BIPM

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BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 45 (1991 October 31)

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

(Since 1991 January 1, 0hUTC, TAI-UTC=26s).

Date 1991 0hUTC		Aug 31	Sep 10	Sep 20	Sep 30
MJD		48499	48509	48519	48529
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-0.17	-0.39	-0.68	-0.57
APL (Laurel)		-1.17	-1.20	-1.19	-1.19
AUS (Canberra)		0.18	0.16	0.14	0.13
BEV (Wien)	(1)	-9.35	9.80	8.93	8.07
CAO (Cagliari)		-	-	-	-
CH (Bern)		1.69	1.64	1.60	1.58
CRL (Tokyo)		2.07	2.10	2.11	2.15
CSAO (Lintong)		-3.59	-3.46	-3.42	-3.37
DPT (Pretoria)		-24.81	-24.72	-24.68	-24.61
FTZ (Darmstadt)		21.89	22.17	22.41	22.43
IEN (Torino)		-0.97	-0.99	-1.01	-1.03
IFAG (Wettzell)		1.61	1.66	1.73	1.74
IGMA (Buenos Aires)		1.03	1.13	1.27	1.44
INPL (Jerusalem)		-0.36	-0.45	-0.55	-0.66
JATC (Lintong)	(2)	-23.35	-27.20	-27.08	-26.93
KSRI (Taejon)		0.70	0.62	0.60	0.62
LDS (Leeds)		-8.84	-9.61	-10.41	-11.27
NAOM (Mizusawa)		-9.07	-9.22	-9.33	-9.44
NIM (Beijing)		7.82	7.82	7.68	7.76
NIST (Boulder)		-1.11	-1.10	-1.08	-1.07
NPL (Teddington)		-0.18	-0.28	-0.31	-0.41
NPLI (New-Delhi)		-	-	-	-
NRC (Ottawa)		2.08	2.08	2.05	2.03
NRLM (Tsukuba)		-56.92	-59.19	-61.59	-64.17
OMH (Budapest)		3.20	3.15	2.87	2.83
ONRJ (Rio de Janeiro)		12.64	12.38	11.90	11.51
OP (Paris)		-0.85	-0.84	-0.81	-0.77
ORB (Bruxelles)		1.92	1.60	1.40	1.35
PEL (Lower Hutt)		-	-	-0.76	-0.82
PKNM (Warszawa)		-0.94	-0.84	-0.75	-0.50
PTB (Braunschweig)		3.38	3.37	3.36	3.35
RC (Habana)		-2.69	-2.70	-2.94	-3.08
ROA (San Fernando)		6.19	6.03	5.94	5.86
SNT (Stockholm)		0.16	0.14	0.04	0.01
SO (Shanghai)		2.43	2.43	2.33	2.30
SU (Moskva)	(3)(4)	5.51	5.47	5.32	5.24
TAO (Tokyo)		1.15	1.17	1.18	1.19
TL (Chung-Li)		2.69	2.82	2.93	2.94
TP (Praha)	(5)	-0.53	-0.46	-0.53	-0.44
TUG (Graz)		-1.33	-0.99	-0.71	-0.35
USNO (Washington DC)	(USNO MC)	0.18	0.16	0.14	0.13
VSL (Delft)		1.77	1.88	1.94	1.94
YUZM (Beograd)		50.53	51.71	51.34	51.06
ZIPE (Potsdam)		-0.23	-0.13	-0.12	-0.09

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TÉL. (CENTRAL) : + 33 1 45 07 70 70 TELEX : BIPM 631351 F TÉLÉCOPIE : + 33 1 45 34 20 21

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

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

Date 1991 0hUTC		Aug 31	Sep 10	Sep 20	Sep 30
MJD		48499	48509	48519	48529
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
APL (Laurel)		-1.68	-1.71	-1.70	-1.69
AUS (Canberra)		-36.66	-36.82	-37.01	-37.30
CH (Bern)		-70.97	-71.08	-71.18	-71.25
CRL (Tokyo)		5.25	5.42	5.58	5.77
CSAO (Lintong)		24.45	24.39	24.22	24.07
F (Paris)		94.67	94.98	95.28	95.61
JATC (Lintong)	(2)	2.55	-1.44	-1.35	-1.39
KSRI (Taejon)		-18.45	-19.12	-19.83	-20.40
NIM (Beijing)		-10.57	-10.55	-10.67	-10.57
NISA (Boulder)	(6)	-45077.24	-45077.56	-45077.87	-45078.19
NIST (Boulder)		-45172.52	-45173.17	-45173.81	-45174.46
NRC (Ottawa)		18.15	18.15	18.12	18.10
PTB (Braunschweig)		-360.02	-360.03	-360.04	-360.05
RC (Habana)	(7)	-292.11	-292.93	-293.99	-294.96
SO (Shanghai)		-44.92	-44.93	-45.05	-45.08
SU (Moskva)	(4)	2827255.51	2827255.47	2827255.32	2827255.24
USNO (Washington DC)	(8)	-34632.23	-34632.90	-34633.58	-34634.25

3 - Notes on sections 1 and 2.

