BIPM

ISSN 1143-1393

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 47 (1992 January 2)

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

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

Date 1991 0hUTC	Oct 30	Nov 9	Nov 19	Nov 29
MJD	48559	48569	48579	48589
Laboratory k	UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)	0.10	0.62	0.59	0.43
APL (Laurel)	-1.19	-1.15	-1.11	-1.11
AUS (Canberra)	0.14	0.16	0.18	0.17
BEV (Wien)	5.53	4.68	3.80	3.08
CAO (Cagliari)	2.42	1.70	0.83	0.06
CH (Bern)	1.50	1.45	1.38	1.29
CRL (Tokyo)	2.26	2.30	2.37	2.41
CSAO (Lintong)	-2.97	-2.98	-2.88	-2.76
DPT (Pretoria)	-24.55	-24.63	-24.62	-24.59
FTZ (Darmstadt)	22.92	23.01	23.07	23.23
IEN (Torino)	-1.22	-1.27	-1.28	-1.26
IFAG (Wettzell)	1.60	1.53	1.49	1.41
IGMA (Buenos Aires) (1)	-1.43	-1.39	-1.36	-1.39
INPL (Jerusalem)	-0.98	-1.11	-1.10	-1.19
JATC (Lintong)	-26.50	-26.54	-26.45	-26.45
KRIS (Taejon)	0.63	0.65	0.62	0.57
LDS (Leeds)	-13.51	-14.12	-14.68	-15.41
NAOM (Mizusawa)	-8.91	-8.71	-8.50	-8.31
NIM (Beijing)	8.01	8.01	8.00	8.13
NIST (Boulder)	-1.03	-0.99	-0.95	-0.94
NMC (Sofiya) (2)	-3.95	-4.06	-4.16	-3.72
NPL (Teddington)	-0.52	-0.44	-0.37	-0.30
NPLI (New-Delhi)	6.07	7.01	8.28	9.96
NRC (Ottawa)	1.94	1.88	1.77	1.66
NRLM (Tsukuba)	-80.95	-87.06	-93.22	-99.48
OMH (Budapest)	3.07	2.95	3.11	3.15
ONRJ (Rio de Janeiro)	-	-	-	-
OP (Paris)	-0.64	-0.66	-0.64	-0.66
ORB (Bruxelles)	1.48	1.51	1.63	1.61
PEL (Lower Hutt)	-1.11	-1.22	-1.32	-1.38
PKNM (Warszawa)	0.05	0.00	0.05	-0.07
PTB (Braunschweig)	3.35	3.34	3.34	3.31
RC (Habana)	-2.85	-3.09	-2.67	-2.34
ROA (San Fernando)	5.40	5.34	5.23	5.11
SNT (Stockholm)	0.05	0.05	0.11	0.09
SO (Shanghai)	2.38	2.33	2.30	2.46
SU (Moskva) (3)	4.95	4.86	4.74	4.63
TAO (Tokyo)	1.24	1.26	1.26	1.24
TL (Chung-Li)	2.83	2.77	2.65	2.53
TP (Praha)	-0.54	-0.62	-0.68	-0.79
TUG (Graz)	0.61	0.93	1.21	1.52
USNO (Washington DC)(USNO MC)	0.14	0.16	0.18	0.17
VSL (Delft)	1.99	2.02	2.06	2.12
YUZM (Beograd)	-	-	-	-
ZIPE (Potsdam)	-0.19	-0.13	0.09	0.26

