

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 37 (1991 March 1)

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

(From 1990 January 1, 0hUTC, to 1991 January 1, 0hUTC, TAI-UTC = 25s)

(From 1991 January 1, 0hUTC, until further notice, TAI-UTC = 26s)

Date 1990/91	0hUTC	Dec 24	Jan 3	Jan 13	Jan 23
MJD		48249	48259	48269	48279
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)		4.66	2.82	1.52	0.49
APL (Laurel)		-0.66	-0.68	-0.76	-0.75
AUS (Canberra)		0.11	0.13	0.14	0.13
BEV (Wien)		-2.38	-3.21	-4.08	-4.94
CAO (Cagliari)		-	1.73	1.79	1.76
CH (Bern)		0.62	0.67	0.75	0.83
CRL (Tokyo)		1.36	1.42	1.49	1.56
CSAO (Lintong)		-6.25	-6.24	-6.41	-6.44
DPT (Pretoria)		-23.29	-23.56	-23.79	-24.02
FTZ (Darmstadt)		18.33	18.48	18.69	18.95
IEN (Torino)		0.55	0.43	0.29	0.16
IFAG (Wetzell)		2.61	2.69	2.91	2.96
IGMA (Buenos Aires)	(1)	10.31	0.34	0.32	0.26
INPL (Jerusalem)		-	-9.79	-10.94	-12.22
JATC (Lintong)		-19.15	-19.51	-20.13	-21.49
KSRI (Taejon)	(2)	-79.77	-0.23	-0.35	-0.44
LDS (Leeds)	(3)	-27.37	-28.89	-30.47	-31.96
NAOM (Mizusawa)		-5.91	-6.03	-6.15	-6.31
NIM (Beijing)		7.51	7.31	7.25	7.63
NIST (Boulder)		-0.58	-0.62	-0.66	-0.69
NPL (Teddington)		-1.01	-1.10	-1.20	-1.31
NPLI (New-Delhi)	(4)	-30.57	-30.52	-25.22	-25.00
NRC (Ottawa)		0.65	0.69	0.76	0.88
NRLM (Tsukuba)		-22.29	-22.92	-23.62	-24.35
OMH (Budapest)		2.27	2.22	2.42	2.77
ONRJ (Rio de Janeiro)		-	-	-	-
OP (Paris)		-0.26	-0.28	-0.30	-0.37
ORB (Bruxelles)		12.57	12.83	13.20	13.51
PEL (Lower Hutt)		-	-	-	-
PKNM (Warszawa)		5.41	5.70	5.99	6.31
PTB (Braunschweig)		3.66	3.64	3.63	3.62
RC (Habana)		-3.13	-	-	-
ROA (San Fernando)		7.91	7.90	7.91	7.86
SO (Shanghai)		2.08	2.05	2.10	2.12
STA (Stockholm)		-0.31	-0.16	-0.12	-0.59
SU (Moskva)	(5)	8.15	7.82	7.89	7.79
TAO (Tokyo)		0.75	0.76	0.79	0.83
TL (Chung-Li)		2.02	1.77	1.56	1.34
TP (Praha)		1.34	1.21	1.27	1.22
TUG (Graz)	(6)	-4.44	-4.23	-3.94	-3.72
USNO (Washington DC)(USNO MC)		0.11	0.13	0.14	0.13
VSL (Delft)	(7)	4.06	0.09	0.10	0.22
YUZM (Beograd)		27.59	27.34	27.20	27.18
ZIPE (Potsdam)		0.03	-0.01	-0.04	-0.06

2 - International Atomic Time TAI and local atomic time scales TA(k).

The following table gives the computed values of TAI-TA(k).

Date 1990/91	0hUTC	Dec 24	Jan 3	Jan 13	Jan 23
MJD		48249	48259	48269	48279
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-35.34	-37.18	-38.48	-39.51
APL (Laurel)		-1.16	-1.19	-1.27	-1.26
AUS (Canberra)		-32.16	-32.26	-32.42	-32.61
CH (Bern)		-68.68	-68.81	-68.93	-69.04
CRL (Tokyo)		1.29	1.44	1.62	1.77
CSAO (Lintong)		26.80	26.60	26.16	26.00
F (Paris)		87.30	87.60	87.91	88.20
JATC (Lintong)		-0.41	-0.39	-0.33	-0.25
KSRI (Taejon)		-	56.82	55.82	54.88
NIM (Beijing)		-11.38	-11.56	-11.60	-11.19
NISA (Boulder)	(8)	-45069.92	-45070.21	-45070.49	-45070.76
NIST (Boulder)		-45156.53	-45157.19	-45157.84	-45158.47
NRC (Ottawa)		16.71	16.76	16.83	16.95
PTB (Braunschweig)		-359.74	-359.76	-359.77	-359.78
RC (Habana)	(9)	-274.62	-	-	-
SO (Shanghai)		-45.25	-45.31	-45.27	-45.23
SU (Moskva)	(5)	2827258.15	2827257.82	-	-
USNO (Washington DC)	(10)	-34615.51	-34616.17	-34616.85	-34617.52

3 - Notes on sections 1 and 2.

- (1) IGMA. Time step of UTC(IGMA) of 10 μ s on MJD = 48257.00
- (2) KSRI. Change of the source of UTC(KSRI).
- (3) LDS . University of Leeds (U.K.).
- (4) NPLI. Time step of UTC(NPLI) of about -5 μ s on MJD = 48259.2
- (5) SU . Time transfer data obtained from GLONASS satellite trackings at the University of Leeds (U.K.). See Section 5.
- (6) TUG . Change of master clock on MJD = 48270.651
- (7) VSL . Time step of UTC(VSL) of 4 μ s on MJD = 48256.678
- (8) TA(NISA) designates the scale AT1 of NIST.
- (9) RC . Listed values are TAI-TA(RC) - 18 seconds.
- (10) TA(USNO) designates the scale A1(MEAN) of USNO.

