ISSN 1143-1393

BIPM

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T38 (1991 April 2)

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

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

Date 1991 0hUTC	JAN 23	FEB 2	FEB 12	FEB 22
MJD	48279	48289	48299	48309
Laboratory k	UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)	0.48	-	-	-3.15
APL (Laurel)	-0.76	-0.80	-0.81	-0.82
AUS (Canberra)	0.12	0.10	0.08	0.07
BEV (Wien)	-4.95	-5.50	-6.02	-6.82
CAO (Cagliari)	1.75	1.34	1.87	1.93
CH (Bern)	0.82	0.92	1.01	1.11
CRL (Tokyo)	1.56	1.63	1.67	1.67
CSAO (Lintong)	-6.44	-6.38	-6.34	-6.30
DPT (Pretoria)	-24.03	-24.29	-24.49	-24.69
FTZ (Darmstadt)	18.94	19.09	19.23	19.40
IEN (Torino)	0.15	0.01	-0.13	-0.11
IFAG (Wettzell)	2.94	3.01	3.31	3.69
IGMA (Buenos Aires)	0.25	0.27	0.28	0.38
INPL (Jerusalem)	-12.22	-13.60	-14.94	-16.39
JATC (Lintong)	-21.49	-22.66	-23.92	-25.12
KSRI (Taejon)	-0.44	-0.53	-0.62	-0.64
LDS (Leeds)	-31.99	-33.56	-35.01	-36.46
NAOM (Mizusawa)	-6.35	-6.50	-6.63	-6.77
NIM (Beijing)	7.63	7.66	7.59	7.56
NIST (Boulder)	-0.70	-0.75	-0.77	-0.80
NPL (Teddington)	-1.32	-1.47	-1.67	-1.74
NPLI (New-Delhi)	-25.00	-	-	-
NRC (Ottawa)	0.87	0.89	0.93	0.98
NRLM (Tsukuba)	-24.35	-25.23	-26.23	-27.33
OMH (Budapest)	2.76	2.29	2.21	2.21
ONRJ (Rio de Janeiro)	-	10.06	10.20	10.80
OP (Paris)	-0.38	-0.47	-0.56	-0.60
ORB (Bruxelles)	13.51	13.85	14.23	14.76
PEL (Lower Hutt)	-	-	-	-
PKNM (Warszawa)	6.30	6.68	6.89	7.13
PTB (Braunschweig)	3.61	3.58	3.56	3.56
RC (Habana)	-	-	-	-
ROA (San Fernando)	7.84	7.78	7.67	7.54
SO (Shanghai)	2.12	2.25	2.44	2.57
STA (Stockholm)	-0.61	-0.83	-0.73	-0.57
SU (Moskva) (1)	7.78	7.62	7.45	7.43
TAO (Tokyo)	0.83	0.83	0.86	0.86
TL (Chung-Li)	1.34	1.16	0.96	0.96
TP (Praha)	1.21	1.08	0.80	0.51
TUG (Graz)	-3.74	-3.10	-2.52	-1.82
USNO (Washington DC)(USNO MC)	0.12	0.10	0.08	0.07
VSL (Delft)	0.21	0.30	0.28	0.29
YUZM (Beograd)	27.17	27.40	27.43	28.14
ZIPE (Potsdam)	-0.07	-0.09	0.10	0.04

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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		JAN 23	FEB 2	FEB 12	FEB 22
MJD		48279	48289	48299	48309
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-39.52	-	-	-
APL (Laurel)		-1.27	-1.31	-1.32	-1.33
AUS (Canberra)		-32.61	-32.79	-32.92	-33.07
CH (Bern)		-69.05	-69.15	-69.26	-69.36
CRL (Tokyo)		1.77	1.92	2.08	2.23
CSAO (Lintong)		26.00	25.86	25.70	25.54
F (Paris)		88.19	88.48	88.75	89.02
JATC (Lintong)		-0.25	-0.06	0.14	0.41
KSRI (Taejon)		54.88	53.93	52.98	52.09
NIM (Beijing)		-11.20	-11.14	-11.19	-11.19
NISA (Boulder)	(2)	-45070.77	-45071.07	-45071.34	-45071.62
NIST (Boulder)		-45158.48	-45159.12	-45159.74	-45160.38
NRC (Ottawa)		16.94	16.96	17.00	17.05
PTB (Braunschweig)		-359.79	-359.82	-359.84	-359.84
RC (Habana)		-	-	-	-
SO (Shanghai)		-45.24	-45.10	-44.88	-44.74
SU (Moskva)	(1)	2827257.78	2827257.62	2827257.45	2827257.43
USNO (Washington DC)	(3)	-34617.52	-34618.19	-34618.90	-34619.61

3 - Notes on sections 1 and 2.