PAVILLON DE BRETEUIL F - 92312 SÈVRES CEDEX

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		Oct 30	Nov 9	Nov 19	Nov 29
MJD		48559	48569	48579	48589
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
APL (Laurel)		-1.69	-1.65	-1.62	-1.61
AUS (Canberra)		-37.72	-37.94	-38.12	-38.26
CH (Bern)		-71.47	-71.58	-71.71	-71.86
CRL (Tokyo)		6.44	6.66	6.92	7.15
CSAO (Lintong)		23.86	23.66	23.56	23.48
F (Paris)		96.56	96.86	97.18	97.46
JATC (Lintong)		-0.83	-0.74	-0.53	-0.45
KRIS (Taejon)		-22.13	-22.69	-23.18	-23.48
NIM (Beijing)		-10.25	-10.22	-10.21	-10.06
NISA (Boulder)	(4)	-45079.20	-45079.52	-45079.85	-45080.21
NIST (Boulder)		-45176.46	-45177.12	-45177.79	-45178.47
NRC (Ottawa)		18.01	17.95	17.84	17.73
PTB (Braunschweig)		-360.05	-360.06	-360.06	-360.09
RC (Habana)	(5)	-295.78	-296.41	-296.60	-296.92
SO (Shanghai)		-45.05	-45.09	-45.14	-44.96
SU (Moskva)		2827254.95	2827254.86	2827254.74	2827254.63
USNO (Washington DC)	(6)	-34636.27	-34636.94	-34637.61	-34638.27

3 - Notes on sections 1 and 2.

(1) IGMA. Corrected values of UTC-UTC(IGMA) :

MJD	UTC-UTC(IGMA)	MJD	UTC-UTC(IGMA)
48399	0.42	48479	-0.39
48409	0.37	48489	-0.53
48419	0.34	48499	-0.67
48429	0.25	48509	-0.83
48439	0.12	48519	-1.00
48449	0.02	48529	-1.18
48459	-0.06	48539	-1.35
48469	-0.23	48549	-1.43

(2) NMC . National Metrological Center, Sofiya, Bulgaria.

(3) SU . Time transfer data obtained from GLONASS satellite trackings at the University of Leeds (U.K.) and SU. 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 = -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 23h12m	PRN12 NAV10 0h52m	PRN 3 NAV11 4h36m	PRN11 NAV 8 9h 8m	PRN13 NAV 9 15h16m
Oct 30	48559	196	6	-9	3	-3	-3
Oct 31	48560	193	5	-7	3	2	-2
Nov 1	48561	191	2	13	6	-1	-6
Nov 2	48562	186	3	-18	9	2	-1
Nov 3	48563	184	2	-12	1	3	-2
Nov 4	48564	181	-8	-8	12	5	-4
Nov 5	48565	176	5	-16	7	-4	-5
Nov 6	48566	173	-7	14	-6	-6	-6
Nov 7	48567	176	2	-	3	-3	-1
Nov 8	48568	182	-2	3	7	6	3
Nov 9	48569	186	-6	-20	-4	0	5
Nov 10	48570	199	1	-16	10	-4	4
Nov 11	48571	216	-6	-	4	-2	1
Nov 12	48572	229	11	-	7	-1	-1
Nov 13	48573	236	6	-	0	-6	6
Nov 14	48574	237	-8	-9	9	-8	-2
Nov 15	48575	239	-2	-11	4	9	-7
Nov 16	48576	244	-7	-1	13	5	5
Nov 17	48577	244	6	-6	6	2	-8
Nov 18	48578	239	-10	-20	4	-5	4
Nov 19	48579	234	-5	12	7	5	9
Nov 20	48580	228	-	-8	5	-10	-11
Nov 21	48581	227	-1	-4	-1	10	9
Nov 22	48582	230	1	-	-3	-5	6
Nov 23	48583	229	-3	9	7	-1	-11
Nov 24	48584	222	5	-5	0	-2	2
Nov 25	48585	211	-	-	-3	-3	-3
Nov 26	48586	204	-	-8	5	7	6
Nov 27	48587	203	-2	6	-10	2	-7
Nov 28	48588	205	-9	10	2	8	1
Nov 29	48589	207	-9	-	-6	-16	-

