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BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 68 (1993 September 28)

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

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

Date 1993 0hUTC		Jul 31	Aug 10	Aug 20	Aug 30
MJD		49199	49209	49219	49229
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)	(2)	-1.425	-1.834	-0.961	-1.388
APL (Laurel)		0.189	0.239	0.309	0.376
AUS (Canberra)		-0.103	-0.107	-0.096	-0.086
BEV (Wien)		-	-3.48	-4.57	-5.84
CAO (Cagliari)		-0.981	-	-1.767	-2.076
CH (Bern)		0.273	0.341	0.395	0.422
CRL (Tokyo)	(3)	2.615	2.732	2.766	2.796
CSAO (Lintong)		-0.770	-0.790	-0.838	-0.914
CSIR (Pretoria)		-4.127	-4.080	-4.019	-3.867
FTZ (Darmstadt)		0.767	0.894	0.977	1.099
IEN (Torino)		-0.249	-0.240	-0.215	-0.215
IFAG (Wettzell)		4.661	4.777	4.905	4.996
IGMA (Buenos Aires)		-0.28	-0.36	-0.49	-0.47
INPL (Jerusalem)		0.410	0.531	0.647	0.678
JATC (Lintong)		-0.658	-0.937	-0.937	-0.782
KRIS (Taejon)		-0.550	-0.575	-0.279	0.060
LDS (Leeds)		-	-	-	-
MSL (Lower Hutt)	(4)	-3.958	-3.974	-0.154	-0.387
NAOM (Mizusawa)		-1.586	-1.622	-1.683	-1.741
NAOT (Tokyo)		-3.445	-3.605	-3.800	-4.026
NIM (Beijing)		7.47	7.40	7.33	7.31
NIST (Boulder)		-0.060	-0.077	-0.097	-0.120
NMC (Sofiya)		-	-	-	-
NPL (Teddington)		0.125	0.112	0.110	0.101
NPLI (New-Delhi)		-5.228	-5.146	-5.046	-4.979
NRC (Ottawa)		3.096	3.182	3.244	3.300
NRLM (Tsukuba)		-2.819	-3.087	-3.350	-3.633
OMH (Budapest)		4.061	4.162	4.222	4.332
ONBA (Buenos Aires)		-92.86	-94.09	-95.49	-96.71
ONRJ (Rio de Janeiro)		-6.193	-6.662	-7.051	-7.542
OP (Paris)		-0.185	-0.202	-0.211	-0.234
ORB (Bruxelles)		-1.443	-1.483	-1.536	-1.598
PKNM (Warszawa)		0.207	0.235	0.266	0.338
PTB (Braunschweig)		2.854	2.845	2.834	2.815
RC (Habana)		-	-	-	-
ROA (San Fernando)		2.760	2.756	2.718	2.652
SCL (Hong Kong)		-0.699	-0.885	-1.112	-1.314
SNT (Stockholm)		0.387	0.572	0.528	0.443
SO (Shanghai)		2.13	2.13	2.14	2.09
SU (Moskva)		-1.119	-1.216	-1.311	-1.420
TL (Chung-Li)		-0.975	-	-	-
TP (Praha)		-0.884	-0.908	-0.967	-1.059
TUG (Graz)		1.628	1.632	1.652	1.665
USNO (Washington DC)	(USNO MC)	-0.103	-0.107	-0.096	-0.086
VSL (Delft)		0.848	1.039	1.204	1.359

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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		Jul 31	Aug 10	Aug 20	Aug 30
MJD		49199	49209	49219	49229
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
APL (Laurel)		1.652	1.702	1.772	1.839
AUS (Canberra)		-46.907	-47.048	-47.246	-47.490
CH (Bern)		-76.420	-76.440	-76.445	-76.458
CRL (Tokyo)	(3)	26.822	27.316	27.727	28.133
CSAO (Lintong)		18.588	18.442	18.265	18.059
F (Paris)		118.756	119.114	119.482	119.844
INPL (Jerusalem)		-151.019	-152.708	-154.375	-156.101
JATC (Lintong)		8.122	7.825	7.995	8.522
KRIS (Taejon)		-5.610	-5.865	-5.929	-5.950
NIM (Beijing)		-9.49	-9.54	-9.60	-9.59
NISA (Boulder)	(5)	-45102.140	-45102.511	-45102.886	-45103.264
NIST (Boulder)		-45217.357	-45217.993	-45218.630	-45219.269
NRC (Ottawa)		19.165	19.251	19.313	19.369
PTB (Braunschweig)		-360.546	-360.555	-360.566	-360.585
RC (Habana)		-	-	-	-
SO (Shanghai)		-45.43	-45.44	-45.44	-45.52
SU (Moskva)	(6)	27248.881	27248.784	27248.689	27248.580
USNO (Washington DC)	(7)	-33679.458	-33680.146	-33680.839	-33681.532

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) AOS . Change of master clock between MJD = 49199 and MJD = 49209. Time step of UTC(AOS) of -1.3 μs on MJD = 49210.43

(3) CRL . Apparent time step of UTC-UTC(CRL) and TAI-TA(CRL) of 84 ns between MJD = 49199 and MJD = 49209 due to the recalibration of the GPS time link.

(4) MSL . Time step of UTC(MSL) of -4.1 μs on MJD = 49211

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

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

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

4 - 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 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 as observed at Paris Observatory according to the International GPS Common-View Schedule, and after correction for the measured ionospheric delays. 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
Jul 31	49199	-79	4	55
Aug 1	49200	-73	12	47
Aug 2	49201	-68	5	33
Aug 3	49202	-66	3	44
Aug 4	49203	-66	14	47
Aug 5	49204	-69	10	44
Aug 6	49205	-69	11	32
Aug 7	49206	-63	8	42
Aug 8	49207	-56	8	44
Aug 9	49208	-53	15	26
Aug 10	49209	-57	12	47
Aug 11	49210	-64	8	27
Aug 12	49211	-68	9	45
Aug 13	49212	-70	5	59
Aug 14	49213	-72	11	38
Aug 15	49214	-75	8	47
Aug 16	49215	-71	6	57
Aug 17	49216	-70	5	56
Aug 18	49217	-75	6	43
Aug 19	49218	-86	7	57
Aug 20	49219	-96	17	46
Aug 21	49220	-107	10	61
Aug 22	49221	-117	-	-
Aug 23	49222	-121	15	17
Aug 24	49223	-128	7	26
Aug 25	49224	-134	7	23
Aug 26	49225	-136	4	20
Aug 27	49226	-137	11	45
Aug 28	49227	-136	7	35
Aug 29	49228	-136	8	46
Aug 30	49229	-135	8	48

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 SD of his daily GLONASS data. C1 is then derived using UTC - GPS time of section 4.

Date 1993 0hUTC	MJD	C1 (μs)	SD (μs)
Jul 31	49199	-15.09	0.05
Aug 10	49209	-15.17	0.04
Aug 20	49219	-15.33	0.04
Aug 30	49229	-15.58	0.10

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

Interval of validity		f(EAL)-f(TAI)
1993 Apr. 22 - 1993 Aug. 30	49099-49229	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
PTB-CS1	49159-49229	-0.2	3.0
PTB-CS2	49159-49229	+0.5	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 49159-49229 .