chung-Li)	-2.068	-1.990	-1.917	-1.847
TP (Praha)	-0.953	-0.936	-0.912	-0.899
TUG (Graz)	-3.200	-3.102	-3.015	-2.915
UME (Gebze-Kocaeli) (4)	-	-	-1.878	-1.936
USNO (Washington DC)(USNO MC)	0.000	-0.007	-0.017	-0.023
VSL (Delft)	0.504	0.484	0.502	0.524

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2 - International Atomic Time TAI and local atomic time scales TA(k).

The following table gives the computed values of TAI-TA(k) (1).

Date 1994 0h UTC		Aug 25	Sep 4	Sep 14	Sep 24
MJD		49589	49599	49609	49619
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
APL (Laurel)		2.519	2.383	2.241	2.245
AUS (Canberra)		-53.532	-53.906	-54.133	-54.348
CH (Bern)		-73.088	-72.990	-72.882	-72.747
CRL (Tokyo)		43.058	43.494	43.933	44.357
CSAO (Lintong)		13.059	12.820	12.691	12.496
F (Paris)		133.371	133.720	134.067	134.421
INPL (Jerusalem)		-224.692	-226.703	-228.644	-230.592
JATC (Lintong)		13.618	13.470	13.479	13.555
KRIS (Taejon)		-0.589	-0.409	-0.252	-0.092
NIM (Beijing)		-8.04	-7.95	-7.91	-7.92
NISA (Boulder)	(5)	-45117.287	-45117.711	-45118.142	-45118.569
NRC (Ottawa)		22.772	22.886	22.982	23.078
PTB (Braunschweig)		-360.773	-360.785	-360.799	-360.804
RC (Habana)		-	-	-	-
SO (Shanghai)		-45.55	-45.54	-45.58	-45.57
SU (Moskva)	(6)	27245.315	27245.221	27245.131	27245.038
USNO (Washington DC)	(7)	-34705.961	-34706.630	-34707.305	-34707.978

3 - Notes on sections 1 and 2.

(1) Values UTC-UTC(k) and TAI-TA(k) are published within 1 ns except for laboratories which are not linked through GPS common views.

(2) IEN . Change of master clock on MJD = 49596.5

(3) IFAG. Time step of UTC(IFAG) of 4.0 μs on MJD = 49597.48

(4) UME . Ulusai Metroloji Enstitüsü.
Marmara Research Centre, National Metrology Institute,
Gebze-Kocaeli (Turkey).

(5) NIST. TA(NISA) designates the scale AT1 of NIST.

(6) SU . Listed values are TAI-TA(SU) - 2.80 seconds.

(7) USNO. TA(USNO) designates the scale A1(MEAN) of USNO.

4 - [UTC - GPS time] and [TAI - GPS time].

[UTC - GPS time] = -10 s + C0, [TAI - GPS time] = 19 s + C0.

Daily values of C0 are given in the following table. They are obtained as follows: the GPS data taken at the Paris Observatory, for highest elevation, are first corrected for precise satellite ephemerides and for measured ionospheric delays, and then smoothed to obtain daily values of [UTC(OP) - GPS time] at 0h UTC; daily values of C0 are derived from them using linear interpolation of [UTC - UTC(OP)].

For a given day, where N measurements are used for estimation of C0 :
- the dispersion of individual measurements is characterized by a standard deviation σ,
- the daily C0 value is characterized by the standard deviation of the mean $\sigma/\sqrt{N}$.

Date 1994 0h UTC	MJD	C0 (ns)	σ (ns)	$\sigma/\sqrt{N}$ (ns)
Aug 25	49589	25	42	9
Aug 26	49590	21	60	13
Aug 27	49591	19	42	9
Aug 28	49592	19	43	10
Aug 29	49593	14	46	10
Aug 30	49594	7	46	10
Aug 31	49595	2	57	12
Sep 1	49596	-2	37	8
Sep 2	49597	-3	44	9
Sep 3	49598	-3	61	13
Sep 4	49599	-2	41	9
Sep 5	49600	1	39	8
Sep 6	49601	4	33	7
Sep 7	49602	8	49	10
Sep 8	49603	10	49	10
Sep 9	49604	13	64	13
Sep 10	49605	14	46	10
Sep 11	49606	12	33	7
Sep 12	49607	8	48	10
Sep 13	49608	0	34	7
Sep 14	49609	-6	39	8
Sep 15	49610	-7	46	10
Sep 16	49611	-3	45	10
Sep 17	49612	-2	24	5
Sep 18	49613	-1	7	1
Sep 19	49614	-2	9	2
Sep 20	49615	-1	10	2
Sep 21	49616	4	9	2
Sep 22	49617	8	10	2
Sep 23	49618	11	8	2
Sep 24	49619	11	35	7

5 - [UTC - GLONASS time].

[UTC - GLONASS time] = C1 (modulo 1 s).

From his current observations of both the GPS and GLONASS satellite systems Prof. P. Daly, University of Leeds, establishes and reports [GPS time - GLONASS time] at ten-day intervals, together with the standard deviation σ of his daily GLONASS data. C1 is then derived using [UTC - GPS time] of section 4.

Date 1994 0h UTC	MJD	C1 (μs)	σ (μs)
Aug 25	49589	-16.55	0.03
Sep 4	49599	-16.45	0.03
Sep 14	49609	-16.35	0.04
Sep 24	49619	-16.22	0.05

6 - Difference between the normalized frequencies of EAL and TAI.

Interval of validity		f(EAL)-f(TAI)
1993 Apr. 22 - 1994 Sep. 24	49099-49619	7.40×10^{-13}

7 - Duration of the TAI scale interval.

The following table gives the departure D of the duration of the TAI scale interval from the SI second on the rotating geoid as realized by a given primary standard occasionally evaluated or continuously operating as a clock. In the later case the chosen two-month period of observation is also indicated. The last communicated estimate of the inaccuracy of the standard provides the uncertainty σ of the D value.

D and σ are expressed in units of 10^{-14} second.

Standard	Obs. period	D	σ
* NIST-7	49589-49599	-2.0	1.0
* NIST-7	49599-49609	-0.3	1.0
PTB-CS1	49559-49619	+0.8	3.0
PTB-CS2	49559-49619	+1.9	1.5

The estimate of the duration of the TAI scale interval, computed by the BIPM, from all the available measurements of the TAI frequency, obtained by comparison with primary frequency standards continuously observed or occasionally evaluated (*CRL, *LPTF, *NIST, NRC, PTB, SU), is:

$$1 + 0 \times 10^{-14} \pm 2 \times 10^{-14}$$

in SI second on the rotating geoid, for the two-month interval 49559-49619 .

* The frequencies of the primary frequency standards Cs1 from CRL, JPO from LPTF, and NIST-7 from NIST, are corrected for the black body radiation shift.