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BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 43 (1991 September 2)

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

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

Date 1991 0hUTC	Jun 22	Jul 2	Jul 12	Jul 22
MJD	48429	48439	48449	48459
Laboratory k	UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec) (1)	-4.77	-	-0.83	-0.50
APL (Laurel)	-1.10	-1.12	-1.13	-1.20
AUS (Canberra)	0.36	0.34	0.31	0.29
BEV (Wien)	-3.19	-4.05	-4.74	-5.51
CAO (Cagliari)	-2.24	-2.60	-3.10	-3.55
CH (Bern)	2.05	1.99	1.94	1.91
CRL (Tokyo)	1.95	1.98	2.00	2.03
CSAO (Lintong)	-4.33	-4.25	-4.16	-4.06
DPT (Pretoria)	-25.47	-25.47	-25.41	-25.29
FTZ (Darmstadt)	20.89	21.01	21.14	21.30
IEN (Torino)	-0.51	-0.64	-0.77	-0.87
IFAG (Wettzell)	0.95	1.29	1.32	1.34
IGMA (Buenos Aires)	0.44	0.53	0.58	0.62
INPL (Jerusalem)	-32.89	-34.10	-35.31	-36.53
JATC (Lintong)	-24.70	-24.70	-24.53	-24.28
KSRI (Taejon)	1.23	1.21	1.20	1.12
LDS (Leeds)	-3.78	-4.55	-5.37	-5.95
NAOM (Mizusawa)	-8.16	-8.27	-8.39	-8.51
NIM (Beijing)	7.84	7.73	7.64	7.65
NIST (Boulder)	-1.09	-1.11	-1.10	-1.10
NPL (Teddington)	-0.65	-0.63	-0.54	-0.43
NPLI (New-Delhi)	-	-	-	-
NRC (Ottawa)	1.97	1.97	2.05	2.09
NRLM (Tsukuba)	-43.56	-45.17	-46.85	-48.58
OMH (Budapest)	3.51	3.79	3.99	3.61
ONRJ (Rio de Janeiro)	13.78	13.72	14.07	14.16
OP (Paris)	-0.94	-0.95	-0.91	-0.89
ORB (Bruxelles)	1.95	1.82	1.55	1.53
PEL (Lower Hutt)	0.47	0.47	0.32	0.13
PKNM (Warszawa)	1.32	0.83	0.25	-0.33
PTB (Braunschweig)	3.41	3.39	3.42	3.43
RC (Habana)	-1.96	-	-	-
ROA (San Fernando)	6.59	6.49	6.36	6.29
SNT (Stockholm)	0.25	0.29	0.28	0.33
SO (Shanghai)	2.80	2.66	2.67	2.71
SU (Moskva) (2)	6.37	6.26	6.13	6.04
TAO (Tokyo)	1.01	1.04	1.04	1.07
TL (Chung-Li)	2.13	2.17	2.26	2.35
TP (Praha)	-0.18	-0.25	-0.33	-0.47
TUG (Graz)	-3.60	-3.29	-2.94	-2.60
USNO (Washington DC)(USNO MC)	0.36	0.34	0.31	0.29
VSL (Delft)	1.06	1.14	1.29	1.36
YUZM (Beograd)	32.76	32.52	41.78	49.25
ZIPE (Potsdam)	-0.02	-0.01	-0.14	-0.29

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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 1991 0hUTC			Jun 22	Jul 2	Jul 12	Jul 22
MJD			48429	48439	48449	48459
Laboratory k			TAI-TA(k) (Unit = 1 microsecond)			
AOS	(Borowiec)		-	-	-	-
APL	(Laurel)		-1.61	-1.63	-1.63	-1.70
AUS	(Canberra)		-34.99	-35.31	-35.53	-35.84
CH	(Bern)		-70.20	-70.32	-70.43	-70.52
CRL	(Tokyo)		4.17	4.33	4.48	4.64
CSAO	(Lintong)		25.11	24.99	24.88	24.78
F	(Paris)		92.58	92.89	93.20	93.52
JATC	(Lintong)		2.04	2.00	2.05	2.20
KSRI	(Taejon)		-13.85	-14.52	-15.19	-15.84
NIM	(Beijing)		-10.68	-10.79	-10.86	-10.83
NISA	(Boulder)	(3)	-45075.09	-45075.39	-45075.69	-45075.99
NIST	(Boulder)		-45167.94	-45168.60	-45169.24	-45169.88
NRC	(Ottawa)		18.04	18.04	18.12	18.16
PTB	(Braunschweig)		-359.99	-360.01	-359.98	-359.97
RC	(Habana)	(4)	-285.99	-	-	-
SO	(Shanghai)		-44.57	-44.70	-44.70	-44.66
SU	(Moskva)		2827256.37	2827256.26	2827256.13	2827256.04
USNO	(Washington DC)	(5)	-34627.56	-34628.23	-34628.90	-34629.56

3 - Notes on sections 1 and 2.

(1) AOS . Change of master clock between MJD=48429 and MJD=48439 .

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

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

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

(5) 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.

