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BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 70 (1993 November 25)

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

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

Date 1993 0hUTC	Sep 29	Oct 9	Oct 19	Oct 29
MJD	49259	49269	49279	49289
Laboratory k	UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)	-1.343	-1.285	-1.160	-1.146
APL (Laurel)	0.593	0.687	0.762	0.831
AUS (Canberra)	-0.066	-0.048	-0.042	-0.036
BEV (Wien)	-9.40	-10.68	-12.00	-13.21
CAO (Cagliari)	-2.778	-3.047	-3.323	-3.573
CH (Bern)	0.518	0.558	0.596	0.645
CRL (Tokyo)	2.758	2.727	2.703	2.651
CSAO (Lintong)	-0.859	-0.797	-0.798	-0.764
CSIR (Pretoria)	-3.564	-3.588	-3.599	-3.535
FTZ (Darmstadt)	1.254	1.110	0.965	0.809
IEN (Torino)	-0.179	-0.166	-0.159	-0.133
IFAG (Wettzell)	5.025	5.009	4.973	4.795
IGMA (Buenos Aires)	-0.66	-0.67	-0.71	-0.74
INPL (Jerusalem)	0.597	0.475	0.342	0.206
JATC (Lintong)	-0.857	-0.849	-0.903	-1.223
KRIS (Taejon)	-0.160	-0.242	-0.054	0.270
LDS (Leeds)	0.180	0.151	0.120	0.119
MSL (Lower Hutt)	-0.765	-0.815	-0.969	-1.035
NAOM (Mizusawa)	-1.819	-1.748	-1.673	-1.612
NAOT (Tokyo)	-4.611	-4.811	-4.981	-5.130
NIM (Beijing)	7.37	7.37	7.29	7.37
NIST (Boulder)	-0.151	-0.146	-0.132	-0.122
NMC (Sofiya)	-	-	-	-
NPL (Teddington)	0.069	0.066	0.065	0.060
NPLI (New-Delhi)	-4.784	-4.703	-4.611	-
NRC (Ottawa)	3.517	3.597	3.683	3.786
NRLM (Tsukuba)	-4.479	-4.746	-5.020	-5.306
OMH (Budapest)	4.544	4.541	4.648	4.791
ONBA (Buenos Aires)	-101.15	-	-	-
ONRJ (Rio de Janeiro)	-8.537	-8.786	-8.623	-8.866
OP (Paris)	-0.293	-0.306	-0.296	-0.276
ORB (Bruxelles)	-1.603	-1.622	-1.571	-1.493
PKNM (Warszawa)	-0.083	-0.202	0.024	-0.187
PTB (Braunschweig)	2.776	2.767	2.764	2.752
RC (Habana)	-	-	-	-
ROA (San Fernando)	2.527	2.551	2.588	2.586
SCL (Hong Kong) (2)	-1.982	-0.094	-0.223	-0.357
SNT (Stockholm)	0.494	0.530	0.471	0.346
SO (Shanghai)	2.04	1.96	2.02	2.03
SU (Moskva)	-1.737	-1.838	-1.934	-2.031
TL (Chung-Li)	-2.066	-2.301	-2.403	-2.362
TP (Praha)	-1.251	-1.321	-1.413	-1.536
TUG (Graz)	3.214	3.274	3.350	3.415
USNO (Washington DC)(USNO MC)	-0.066	-0.048	-0.042	-0.036
VSL (Delft)	1.702	1.514	1.013	0.566

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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 0hUTC		Sep 29	Oct 9	Oct 19	Oct 29
MJD		49259	49269	49279	49289
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
APL (Laurel)		2.056	2.150	2.225	2.294
AUS (Canberra)		-47.948	-48.154	-48.331	-48.537
CH (Bern)		-76.482	-76.482	-76.484	-76.475
CRL (Tokyo)		29.361	29.768	30.184	30.576
CSAO (Lintong)		17.604	17.494	17.320	17.181
F (Paris)		120.951	121.329	121.722	122.105
INPL (Jerusalem)		-161.299	-163.075	-164.837	-166.583
JATC (Lintong)		9.290	9.433	9.642	9.370
KRIS (Taejon)		-6.220	-6.302	-6.194	-6.030
NIM (Beijing)		-9.47	-9.45	-9.51	-9.40
NISA (Boulder)	(3)	-45104.402	-45104.783	-45105.159	-45105.539
NIST (Boulder)		-45221.206	-45221.854	-45222.493	-45223.134
NRC (Ottawa)		19.586	19.666	19.752	19.855
PTB (Braunschweig)		-360.624	-360.633	-360.636	-360.648
RC (Habana)		-	-	-	-
SO (Shanghai)		-45.61	-45.68	-45.61	-45.55
SU (Moskva)	(4)	27248.263	27248.162	27248.066	27247.969
USNO (Washington DC)	(5)	-34683.613	-34684.290	-34684.972	-34685.663

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) SCL . Time step of UTC(SCL) of - 2 µs on MJD = 49259.288

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

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

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

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

Date 1993	MJD	Time comparisons (Unit = 1 microsecond)	uncert.	source	meth.
Oct 19	49279.05	UTC(CRL)-UTC(NAOT) = -7.682	0.005	CRL report	(1)

(1) Clock Transportation.

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

UTC - GPS time = -9 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, 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 0hUTC	MJD	C0 (ns)	SD(ns) Block I	Block II
Sep 29	49259	-42	8	37
Sep 30	49260	-41	7	47
Oct 1	49261	-40	5	34
Oct 2	49262	-40	4	31
Oct 3	49263	-42	3	51
Oct 4	49264	-43	4	38
Oct 5	49265	-42	3	30
Oct 6	49266	-39	3	42
Oct 7	49267	-37	6	53
Oct 8	49268	-38	3	48
Oct 9	49269	-42	5	42
Oct 10	49270	-46	3	33
Oct 11	49271	-49	6	56
Oct 12	49272	-49	7	43
Oct 13	49273	-43	5	57
Oct 14	49274	-36	5	42
Oct 15	49275	-32	10	36
Oct 16	49276	-32	7	44
Oct 17	49277	-34	3	44
Oct 18	49278	-38	11	43
Oct 19	49279	-40	8	55
Oct 20	49280	-35	5	42
Oct 21	49281	-27	10	60
Oct 22	49282	-23	9	42
Oct 23	49283	-25	10	37
Oct 24	49284	-31	6	45
Oct 25	49285	-34	4	48
Oct 26	49286	-31	6	56
Oct 27	49287	-22	8	59
Oct 28	49288	-13	8	43
Oct 29	49289	-10	7	40

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 0hUTC	MJD	C1 (μs)	SD (μs)
Sep 29	49259	-16.00	0.04
Oct 9	49269	-16.16	0.04
Oct 19	49279	-16.46	0.04
Oct 29	49289	-16.79	0.04

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

Interval of validity		f(EAL)-f(TAI)
1993 Apr. 22 - 1993 Oct. 29	49099-49289	7.40×10^{-13}

8 - 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
PTB-CS1	49229-49289	+0.8	3.0
PTB-CS2	49229-49289	+1.2	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:

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

in SI second on the rotating geoid, for the two-month interval 49229-49289 .