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 1h40m	PRN17 NAV17 8h 4m	PRN15 NAV15 10h28m	PRN21 NAV21 11h48m	PRN14 NAV14 13h24m
Oct 30	48559	196	2	-1	-6	26	5
Oct 31	48560	193	-3	-1	-8	14	-7
Nov 1	48561	191	15	2	-4	20	-27
Nov 2	48562	186	4	-7	-5	-2	-6
Nov 3	48563	184	13	3	-4	6	-2
Nov 4	48564	181	18	-2	3	16	3
Nov 5	48565	176	3	6	1	-2	1
Nov 6	48566	173	8	4	9	-4	4
Nov 7	48567	176	9	-6	-4	11	-2
Nov 8	48568	182	39	-1	-20	0	-7
Nov 9	48569	186	7	-10	7	3	-10
Nov 10	48570	199	-11	5	-7	14	3
Nov 11	48571	216	4	-11	-1	4	-5
Nov 12	48572	229	2	-4	-30	-5	-8
Nov 13	48573	236	1	5	3	7	-6
Nov 14	48574	237	5	-8	-19	-10	-1
Nov 15	48575	239	-13	-10	3	2	-40
Nov 16	48576	244	-3	1	-50	26	12
Nov 17	48577	244	53	-	-37	-75	40
Nov 18	48578	239	-11	-35	84	110	48
Nov 19	48579	234	-20	-56	6	48	-17
Nov 20	48580	228	-29	36	23	-30	-
Nov 21	48581	227	54	66	61	33	-
Nov 22	48582	230	-	4	66	-30	-57
Nov 23	48583	229	-	5201	-1522	5198	-
Nov 24	48584	222	-38	274	-	-	-
Nov 25	48585	211	15	55	2	-15	-111
Nov 26	48586	204	30	6	4	44	-28
Nov 27	48587	203	-21	-79	54	-20	-54
Nov 28	48588	205	69	33	-41	114	-11
Nov 29	48589	207	32	-	-	5	12

Section 4 (Cont.)

Date 1991 0hUTC	MJD	C0 (ns)	r(ns) Block II PRN18 NAV18 16h 0m	PRN16 NAV16 19h12m	PRN19 NAV19 19h44m	PRN 2 NAV13 22h24m	PRN23 NAV23 22h56m
Oct 30	48559	196	-5	6	-21	0	-1
Oct 31	48560	193	10	17	22	-1	-6
Nov 1	48561	191	6	0	8	-4	-4
Nov 2	48562	186	4	7	-13	10	-2
Nov 3	48563	184	6	-21	0	7	0
Nov 4	48564	181	3	2	-9	6	0
Nov 5	48565	176	2	30	9	9	-5
Nov 6	48566	173	5	17	-6	20	-6
Nov 7	48567	176	-4	24	-2	-5	-8
Nov 8	48568	182	-1	-4	1	-4	-1
Nov 9	48569	186	-8	-2	5	16	0
Nov 10	48570	199	7	-10	-17	-1	-8
Nov 11	48571	216	7	25	-9	3	9
Nov 12	48572	229	3	10	19	12	4
Nov 13	48573	236	7	2	-18	0	1
Nov 14	48574	237	11	8	-6	-1	4
Nov 15	48575	239	36	11	-26	-51	25
Nov 16	48576	244	-	4	-1	35	-3
Nov 17	48577	244	-26	-60	-13	-10	-31
Nov 18	48578	239	-18	70	-29	0	122
Nov 19	48579	234	11	54	-4	-56	8
Nov 20	48580	228	15	86	-8	-5	2
Nov 21	48581	227	-59	-6	-10	-2	0
Nov 22	48582	230	-1153	-1978	-5	2992	-
Nov 23	48583	229	597	-	-2	451	-712
Nov 24	48584	222	-408	11	-5	765	318
Nov 25	48585	211	14	-5	-2	72	11
Nov 26	48586	204	73	22	15	-18	-44
Nov 27	48587	203	-44	4	-1	47	47
Nov 28	48588	205	88	18	20	-9	-49
Nov 29	48589	207	7	-	-1	4	17

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)
Oct 30	48559	-7.37	0.06
Nov 9	48569	-7.56	0.05
Nov 19	48579	-7.74	0.05
Nov 29	48589	-7.92	0.05

6 - 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	48529-48589	+7.5	10.0
PTB-CS1	48529-48589	+0.5	3.0
PTB-CS2	48529-48589	+2.3	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:

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

in SI second on the rotating geoid, for the two-month interval 48529-48589 .