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

MJD	TAI-TA(SU)
48269	2827257.88

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

(3) 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			PRN 3	PRN11	PRN 6	PRN12	PRN13
1991	MJD	C0	NAV11	NAV 8	NAV 3	NAV10	NAV 9
0hUTC		(ns)	23h20m	4h12m	15h40m	19h40m	19h56m
Jan 23	48279	48	-4	4	-9	6	3
Jan 24	48280	31	6	5	3	-17	-6
Jan 25	48281	21	-2	5	3	19	9
Jan 26	48282	16	3	-12	3	3	-27
Jan 27	48283	13	5	-1	16	-7	-2
Jan 28	48284	8	7	-11	4	-16	-9
Jan 29	48285	0	4	-4	4	3	-14
Jan 30	48286	-3	5	7	9	-17	-11
Jan 31	48287	-2	0	6	-2	-11	-2
Feb 1	48288	5	5	13	-4	-5	3
Feb 2	48289	10	0	9	-2	-8	2
Feb 3	48290	9	6	-7	2	-1	7
Feb 4	48291	6	5	-4	-10	2	-10
Feb 5	48292	5	3	2	-7	8	2
Feb 6	48293	8	9	-5	12	-13	-13
Feb 7	48294	13	7	-3	-7	-1	-3
Feb 8	48295	22	10	7	23	-13	-9
Feb 9	48296	36	8	-5	3	15	-15
Feb 10	48297	51	7	10	-8	-11	7
Feb 11	48298	64	-1	1	13	-4	-15
Feb 12	48299	71	1	-4	10	9	-21
Feb 13	48300	82	5	5	-1	24	-10
Feb 14	48301	94	9	-11	5	-6	5
Feb 15	48302	109	-1	4	-9	-6	-8
Feb 16	48303	121	1	2	7	7	5
Feb 17	48304	126	10	4	-5	-14	2
Feb 18	48305	125	7	-4	11	-5	-20
Feb 19	48306	125	1	-4	-1	-2	-7
Feb 20	48307	132	-3	7	6	-14	7
Feb 21	48308	138	4	7	0	2	-14
Feb 22	48309	143	2	0	-3	-5	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 PRN14 NAV14 8h12m	PRN18 NAV18 10h20m	PRN16 NAV16 14h 4m	PRN 2 NAV13 17h16m	PRN20 NAV20 20h44m
Jan 23	48279	48	5	-16	12	4	-11
Jan 24	48280	31	-23	-11	-14	2	-7
Jan 25	48281	21	-11	-10	-12	-1	-3
Jan 26	48282	16	0	9	-4	11	5
Jan 27	48283	13	-8	-22	-10	6	6
Jan 28	48284	8	-1	9	-11	12	-1
Jan 29	48285	0	5	-1	-10	2	-7
Jan 30	48286	-3	-16	-7	-11	-10	-12
Jan 31	48287	-2	-6	4	0	13	0
Feb 1	48288	5	2	-5	6	-1	13
Feb 2	48289	10	-3	-2	0	23	-1
Feb 3	48290	9	4	-2	13	3	2
Feb 4	48291	6	10	1	-17	10	-9
Feb 5	48292	5	-13	-14	-7	4	-4
Feb 6	48293	8	0	-17	5	0	-1
Feb 7	48294	13	-7	-14	3	13	-1
Feb 8	48295	22	5	9	-14	6	7
Feb 9	48296	36	5	-2	1	-5	1
Feb 10	48297	51	5	2	-9	4	-1
Feb 11	48298	64	-8	-3	-5	17	1
Feb 12	48299	71	14	15	-11	7	4
Feb 13	48300	82	-4	-9	5	-5	-7
Feb 14	48301	94	4	-5	-17	13	6
Feb 15	48302	109	10	5	-9	-6	-12
Feb 16	48303	121	-4	2	4	19	1
Feb 17	48304	126	9	1	4	15	12
Feb 18	48305	125	-5	-13	-11	13	-7
Feb 19	48306	125	3	-4	-10	-5	5
Feb 20	48307	132	4	-4	-1	9	18
Feb 21	48308	138	-3	3	-5	-	-13
Feb 22	48309	143	9	-1	-11	16	-5

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.

UTC(USNO) - UTC(SU) is also provided by Prof. Daly.

Date 1991 0hUTC	MJD	C1 (μs)	SD (μs)	UTC(USNO)-UTC(SU) (μs)
Jan 23	48279	1.42	0.06	7.66
Feb 2	48289	0.98	0.06	7.53
Feb 12	48299	0.59	0.06	7.37
Feb 22	48309	0.16	0.06	7.36

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

Date 1991	MJD	Time comparisons (Unit : 1 microsecond)	uncert.	source	meth.
Feb 12	48299.07	UTC(CRL) - UTC(TAO) = -0.868	0.005	CRL letter	(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 1*10**-14 second.

Standard	Obs. period	D	s
NRC-CsV	48249-48309	-6.7	10.0
PTB-CS1	48249-48309	+2.1	3.0
PTB-CS2	48249-48309	+3.9	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*10**-14 +or- 2*10**-14

in SI second at sea level, for the two-month interval 48249-48309 .