(1) BEV . Corrected value of UTC-UTC(BEV) for MJD = 48499 . Time step of UTC(BEV) of -20 μs on MJD = 48508.5

(2) JATC. Apparent time step of UTC(JATC) and TA(JATC) of 4.115 μs between MJD = 48499 and MJD = 48509 due to change of time transfer method.

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

(4) SU . Revised values of UTC-UTC(SU) and TAI-TA(SU) for MJD = 48499 .

(5) TP . Apparent time step of UTC(TP) of 0.108 μs between MJD = 48509 and MJD = 48519 due to introduction of the GPS time link.

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

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

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

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

UTC - GPS time = -7s + C0, TAI - GPS time = 19s + C0.

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

The r values are the residuals to the smoothed data for the middle of the 13-minute tracking period. The reference times are given for the first date of the table only. The r values are reported here only to show the quality of the synchronization.

UTC may be derived at any site from observation of any listed satellite, by interpolating C0 to the tracking time. The quality of the access to UTC mainly depends upon local conditions of observation.

			r(ns) Block I				
Date 1991 0hUTC	MJD	C0 (ns)	PRN 6 NAV 3 3h16m	PRN12 NAV10 4h52m	PRN 3 NAV11 8h36m	PRN11 NAV 8 13h 8m	PRN13 NAV 9 19h16m
Aug 31	48499	200	-5	-5	-5	0	-5
Sep 1	48500	200	-9	-	5	3	-4
Sep 2	48501	207	6	-	6	3	-2
Sep 3	48502	211	5	-	0	8	-7
Sep 4	48503	212	-3	-	0	4	-7
Sep 5	48504	214	-2	-	11	-4	-7
Sep 6	48505	219	-3	9	5	8	-12
Sep 7	48506	223	-3	3	1	0	4
Sep 8	48507	224	-16	-	6	0	-19
Sep 9	48508	222	-1	4	0	15	3
Sep 10	48509	217	-11	-	11	-7	-10
Sep 11	48510	212	-15	-	3	4	-3
Sep 12	48511	207	-14	-1	12	0	1
Sep 13	48512	202	3	-	2	3	-17
Sep 14	48513	198	0	-	13	12	-17
Sep 15	48514	196	4	-	9	-2	-6
Sep 16	48515	193	5	-	0	5	-1
Sep 17	48516	188	7	-	5	6	-7
Sep 18	48517	178	0	-1	-1	-1	-10
Sep 19	48518	170	-2	13	4	-3	-13
Sep 20	48519	164	-1	5	7	5	5
Sep 21	48520	157	-3	-	2	7	-12
Sep 22	48521	147	-12	-1	-6	3	2
Sep 23	48522	142	6	8	10	0	-8
Sep 24	48523	140	12	8	-2	4	-3
Sep 25	48524	141	-2	-3	-3	5	-3
Sep 26	48525	146	9	-	6	-3	-9
Sep 27	48526	155	1	-1	-1	7	-6
Sep 28	48527	163	3	16	6	-5	-5
Sep 29	48528	167	-4	-	6	-11	-11
Sep 30	48529	169	-3	-1	5	11	0

Section 4 (Cont.)

For Block II satellites, the r values are computed with respect to C0 obtained from Block I only.

