ISSN 1143-1393

BIPM

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 40 (1991 June 3)

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

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

Date 1991 0hUTC		MAR 24	APR 3	APR 13	APR 23
MJD		48339	48349	48359	48369
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)	(1)	-3.04	-3.26	-2.31	-2.95
APL (Laurel)		-0.89	-0.92	-0.95	-0.97
AUS (Canberra)		0.10	0.12	0.13	0.15
BEV (Wien)	(2)	-	3.00	2.21	1.50
CAO (Cagliari)	(3)	0.94	0.42	-0.35	-0.82
CH (Bern)		1.43	1.59	1.73	1.80
CRL (Tokyo)		1.74	1.76	1.75	1.79
CSAO (Lintong)		-5.34	-5.28	-5.18	-5.00
DPT (Pretoria)		-25.14	-25.33	-25.40	-25.42
FTZ (Darmstadt)		19.72	19.83	19.95	20.11
IEN (Torino)		-0.07	-0.05	-0.07	-0.09
IFAG (Wettzell)		4.43	4.84	5.14	5.37
IGMA (Buenos Aires)		0.38	0.38	0.44	0.52
INPL (Jerusalem)		-20.73	-22.38	-24.11	-25.91
JATC (Lintong)		-26.20	-26.45	-26.43	-26.12
KSRI (Taejon)		-0.29	-0.10	0.09	0.29
LDS (Leeds)		-40.68	-	1.75	1.01
NAOM (Mizusawa)		-7.07	-7.19	-7.34	-7.47
NIM (Beijing)		7.51	7.49	7.54	7.67
NIST (Boulder)		-0.87	-0.91	-0.94	-0.98
NPL (Teddington)		-1.61	-1.56	-1.43	-1.28
NPLI (New-Delhi)		-	-	-	-
NRC (Ottawa)		1.23	1.33	1.43	1.55
NRLM (Tsukuba)		-30.80	-32.02	-33.44	-34.94
OMH (Budapest)		2.61	3.52	3.75	4.45
ONRJ (Rio de Janeiro)		11.20	11.19	11.41	11.38
OP (Paris)		-0.63	-0.66	-0.70	-0.76
ORB (Bruxelles)	(4)	15.56	15.95	2.08	1.92
PEL (Lower Hutt)		-	0.51	0.49	0.55
PKNM (Warszawa)		6.37	5.85	4.10	4.49
PTB (Braunschweig)		3.53	3.50	3.48	3.45
RC (Habana)		-7.13	-7.56	-7.19	-7.24
ROA (San Fernando)		7.35	7.25	7.14	7.07
SO (Shanghai)		2.61	2.60	2.77	2.90
STA (Stockholm)		-0.02	0.07	0.05	0.14
SU (Moskva)	(5)	7.30	7.20	7.09	6.99
TAO (Tokyo)		0.92	0.92	0.91	0.94
TL (Chung-Li)		1.10	1.29	1.48	1.63
TP (Praha)		0.37	0.28	0.23	0.17
TUG (Graz)		0.05	0.79	1.50	2.05
USNO (Washington DC)	(USNO MC)	0.10	0.12	0.13	0.15
VSL (Delft)		0.44	0.54	0.59	0.62
YUZM (Beograd)		34.45	34.45	35.08	35.39
ZIPE (Potsdam)		-0.41	-0.41	-0.31	-0.18

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		MAR 24	APR 3	APR 13	APR 23
MJD		48339	48349	48359	48369
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-	-	-	-
APL (Laurel)		-1.40	-1.43	-1.46	-1.48
AUS (Canberra)		-33.52	-33.65	-33.77	-33.93
CH (Bern)		-69.64	-69.68	-69.72	-69.81
CRL (Tokyo)		2.72	2.88	3.01	3.19
CSAO (Lintong)		25.91	25.76	25.67	25.64
F (Paris)		89.94	90.24	90.53	90.81
JATC (Lintong)		0.66	0.87	1.16	1.36
KSRI (Taejon)		-7.35	-8.11	-8.86	-9.63
NIM (Beijing)		-11.18	-11.19	-11.11	-10.97
NISA (Boulder)	(6)	-45072.44	-45072.73	-45073.03	-45073.33
NIST (Boulder)		-45162.20	-45162.82	-45163.45	-45164.09
NRC (Ottawa)		17.30	17.40	17.50	17.62
PTB (Braunschweig)		-359.87	-359.90	-359.92	-359.95
RC (Habana)	(7)	-285.09	-286.25	-286.49	-287.20
SO (Shanghai)		-44.72	-44.76	-44.60	-44.48
SU (Moskva)		2827257.30	2827257.20	2827257.09	2827256.99
USNO (Washington DC)	(8)	-34621.61	-34622.30	-34622.94	-34623.58

3 - Notes on sections 1 and 2.

(1) AOS . Corrected values after introduction of GPS time link.

MJD	UTC-UTC(AOS)
48309	-1.12
48319	-1.46
48329	-2.24

(2) BEV . Erratum (Circular T 39). No value available for UTC-UTC(BEV) on MJD = 48339.