Date 1991 0hUTC	MJD	C0 (ns)	r(ns) Block I PRN 3 NAV11 13h20m	PRN11 NAV 8 18h08m	PRN 6 NAV 3 5h40m	PRN12 NAV10 9h40m	PRN13 NAV 9 9h56m
Jun 22	48429	376	-1	3	-	-5	-4
Jun 23	48430	374	-1	13	1	11	-2
Jun 24	48431	370	0	11	-17	-3	-
Jun 25	48432	364	11	10	-	11	-19
Jun 26	48433	361	7	-	-	-19	-12

Date 1991 0hUTC	MJD	C0 (ns)	r(ns) Block I PRN 6 NAV 3 7h36m	PRN12 NAV10 9h12m	PRN 3 NAV11 12h56m	PRN11 NAV 8 17h28m	PRN13 NAV 9 23h36m
Jun 27	48434	379	-	-	1	-5	-9
Jun 28	48435	376	-	12	1	-3	5
Jun 29	48436	365	-	10	19	-23	-16
Jun 30	48437	351	-11	3	6	-15	8
Jul 1	48438	346	-15	16	3	13	3
Jul 2	48439	345	14	-23	6	2	-3
Jul 3	48440	347	10	-5	-4	7	-13
Jul 4	48441	350	21	20	-3	4	-9
Jul 5	48442	352	18	2	-4	10	-10
Jul 6	48443	353	-	-24	5	-4	-1
Jul 7	48444	356	23	12	-10	-5	-
Jul 8	48445	359	-	-	-1	12	-
Jul 9	48446	356	15	-15	-7	-8	-8
Jul 10	48447	349	9	23	-1	-4	-7
Jul 11	48448	344	32	12	-5	10	-18
Jul 12	48449	339	23	-22	-7	-9	-2
Jul 13	48450	346	23	-6	24	-7	-4
Jul 14	48451	359	-	-	-1	-18	0
Jul 15	48452	373	11	-	5	-8	-3
Jul 16	48453	382	-1	-	9	7	0
Jul 17	48454	385	9	-	3	-9	-13
Jul 18	48455	384	-	-11	4	9	0
Jul 19	48456	385	6	1	2	1	-4
Jul 20	48457	390	5	-7	12	-8	-10
Jul 21	48458	394	14	8	-3	7	-2
Jul 22	48459	396	-	4	-7	-6	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 22h08m	PRN18 NAV18 0h20m	PRN16 NAV16 4h04m	PRN 2 NAV13 7h16m	PRN20 NAV20 10h44m
Jun 22	48429	376	-11	10	-3	4	-13
Jun 23	48430	374	7	-1	-6	-7	-1
Jun 24	48431	370	1	-16	-7	-6	7
Jun 25	48432	364	-23	-7	-29	-18	-2
Jun 26	48433	361	-31	-	-15	-20	0

Date 1991 0hUTC	MJD	C0 (ns)	r(ns) Block II PRN18 NAV18 0h24m	PRN16 NAV16 3h36m	PRN20 NAV20 10h 0m	PRN15 NAV15 18h48m	PRN14 NAV14 21h44m
Jun 27	48434	379	6	-7	2	4	6
Jun 28	48435	376	14	10	6	1	6
Jun 29	48436	365	-7	-4	-11	-6	-16
Jun 30	48437	351	-10	-20	-18	-2	-7
Jul 1	48438	346	-10	-20	11	-16	33
Jul 2	48439	345	-	56	-7	-29	39
Jul 3	48440	347	-127	-11	6	31	27
Jul 4	48441	350	8	-20	6	-6	-
Jul 5	48442	352	2	29	16	-24	-
Jul 6	48443	353	6	-22	18	-6	-
Jul 7	48444	356	-	14	41	-7	-
Jul 8	48445	359	-	43	3	16	-
Jul 9	48446	356	-9	28	-1	20	-
Jul 10	48447	349	-1	17	10	26	0
Jul 11	48448	344	25	9	19	-14	10
Jul 12	48449	339	-11	26	-2	19	4
Jul 13	48450	346	8	4	-2	6	8
Jul 14	48451	359	11	2	6	29	-
Jul 15	48452	373	22	28	-	-	-
Jul 16	48453	382	6	-2	-	5	-
Jul 17	48454	385	5	9	-	12	6
Jul 18	48455	384	-2	8	-6	6	7
Jul 19	48456	385	-2	-1	-18	-6	-13
Jul 20	48457	390	4	9	12	6	9
Jul 21	48458	394	22	3	8	-4	-7
Jul 22	48459	396	-7	24	18	23	6

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)
Jun 22	48429	-3.95	0.05
Jul 2	48439	-4.20	0.06
Jul 12	48449	-4.49	0.06
Jul 22	48459	-4.73	0.06

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

Date 1991	MJD	Time comparisons (Unit : 1 microsecond)	uncert.	source	meth.
Jul 2	48439.04	UTC(CRL) - UTC(TAO) = -1.005	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 units of 10^{-14} second.

Standard	Obs. period	D	s
NRC-CsV	48399-48459	-3.4	10.0
PTB-CS1	48399-48459	+0.3	3.0
PTB-CS2	48399-48459	+1.1	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:

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

in SI second at sea level, for the two-month interval 48399-48459 .