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BIPM

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 35 (1991 January 3)

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

(From 1990 January 1, 0hUTC, to 1991 January 1, 0hUTC, TAI-UTC = 25s)
(From 1991 January 1, 0hUTC, until further notice, TAI-UTC = 26s)

Date 1990 (0hUTC)		Oct 25	Nov 4	Nov 14	Nov 24
MJD		48189	48199	48209	48219
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-5.80	-7.30	-8.92	-11.03
APL (Laurel)		-0.44	-0.47	-0.49	-0.54
AUS (Canberra)		-0.12	-0.08	-0.02	0.03
BEV (Wien)		1.48	0.77	0.10	-0.44
CAO (Cagliari)		3.16	2.82	2.46	2.27
CH (Bern)		0.34	0.37	0.39	0.43
CRL (Tokyo)		0.86	0.94	1.03	1.13
CSAO (Lintong)		-7.13	-6.92	-6.71	-6.50
DPT (Pretoria)		-22.14	-22.32	-22.49	-22.65
FTZ (Darmstadt)		17.19	17.38	17.53	17.74
IEN (Torino)		0.50	0.63	0.74	0.86
IFAG (Wettzell)		1.96	2.17	2.25	2.30
IGMA (Buenos Aires)		9.53	9.66	9.83	9.97
INPL (Jerusalem)		-2.68	-3.48	-4.29	-4.53
JATC (Lintong)		-18.23	-18.20	-18.24	-18.35
KSRI (Taejon)		-74.28	-75.19	-76.11	-76.99
NAOM (Mizusawa)	(1)	-5.43	-5.54	-5.63	-5.62
NIM (Beijing)		8.39	8.55	8.46	7.98
NIST (Boulder)		-0.31	-0.36	-0.41	-0.46
NPL (Teddington)		-0.73	-0.72	-0.76	-0.72
NPLI (New-Delhi)	(2)	-31.74	-31.73	-31.70	-31.50
NRC (Ottawa)		0.66	0.62	0.59	0.49
NRLM (Tsukuba)		-21.65	-21.63	-21.71	-21.71
OMH (Budapest)		-	0.94	1.53	1.68
ONRJ (Rio de Janeiro)		9.84	9.87	9.99	9.99
OP (Paris)		-0.30	-0.26	-0.23	-0.20
ORB (Bruxelles)		10.65	10.95	11.26	11.55
PEL (Lower Hutt)		-	-	-	-
PKNM (Warszawa)		2.09	2.71	3.25	3.87
PTB (Braunschweig)		3.75	3.73	3.72	3.70
RC (Habana)		-3.44	-3.45	-3.55	-3.41
ROA (San Fernando)		7.91	7.93	7.95	7.99
SO (Shanghai)		2.82	2.65	2.64	2.60
STA (Stockholm)		-0.58	-0.71	-0.63	-0.54
SU (Moskva)	(3)	8.90	8.76	8.71	8.54
TAO (Tokyo)		-0.40	-0.19	0.03	0.27
TL (Chung-Li)		3.50	3.26	2.93	2.68
TP (Praha)		0.99	1.39	1.53	1.47
TUG (Graz)		2.96	3.24	3.48	3.77
USNO (Washington DC)	(USNO MC)	-0.12	-0.08	-0.02	0.03
VSL (Delft)		3.84	3.80	3.90	3.91
YUZM (Beograd)		28.64	28.69	28.69	28.34
ZIPE (Potsdam)		0.08	0.09	0.09	-0.10

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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).