Date 1991 0hUTC	MJD	C0 (ns)	r(ns) Block II PRN20 NAV20 5h40m	PRN17 NAV17 12h 4m	PRN15 NAV15 14h28m	PRN21 NAV21 15h48m	PRN14 NAV14 17h24m
Aug 31	48499	200	5	-12	-9	24	8
Sep 1	48500	200	9	18	-12	15	-12
Sep 2	48501	207	-3	6	-19	17	2
Sep 3	48502	211	19	14	4	27	2
Sep 4	48503	212	11	13	13	-11	1
Sep 5	48504	214	12	10	6	21	1
Sep 6	48505	219	21	6	-15	-6	0
Sep 7	48506	223	39	5	-1	35	-11
Sep 8	48507	224	5	3	0	-	-3
Sep 9	48508	222	5	10	17	14	9
Sep 10	48509	217	15	-5	9	7	-13
Sep 11	48510	212	18	13	8	8	-6
Sep 12	48511	207	8	13	-1	18	-1
Sep 13	48512	202	26	-8	-8	6	-2
Sep 14	48513	198	6	9	16	14	-10
Sep 15	48514	196	-	1	-19	15	9
Sep 16	48515	193	-	5	-17	10	-9
Sep 17	48516	188	-	8	12	-19	-9
Sep 18	48517	178	-	7	-16	14	-6
Sep 19	48518	170	-	12	11	40	-3
Sep 20	48519	164	-	8	3	10	-3
Sep 21	48520	157	-	10	-14	4	-4
Sep 22	48521	147	17	-4	-3	8	-2
Sep 23	48522	142	3	7	15	19	-21
Sep 24	48523	140	16	-1	-23	22	-6
Sep 25	48524	141	5	15	-8	-17	22
Sep 26	48525	146	13	-3	16	29	9
Sep 27	48526	155	21	12	0	0	-14
Sep 28	48527	163	27	4	10	13	8
Sep 29	48528	167	2	17	-13	32	-3
Sep 30	48529	169	20	1	8	20	6

Section 4 (Cont.)

Date 1991 0hUTC	MJD	C0 (ns)	r(ns) Block II PRN18 NAV18 20h 0m	PRN16 NAV16 23h12m	PRN19 NAV19 23h44m	PRN 2 NAV13 2h28m	PRN23 NAV23 3h 0m
Aug 31	48499	200	8	9	-41	-11	3
Sep 1	48500	200	7	-11	-2	-6	-6
Sep 2	48501	207	20	2	-57	6	-2
Sep 3	48502	211	0	21	-18	-20	4
Sep 4	48503	212	9	5	-28	3	-2
Sep 5	48504	214	7	27	1	8	5
Sep 6	48505	219	2	25	-22	-	3
Sep 7	48506	223	21	-5	7	-1	2
Sep 8	48507	224	1	14	-30	2	-6
Sep 9	48508	222	11	28	-23	5	11
Sep 10	48509	217	12	1	-31	6	0
Sep 11	48510	212	24	3	-8	0	3
Sep 12	48511	207	11	7	-43	5	7
Sep 13	48512	202	-9	2	-23	-4	6
Sep 14	48513	198	10	1	-6	-2	-1
Sep 15	48514	196	0	17	-8	-3	3
Sep 16	48515	193	6	-10	-22	4	-3
Sep 17	48516	188	9	0	-4	-8	1
Sep 18	48517	178	16	15	-27	4	11
Sep 19	48518	170	20	26	-13	3	18
Sep 20	48519	164	8	18	-23	7	18
Sep 21	48520	157	8	14	-21	-20	21
Sep 22	48521	147	2	-14	-16	6	24
Sep 23	48522	142	8	20	-30	-8	9
Sep 24	48523	140	5	2	-12	-5	13
Sep 25	48524	141	20	22	-20	2	-3
Sep 26	48525	146	10	0	0	11	5
Sep 27	48526	155	8	26	-19	6	3
Sep 28	48527	163	16	13	-19	-6	13
Sep 29	48528	167	2	4	-11	9	9
Sep 30	48529	169	-1	16	-11	-8	11

5 - UTC - GLONASS time.

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

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 1991 0hUTC	MJD	C1 (μs)	SD (μs)
Aug 31	48499	-5.90	0.07
Sep 10	48509	-6.17	0.05
Sep 20	48519	-6.44	0.05
Sep 30	48529	-6.65	0.06

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

Date 1991	MJD	Time comparisons (Unit : 1 microsecond)	uncert.	source	meth.
Sep 24	48523.15	UTC(SU) - UTC(RC) = -8.361		SU report	(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 on the rotating geoid 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 units of 10^{-14} second.

Standard	Obs. period	D	s
NRC-CsV	48469-48529	+1.1	10.0
PTB-CS1	48469-48529	+1.5	3.0
PTB-CS2	48469-48529	+4.6	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:

$$1 + 3\times10^{-14} \pm 2\times10^{-14}$$

in SI second on the rotating geoid, for the two-month interval 48469-48529 .