

## BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 73 (1994 February 25)

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

(From 1993 July 1, 0hUTC, to 1994 July 1, 0hUTC, TAI-UTC = 28 s)

(From 1994 July 1, 0hUTC, until further notice, TAI-UTC = 29 s)

Date 1993/94 0hUTC		Dec 28	Jan 7	Jan 17	Jan 27
MJD		49349	49359	49369	49379
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-1.267	-1.391	-1.402	-1.585
APL (Laurel)		1.077	1.147	1.221	1.303
AUS (Canberra)	(2)	0.058	0.519	0.499	0.526
BEV (Wien)		9.64	9.52	9.56	9.36
CAO (Cagliari)		-4.846	-5.011	-5.213	-5.454
CH (Bern)		1.009	1.098	1.196	1.351
CRL (Tokyo)		2.320	2.276	2.250	2.207
CSAO (Lintong)		-0.756	-0.845	-0.837	-0.730
CSIR (Pretoria)		-3.401	-3.427	-3.464	-3.421
FTZ (Darmstadt)		0.113	-0.018	-0.032	-0.022
IEN (Torino)		-0.080	-0.063	-0.056	-0.057
IFAG (Wettzell)	(3)	3.076	0.751	0.480	0.209
IGMA (Buenos Aires)	(4)	-0.98	-2.32	-2.37	-2.52
INPL (Jerusalem)		-0.512	-0.584	-0.668	-0.725
JATC (Lintong)		-2.857	-2.941	-3.156	-3.068
KRIS (Taejon)		-0.206	-0.268	-0.321	-0.364
LDS (Leeds)		-0.036	-0.040	-0.065	-0.092
MSL (Lower Hutt)		-1.168	-0.970	-0.875	-0.804
NAOM (Mizusawa)		-1.354	-1.353	-1.329	-1.360
NAOT (Tokyo)		-2.184	-1.409	-0.613	0.164
NIM (Beijing)		7.73	8.15	7.60	7.35
NIST (Boulder)		0.032	0.041	0.044	0.039
NMC (Sofiya)		-	-	-	-
NPL (Teddington)		0.097	0.107	0.113	0.114
NPLI (New-Delhi)		-3.875	-3.794	-3.695	-3.655
NRC (Ottawa)		4.427	4.497	4.545	4.627
NRLM (Tsukuba)		-6.973	-7.268	-7.542	-7.833
OMH (Budapest)		5.614	5.823	5.974	6.119
ONBA (Buenos Aires)	(5)	3.13	2.03	2.49	2.64
ONRJ (Rio de Janeiro)		-9.889	-10.079	-10.488	-10.783
OP (Paris)		-0.166	-0.158	-0.151	-0.136
ORB (Bruxelles)		-1.601	-1.581	-1.580	-1.596
PKNM (Warszawa)		0.076	0.157	0.021	0.022
PTB (Braunschweig)		2.730	2.737	2.732	2.739
RC (Habana)		-3.49	-	-	-
ROA (San Fernando)		2.592	2.578	2.591	2.602
SCL (Hong Kong)		-0.062	-0.205	-0.256	-0.402
SNT (Stockholm)		0.138	0.165	0.206	0.177
SO (Shanghai)		2.17	2.16	2.19	2.14
SU (Moskva)		-2.580	-2.668	-2.761	-2.853
TL (Chung-Li)		-2.192	-2.385	-2.399	-2.510
TP (Praha)	(6)	-1.268	-1.260	-1.251	-1.240
TUG (Graz)		3.859	3.927	3.986	4.049
USNO (Washington DC)(USNO MC)		0.058	0.063	0.071	0.068
VSL (Delft)		-0.309	-0.298	-0.286	-0.222

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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 1993/94 0hUTC	Dec 28 MJD Laboratory k	Jan 7 49349	Jan 17 49359	Jan 27 49369	TAI-TA(k) (Unit = 1 microsecond)
APL (Laurel)		2.540	2.610	2.684	2.766
AUS (Canberra)	-49.413	-49.561	-49.791	-50.014	
CH (Bern)	-76.351	-76.302	-76.244	-76.129	
CRL (Tokyo)	32.895	33.298	33.719	34.122	
CSAO (Lintong)	16.152	15.890	15.726	15.660	
F (Paris)	124.411	124.795	125.178	125.572	
INPL (Jerusalem)	-177.342	-179.174	-181.043	-182.908	
JATC (Lintong)	8.480	8.765	8.530	8.511	
KRIS (Taejon)	-5.006	-4.868	-4.721	-4.554	
NIM (Beijing)	-8.94	-8.50	-9.04	-9.27	
NISA (Boulder)	(7) -45107.782	-45108.161	-45108.538	-45108.923	
NRC (Ottawa)	20.496	20.566	20.614	20.696	
PTB (Braunschweig)	-360.670	-360.663	-360.668	-360.661	
RC (Habana)	(8) -326.60	-	-	-	
SO (Shanghai)	-45.39	-45.46	-45.43	-45.45	
SU (Moskva)	(9) 27247.420	27247.332	27247.239	27247.147	
USNO (Washington DC)	(10) -34689.743	-34690.427	-34691.099	-34691.788	

