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BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 42 (1991 August 1)

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

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

Date 1991 0hUTC		MAY 23	JUN 2	JUN 12	JUN 22
MJD		48399	48409	48419	48429
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-3.26	-3.74	-4.26	-4.77
APL (Laurel)		-1.08	-1.12	-1.10	-1.10
AUS (Canberra)		0.30	0.33	0.35	0.36
BEV (Wien)		-0.89	-1.62	-2.39	-3.19
CAO (Cagliari)	(1)	-11.23	-1.66	-1.87	-2.24
CH (Bern)		2.08	2.11	2.10	2.05
CRL (Tokyo)		1.86	1.89	1.91	1.95
CSAO (Lintong)		-4.64	-4.46	-4.40	-4.33
DPT (Pretoria)		-25.49	-25.47	-25.46	-25.47
FTZ (Darmstadt)		20.56	20.69	20.78	20.89
IEN (Torino)		-0.15	-0.28	-0.40	-0.51
IFAG (Wettzell)	(2)	6.04	6.26	0.60	0.95
IGMA (Buenos Aires)		0.42	0.29	0.39	0.44
INPL (Jerusalem)		-29.29	-30.49	-31.70	-32.89
JATC (Lintong)		-25.09	-24.99	-24.93	-24.70
KSRI (Taejon)		0.93	1.07	1.22	1.23
LDS (Leeds)		-1.52	-2.25	-2.99	-3.78
NAOM (Mizusawa)		-7.80	-7.94	-8.03	-8.16
NIM (Beijing)		7.88	7.85	7.80	7.84
NIST (Boulder)		-1.04	-1.06	-1.08	-1.09
NPL (Teddington)		-0.80	-0.63	-0.61	-0.65
NPLI (New-Delhi)		-	-	-	-
NRC (Ottawa)		1.90	1.93	1.97	1.97
NRLM (Tsukuba)		-39.26	-40.65	-42.00	-43.56
OMH (Budapest)		3.46	3.50	3.64	3.51
ONRJ (Rio de Janeiro)		13.09	13.64	14.02	13.78
OP (Paris)		-0.92	-0.94	-0.94	-0.94
ORB (Bruxelles)		1.95	2.02	2.03	1.95
PEL (Lower Hutt)		0.59	-	0.44	0.47
PKNM (Warszawa)		2.85	2.34	1.77	1.32
PTB (Braunschweig)		3.44	3.43	3.42	3.41
RC (Habana)		-1.99	-2.05	-2.12	-1.96
ROA (San Fernando)		6.84	6.74	6.67	6.59
SNT (Stockholm)	(3)	0.08	0.04	0.12	0.25
SO (Shanghai)		2.78	2.70	2.89	2.80
SU (Moskva)	(4)	6.70	6.57	6.49	6.37
TAO (Tokyo)		0.99	0.99	1.01	1.01
TL (Chung-Li)		1.94	2.06	2.10	2.13
TP (Praha)		0.04	0.02	-0.13	-0.18
TUG (Graz)	(5)	4.19	-4.28	-3.96	-3.60
USNO (Washington DC)	(USNO)	0.30	0.33	0.35	0.36
VSL (Delft)		0.86	0.96	1.03	1.06
YUZM (Beograd)		33.21	32.26	31.10	32.76
ZIPE (Potsdam)		0.21	0.09	0.00	-0.02

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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	MAY 23	JUN 2	JUN 12	JUN 22
MJD	48399	48409	48419	48429
Laboratory k	TAI-TA(k) (Unit = 1 microsecond)			
AOS (Borowiec)	-	-	-	-
APL (Laurel)	-1.59	-1.62	-1.61	-1.61
AUS (Canberra)	-34.40	-34.61	-34.77	-34.99
CH (Bern)	-69.92	-70.00	-70.09	-70.20
CRL (Tokyo)	3.69	3.86	4.02	4.17
CSAO (Lintong)	25.40	25.38	25.24	25.11
F (Paris)	91.68	91.98	92.28	92.58
JATC (Lintong)	1.60	1.65	1.98	2.04
KSRI (Taejon)	-11.75	-12.47	-13.14	-13.85
NIM (Beijing)	-10.70	-10.71	-10.74	-10.68
NISA (Boulder) (6)	-45074.19	-45074.50	-45074.80	-45075.09
NIST (Boulder)	-45166.00	-45166.65	-45167.30	-45167.95
NRC (Ottawa)	17.97	18.00	18.04	18.04
PTB (Braunschweig)	-359.96	-359.97	-359.98	-359.99
RC (Habana) (7)	-283.95	-284.69	-285.45	-285.99
SO (Shanghai)	-44.58	-44.67	-44.49	-44.57
SU (Moskva)	2827256.70	2827256.57	2827256.49	2827256.37
USNO (Washington DC)(8)	-34625.58	-34626.24	-34626.90	-34627.56

3 - Notes on sections 1 and 2.

(1) CAO . Corrected values.