Date 1990 (0hUTC)			Oct 25	Nov 4	Nov 14	Nov 24
MJD			48189	48199	48209	48219
Laboratory k			TAI-TA(k) (Unit = 1 microsecond)			
AOS	(Borowiec)		-25.79	-27.30	-28.92	-31.03
APL	(Laurel)		-0.95	-0.97	-1.00	-1.04
AUS	(Canberra)		-31.15	-31.30	-31.47	-31.69
CH	(Bern)		-67.78	-67.95	-68.13	-68.29
CRL	(Tokyo)		0.39	0.54	0.69	0.85
CSAO	(Lintong)		27.11	27.12	27.13	27.14
F	(Paris)		85.53	85.82	86.11	86.42
JATC	(Lintong)		-0.28	-0.23	-0.15	-0.12
NIM	(Beijing)		-10.71	-10.51	-10.56	-11.00
NISA	(Boulder)	(4)	-45068.32	-45068.57	-45068.84	-45069.12
NIST	(Boulder)		-45152.63	-45153.28	-45153.92	-45154.58
NRC	(Ottawa)		16.73	16.69	16.66	16.56
PTB	(Braunschweig)		-359.65	-359.67	-359.68	-359.70
RC	(Habana)	(5)	-270.89	-271.47	-272.22	-272.78
SO	(Shanghai)		-44.59	-44.75	-44.77	-44.78
SU	(Moskva)	(3)	2827258.90	2827258.76	2827258.71	2827258.54
USNO	(Washington DC)	(6)	-34611.65	-34612.28	-34612.90	-34613.54

3 - Notes on sections 1 and 2.

(1) NAOM. Change of master clock on MJD = 48195 .

(2) NPLI. Time step of UTC(NPLI) of about 1.3 μs on MJD = 48166.5

MJD	UTC-UTC(NPLI)
48169	-31.95
48179	-31.81

(3) SU . Time transfer data obtained from GLONASS satellite trackings at the University of Leeds (U.K.). See Section 5.

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

(5) RC . Listed values are TAI-TA(RC) - 18 seconds.

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

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

UTC - GPS time = -6s + Co, TAI - GPS time = 19s + Co.

The GPS data taken at the Paris Observatory, from Block I satellites only, are usually corrected for the measured ionospheric delays and then smoothed to obtain daily values, at 0hUTC, of UTC(OP) - GPS time. Co is derived from them using linear interpolation of UTC - UTC(OP).

The DC values are the residuals to the smoothed data for the middle of the 13-minute tracking period. This time is given for the first date of the table. The DC values are reported here only to show the quality of the synchronization.

UTC may be derived from observation at any site of any listed satellite, by interpolating Co. The quality of the access to UTC mainly depends upon local conditions of observation.

Date 1990	MJD	Co (ns) 0hUTC	DC(ns) Block I PRN 6 NAV 3 22h32m	PRN 9 NAV 6 1h32m	PRN13 NAV 9 2h 4m	PRN12 NAV10 2h20m	PRN 3 NAV11 5h32m
Oct 25	48189	-250	-	5	-16	1	3
Oct 26	48190	-239	1	-2	-6	-5	13
Oct 27	48191	-226	4	-14	13	-12	4
Oct 28	48192	-220	0	-3	-28	24	10
Oct 29	48193	-218	-3	12	-5	-17	8
Oct 30	48194	-211	0	6	-12	-1	11
Oct 31	48195	-197	-10	-4	-1	-21	1
Nov 1	48196	-184	-11	-8	12	14	6
Nov 2	48197	-179	-8	-5	-5	4	9
Nov 3	48198	-176	5	-2	-	-9	10
Nov 4	48199	-171	-2	-1	11	-11	0
Nov 5	48200	-168	6	4	-14	-14	15
Nov 6	48201	-164	1	-5	-20	13	4
Nov 7	48202	-160	-	5	-9	-2	9
Nov 8	48203	-150	0	-3	3	-1	-10
Nov 9	48204	-140	-7	-1	11	10	2
Nov 10	48205	-135	-1	-10	2	-5	7
Nov 11	48206	-135	-10	-2	-11	-27	19
Nov 12	48207	-134	12	7	1	0	5
Nov 13	48208	-134	-1	-4	-16	-6	-4
Nov 14	48209	-130	-2	2	-3	7	2
Nov 15	48210	-127	2	-3	0	-1	13
Nov 16	48211	-128	1	-	-7	-31	3
Nov 17	48212	-127	0	-5	-13	9	1
Nov 18	48213	-121	-9	-4	6	-27	11
Nov 19	48214	-110	-4	3	4	-10	16
Nov 20	48215	-99	7	5	-6	-	6
Nov 21	48216	-94	7	-2	-16	5	0
Nov 22	48217	-93	0	-3	-9	-17	4
Nov 23	48218	-90	0	-11	3	-1	0
Nov 24	48219	-82	7	-10	-	31	15

Section 4 (Cont.)