4 - UTC - GPS time and TAI - GPS time.

UTC - GPS time = -6s + C0 (until 1991 January 1, 0hUTC)

UTC - GPS time = -7s + C0 (from 1991 January 1, 0hUTC)

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		C0 (ns)	r(ns) Block I				
1990/91	MJD		PRN 3	PRN11	PRN 6	PRN12	PRN13
0hUTC			NAV11 1h24m	NAV 8 6h12m	NAV 3 17h40m	NAV10 21h40m	NAV 9 21h56m
Dec 24	48249	91	15	3	-2	10	9
Dec 25	48250	96	7	-15	9	-13	28
Dec 26	48251	97	5	-1	12	-8	-22
Dec 27	48252	99	3	-1	2	6	0
Dec 28	48253	108	8	-1	-4	23	-14
Dec 29	48254	119	4	-2	-5	-8	12
Dec 30	48255	125	10	7	0	-14	-2
Dec 31	48256	128	-6	-11	7	11	4
Jan 1	48257	134	0	-1	4	-10	-32
Jan 2	48258	146	0	-2	-6	-15	16
Jan 3	48259	160	12	-14	1	6	9
Jan 4	48260	170	0	6	7	-16	-9
Jan 5	48261	173	4	-4	-4	-9	-9
Jan 6	48262	179	14	1	5	-2	-9
Jan 7	48263	185	6	4	3	11	-15
Jan 8	48264	188	7	-9	-9	20	-9
Jan 9	48265	189	-9	-3	14	-15	8
Jan 10	48266	195	-5	4	17	31	-23
Jan 11	48267	203	-3	2	2	0	-14
Jan 12	48268	212	1	17	14	-18	11
Jan 13	48269	211	-	5	-9	-4	-12
Jan 14	48270	200	-5	2	7	-1	-15
Jan 15	48271	188	-15	15	21	-6	-1
Jan 16	48272	171	4	-10	12	-34	-22
Jan 17	48273	153	19	4	-16	-15	-11
Jan 18	48274	142	7	9	-4	-3	3
Jan 19	48275	125	6	-6	-9	18	-14
Jan 20	48276	105	-1	-15	9	35	1
Jan 21	48277	88	7	-4	-7	3	-6
Jan 22	48278	74	2	7	2	2	-10
Jan 23	48279	59	-4	4	-9	6	3

Section 4 (Cont.)

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

Date		C0 (ns)	r(ns) Block II				
1990/91	MJD		PRN14	PRN18	PRN16	PRN 2	PRN20
0hUTC			NAV14 10h12m	NAV18 12h20m	NAV16 16h 4m	NAV13 19h16m	NAV20 22h44m
Dec 24	48249	91	-14	0	12	7	-18
Dec 25	48250	96	-14	-11	-13	2	-3
Dec 26	48251	97	-10	-5	0	3	-1
Dec 27	48252	99	-14	-19	-7	8	-2
Dec 28	48253	108	-15	-4	7	21	-9
Dec 29	48254	119	-9	-4	-6	6	1
Dec 30	48255	125	2	-8	-7	2	0
Dec 31	48256	128	12	13	6	13	-1
Jan 1	48257	134	-15	-10	7	2	9
Jan 2	48258	146	9	-5	6	7	5
Jan 3	48259	160	-9	3	0	14	7
Jan 4	48260	170	-14	-11	1	0	3
Jan 5	48261	173	-6	-15	-7	8	6
Jan 6	48262	179	-2	5	2	7	1
Jan 7	48263	185	6	-13	-	19	4
Jan 8	48264	188	-6	5	-	12	-7
Jan 9	48265	189	9	11	-9	7	-5
Jan 10	48266	195	-2	7	-30	-3	3
Jan 11	48267	203	-19	5	-18	-1	-1
Jan 12	48268	212	-15	-12	-23	1	-4
Jan 13	48269	211	-11	0	3	13	-14
Jan 14	48270	200	-6	-3	-21	-9	-2
Jan 15	48271	188	0	2	3	18	12
Jan 16	48272	171	11	10	4	28	5
Jan 17	48273	153	-5	4	-14	-9	3
Jan 18	48274	142	-11	-8	2	9	2
Jan 19	48275	125	-1	6	-15	14	-7
Jan 20	48276	105	-20	-5	-15	12	0
Jan 21	48277	88	2	-4	-9	-8	2
Jan 22	48278	74	-16	-3	-9	2	-11
Jan 23	48279	59	5	-16	12	4	-11

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 1990/91 0hUTC	MJD	C1 (μ s)	SD (μ s)	UTC(USNO)-UTC(SU) (μ s)
Dec 24	48249	2.58*	0.06	8.04*
Jan 3	48259	2.20	0.06	7.69
Jan 13	48269	1.84	0.06	7.75
Jan 23	48279	1.43	0.06	7.66

* interpolated value

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 $1 \cdot 10^{-14}$ second.

Standard	Obs. period	D	s
NRC-CsV	48219-48279	-7.5	10.0
PTB-CS1	48219-48279	+1.6	3.0
PTB-CS2	48219-48279	+1.4	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:

$$1 + 1 \cdot 10^{-14} \text{ } \pm \text{ } 2 \cdot 10^{-14}$$

in SI second at sea level, for the two-month interval 48219-48279 .