MJD	UTC-UTC(CAO)
48369	- 9.92
48379	-10.71
48389	-11.00

Time step of UTC-UTC(CAO) of -8.7 μs between MJD = 48359 and MJD = 48369 due to the introduction of GPS time link.
Time step of UTC(CAO) of -10 μs on MJD = 48408.5.

(2) IFAG. Time step of UTC(IFAG) of 6 μs on MJD = 48410.

(3) SNT . Swedish National Time and Frequency Laboratory, Stockholm (Sweden), formely STA.

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

(5) TUG . Time step of UTC(TUG) of 8.938 μs on MJD = 48403.50.

(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 15h20m	PRN11 NAV 8 20h 8m	PRN 6 NAV 3 7h40m	PRN12 NAV10 11h40m	PRN13 NAV 9 11h56m
May 23	48399	313	6	1	-14	14	-2
May 24	48400	318	0	-2	-	0	0
May 25	48401	320	8	12	-14	-7	-15
May 26	48402	333	11	4	-5	16	-24
May 27	48403	347	2	14	-4	-22	2
May 28	48404	356	7	2	-4	-8	6
May 29	48405	361	2	-	-	-5	-23
May 30	48406	370	9	4	7	-	0
May 31	48407	376	6	13	-2	-21	-18
Jun 1	48408	378	9	5	9	-16	-8
Jun 2	48409	380	6	8	-5	9	-17
Jun 3	48410	379	2	8	-7	-23	2
Jun 4	48411	375	3	5	-5	19	-10
Jun 5	48412	371	6	9	-11	0	-16
Jun 6	48413	367	0	28	-12	-16	-13
Jun 7	48414	365	4	6	-12	-	10
Jun 8	48415	360	-4	22	-11	-9	-20
Jun 9	48416	357	2	12	-7	0	-13
Jun 10	48417	363	2	6	-12	4	6
Jun 11	48418	367	7	2	-4	-	-
Jun 12	48419	371	1	0	-4	-14	-4
Jun 13	48420	376	0	2	12	8	-10
Jun 14	48421	381	-7	10	-3	-15	-2
Jun 15	48422	384	4	-4	6	11	4
Jun 16	48423	383	1	17	13	-22	-20
Jun 17	48424	382	0	-	3	-	-7
Jun 18	48425	382	0	1	1	-1	2
Jun 19	48426	381	-9	20	-8	-	-11
Jun 20	48427	379	5	8	1	-20	3
Jun 21	48428	378	-3	13	9	-14	-10
Jun 22	48429	376	-1	3	-	-5	-4

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 PRN14 NAV14 0h12m	PRN18 NAV18 2h20m	PRN16 NAV16 6h 4m	PRN 2 NAV13 9h16m	PRN20 NAV20 12h44m
May 23	48399	313	8	-1	1	30	-3
May 24	48400	318	-12	-16	-13	6	0
May 25	48401	320	-	-1	2	-9	-3
May 26	48402	333	1	-1	7	12	2
May 27	48403	347	-4	20	-4	1	6
May 28	48404	356	-16	0	-3	-16	4
May 29	48405	361	-	-	-	-	-7
May 30	48406	370	-2	-	-	-18	14
May 31	48407	376	3	-5	6	4	7
Jun 1	48408	378	7	9	-7	4	-9
Jun 2	48409	380	0	-5	0	4	-13
Jun 3	48410	379	-17	0	15	0	0
Jun 4	48411	375	8	-1	3	-7	-16
Jun 5	48412	371	9	-9	-3	-7	-8
Jun 6	48413	367	2	-3	-5	8	2
Jun 7	48414	365	-1	8	-16	6	-2
Jun 8	48415	360	-7	9	0	-6	-7
Jun 9	48416	357	-6	1	12	-10	-9
Jun 10	48417	363	18	5	-16	0	5
Jun 11	48418	367	10	-7	6	-9	-10
Jun 12	48419	371	5	3	-2	1	3
Jun 13	48420	376	-4	-12	-9	-7	3
Jun 14	48421	381	-15	-8	-19	-19	-7
Jun 15	48422	384	-16	-1	-5	10	11
Jun 16	48423	383	3	-3	-8	-10	-15
Jun 17	48424	382	7	-11	-4	-4	-2
Jun 18	48425	382	-2	-5	-5	5	-5
Jun 19	48426	381	4	-3	22	-13	0
Jun 20	48427	379	-4	2	6	-1	1
Jun 21	48428	378	2	-5	3	-7	1
Jun 22	48429	376	-11	10	-3	4	-13

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)
May 23	48399	-3.10	0.05
Jun 2	48409	-3.39	0.06
Jun 12	48419	-3.68	0.06
Jun 22	48429	-3.95	0.05

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

Date 1991	MJD	Time comparison (Unit : 1 microsecond)	uncert.	source	meth.
Apr 11	48357.05	UTC(CRL) - UTC(TAO) = -0.899	0.005	CRL 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 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 10^{-14} second.

Standard	Obs. period	D	s
NRC-CsV	48369-48429	-8.0	10.0
PTB-CS1	48369-48429	+0.8	3.0
PTB-CS2	48369-48429	+1.7	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:

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

in SI second at sea level, for the two-month interval 48369-48429 .