For Block II satellites, the DC values are computed with respect to Co obtained from Block I only.

Date 1990	MJD	Co (ns) 0hUTC	DC(ns) Block II PRN14 NAV14 16h56m	PRN20 NAV20 2h36m	PRN16 NAV16 6h52m	PRN17 NAV17 10h20m	PRN 2 NAV13 12h12m
Oct 25	48189	-250	0	1	-1	-14	-7
Oct 26	48190	-239	-3	-4	-4	-14	-12
Oct 27	48191	-226	6	-2	-23	14	-7
Oct 28	48192	-220	-20	-1	-8	-2	-2
Oct 29	48193	-218	11	3	-10	-17	-13
Oct 30	48194	-211	6	-11	-8	12	-20
Oct 31	48195	-197	17	1	-1	21	2
Nov 1	48196	-184	20	8	7	24	6
Nov 2	48197	-179	3	3	9	-12	2
Nov 3	48198	-176	0	4	4	1	-8
Nov 4	48199	-171	12	5	9	-1	-15
Nov 5	48200	-168	3	7	-1	15	-5
Nov 6	48201	-164	-1	10	5	-15	1
Nov 7	48202	-160	-1	4	-2	10	-9
Nov 8	48203	-150	15	-3	6	7	-4
Nov 9	48204	-140	-2	14	18	-16	0
Nov 10	48205	-135	9	7	18	-3	5
Nov 11	48206	-135	-13	17	-3	-11	-1
Nov 12	48207	-134	-2	1	12	-3	-9
Nov 13	48208	-134	9	-6	7	-22	3
Nov 14	48209	-130	21	12	25	5	-6
Nov 15	48210	-127	5	5	16	-3	7
Nov 16	48211	-128	8	4	1	-6	-8
Nov 17	48212	-127	14	8	39	8	-1
Nov 18	48213	-121	4	1	-11	-6	2
Nov 19	48214	-110	-3	6	14	17	6
Nov 20	48215	-99	17	6	19	9	9
Nov 21	48216	-94	0	13	20	-3	3
Nov 22	48217	-93	-1	7	25	3	-2
Nov 23	48218	-90	-8	3	7	-9	3
Nov 24	48219	-82	-14	6	30	-9	-1

5 - UTC - GLONASS time.

UTC - GLONASS time = C1.

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.

UTC(USNO) - UTC(SU) is also provided by Prof. Daly.

Date 1990 (0hUTC)	MJD (0hUTC)	C1 (µs)	SD (µs)	UTC(USNO)-UTC(SU) (µs)
Oct 25	48189	5.49	0.06	9.02
Nov 4	48199	4.97	0.11	8.84
Nov 14	48209	4.33	0.08	8.73
Nov 24	48219	3.85	0.05	8.51

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

Date 1990	MJD	Time comparisons (Unit : 1 microsecond)	uncert.	source	meth.
Nov 1	48196.22	UTC(CRL) - UTC(TAO) = -1.212	0.005	CRL letter	(1)

(1) Clock transportation.

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 at sea level as realized by a given primary frequency 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 s of the D value.

D and s are expressed in 1*10**-14 second.

Standard	Obs. period	D	s
NRC-CsV	48159-48219	+6.6	10.0
PTB-CS1	48159-48219	+0.6	3.1
PTB-CS2	48159-48219	+2.1	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, NIST, NRC, PTB, SU), is:

1 + 2*10**-14 +or- 2*10**-14

in SI second at sea level, for the two-month interval 48159-48219 .