(3) CAO . Time step of UTC-UTC(CAO) of -0.407 μs between MJD=48359 and MJD=48369 due to the introduction of GPS time link.

(4) ORB . Time step of UTC(ORB) of 14 μs on MJD = 48355.25

(5) SU . Time transfer data obtained from GLONASS satellite trackings at LDS (See Section 5) and SU.

(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 3 NAV11 19h20m	PRN11 NAV 8 0h12m	PRN 6 NAV 3 11h40m	PRN12 NAV10 15h40m	PRN13 NAV 9 15h56m
Mar 24	48339	116	5	-3	-4	12	-8
Mar 25	48340	110	2	3	-6	0	6
Mar 26	48341	102	-3	-	1	2	-9
Mar 27	48342	96	3	2	-2	-	-6
Mar 28	48343	101	5	-7	9	-	-6
Mar 29	48344	112	4	5	10	1	-16
Mar 30	48345	120	6	12	-8	12	-3
Mar 31	48346	120	8	8	-11	-14	-7
Apr 1	48347	120	9	15	1	-12	-22
Apr 2	48348	128	8	0	-5	13	-8
Apr 3	48349	139	1	2	5	-	-
Apr 4	48350	146	8	7	6	-14	-12
Apr 5	48351	148	1	7	1	-19	-4
Apr 6	48352	148	-4	13	9	-	-5
Apr 7	48353	146	-7	6	7	-4	-9
Apr 8	48354	143	9	12	10	-11	-16
Apr 9	48355	144	11	6	2	-2	-18
Apr 10	48356	146	-8	7	6	-12	-1
Apr 11	48357	149	8	4	10	-10	-
Apr 12	48358	153	3	-4	2	-	-11
Apr 13	48359	158	10	-2	-3	-	-3
Apr 14	48360	164	3	6	2	9	-8
Apr 15	48361	168	-6	8	10	-10	-17
Apr 16	48362	170	8	2	3	13	-11
Apr 17	48363	176	0	-3	-3	-	-11
Apr 18	48364	183	10	9	-1	-5	5
Apr 19	48365	188	4	-2	0	0	-14
Apr 20	48366	190	10	2	8	4	-21
Apr 21	48367	191	0	9	6	-	-15
Apr 22	48368	193	6	-3	-2	-	6
Apr 23	48369	193	5	2	4	-7	-9

Section 4 (Cont.)

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

			r(ns) Block II				
Date 1991 0hUTC	MJD	C0 (ns)	PRN14 NAV14 4h12m	PRN18 NAV18 6h20m	PRN16 NAV16 10h 4m	PRN 2 NAV13 13h16m	PRN20 NAV20 16h44m
Mar 24	48339	116	6	16	0	18	14
Mar 25	48340	110	5	17	-1	11	-6
Mar 26	48341	102	6	-18	-20	-24	3
Mar 27	48342	96	-11	-7	-17	24	-4
Mar 28	48343	101	-5	1	-4	12	-2
Mar 29	48344	112	5	8	-10	-9	14
Mar 30	48345	120	1	-4	-13	18	-7
Mar 31	48346	120	12	-4	0	-2	-12
Apr 1	48347	120	-3	4	-19	19	-6
Apr 2	48348	128	1	3	15	11	8
Apr 3	48349	139	9	9	-8	3	3
Apr 4	48350	146	3	13	-6	35	-10
Apr 5	48351	148	20	3	5	25	18
Apr 6	48352	148	18	10	4	9	4
Apr 7	48353	146	5	6	-11	14	4
Apr 8	48354	143	12	-11	-10	9	-9
Apr 9	48355	144	9	-11	9	8	9
Apr 10	48356	146	-8	12	-	11	3
Apr 11	48357	149	3	11	-5	6	8
Apr 12	48358	153	-1	2	19	22	4
Apr 13	48359	158	-	-1	-11	0	-10
Apr 14	48360	164	8	9	-2	13	5
Apr 15	48361	168	-1	0	-13	1	9
Apr 16	48362	170	8	7	15	15	15
Apr 17	48363	176	9	-3	-2	11	-6
Apr 18	48364	183	0	2	-7	3	-3
Apr 19	48365	188	7	15	6	-8	-3
Apr 20	48366	190	3	-12	-9	13	14
Apr 21	48367	191	0	4	-1	-6	-5
Apr 22	48368	193	5	5	10	0	7
Apr 23	48369	193	22	-2	2	17	7

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)
Mar 24	48339	-1.11	0.06
Apr 3	48349	-1.54	0.06
Apr 13	48359	-1.86	0.06
Apr 23	48369	-2.19	0.07

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 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	48309-48369	-10.7	10.0
PTB-CS1	48309-48369	+2.2	3.0
PTB-CS2	48309-48369	+5.3	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:

$$1 + 4*10^{**-14} \pm 2*10^{**-14}$$

in SI second at sea level, for the two-month interval 48309-48369 .