## 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) AUS . Introduction of a master clock on MJD = 49353.0 at Orroral Observatory, Belconnen, Australia, as source of UTC(AUS).
- (3) IFAG. Time step of UTC(IFAG) of 2  $\mu$ s on MJD = 49355.6
- (4) IGMA. Apparent time step of UTC-UTC(IGMA) due to change of GPS receiver.
- (5) ONBA. Apparent time step of UTC-UTC(ONBA) due to change of GPS receiver at IGMA.
- (6) TP . Change of master clock on MJD = 49354.0
- (7) NIST. TA(NISA) designates the scale AT1 of NIST.
- (8) RC . Listed values are TAI-TA(RC) - 18 seconds.
- (9) SU . Listed values are TAI-TA(SU) - 2.80 seconds.
- (10) USNO. TA(USNO) designates the scale A1(MEAN) of USNO.

## 4 - Information. UTC time step on the 1st of July 1994.

Bulletin C7 of the International Earth Rotation Service informs that a positive leap second will be introduced at the end of June 1994. The sequence of dates of the UTC second markers will be :

1994 June 30, 23h 59m 59s  
 1994 June 30, 23h 59m 60s  
 1994 July 1, 0h 0m 0s

5 - UTC - GPS time and TAI - GPS time.

UTC - GPS time = -9 s + C0 (until 1994 July 1, 0hUTC)  
 UTC - GPS time = -10 s + C0 (from 1994 July 1, 0hUTC)  
 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, from Block I only, are first corrected for the precise satellite ephemerides and for the measured ionospheric delays, and then smoothed to obtain daily values of UTC(OP) - GPS time at 0hUTC; daily values of C0 are derived from them using linear interpolation of UTC - UTC(OP).

This procedure also allows the computation of daily standard deviations obtained from Block I and Block II data from Paris Observatory according to the International GPS Common-View Schedule. They are given in the following table in order to show the quality of the dissemination of GPS time from Block I and Block II satellites.

Date 1993/94 0hUTC	MJD	C0 (ns)	SD(ns)	
			Block I	Block II
Dec 28	49349	98	7	40
Dec 29	49350	98	6	39
Dec 30	49351	101	7	32
Dec 31	49352	99	7	55
Jan 1	49353	89	4	36
Jan 2	49354	86	7	34
Jan 3	49355	94	5	55
Jan 4	49356	101	6	33
Jan 5	49357	103	3	44
Jan 6	49358	102	6	49
Jan 7	49359	103	2	46
Jan 8	49360	103	4	45
Jan 9	49361	99	5	48
Jan 10	49362	97	3	24
Jan 11	49363	98	7	53
Jan 12	49364	99	6	31
Jan 13	49365	96	7	33
Jan 14	49366	104	7	58
Jan 15	49367	112	9	29
Jan 16	49368	107	7	39
Jan 17	49369	104	6	49
Jan 18	49370	110	4	40
Jan 19	49371	110	7	43
Jan 20	49372	105	5	54
Jan 21	49373	99	5	37
Jan 22	49374	99	6	40
Jan 23	49375	102	3	60
Jan 24	49376	102	3	51
Jan 25	49377	99	1	48
Jan 26	49378	96	5	54
Jan 27	49379	97	3	36

6 - 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 SD of his daily GLONASS data. C1 is then derived using UTC - GPS time of section 5.

Date 1993/94 0hUTC	MJD	C1 (μs)	SD (μs)
Dec 28	49349	-18.92	0.04
Jan 7	49359	-18.95	0.05
Jan 17	49369	-18.84	0.04
Jan 27	49379	-18.74	0.03

7 - Measurement of UTC(j)-UTC(k).

Date 1993	MJD	Time comparisons (Unit = 1 microsecond)	uncert.	source	meth.
Dec 17	49338.625	UTC(IGMA)-UTC(ONBA) = 3.4698	0.0005	IGMA report	(1)

(1) Clock Transportation.

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

Interval of validity	f(EAL)-f(TAI)
1993 Apr. 22 - 1994 Jan. 27      49099-49379	7.40x10 <sup>-13</sup>

9 - 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<sup>-14</sup> second.

Standard	Obs. period	D	σ
PTB-CS1	49319-49379	-4.4	3.0
PTB-CS2	49319-49379	-0.1	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 49319-49379 .