

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 36 (1991 February 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 (0hUTC)		Nov 24	Dec 4	Dec 14	Dec 24
MJD		48219	48229	48239	48249
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)	(1)	-11.03	-12.35	6.16	4.66
APL (Laurel)		-0.54	-0.54	-0.61	-0.66
AUS (Canberra)		0.02	0.07	0.09	0.11
BEV (Wien)		-0.44	-1.08	-1.55	-2.38
CAO (Cagliari)		2.27	1.98	1.77	-
CH (Bern)		0.43	0.48	0.54	0.62
CRL (Tokyo)		1.13	1.22	1.29	1.37
CSAO (Lintong)		-6.51	-6.40	-6.32	-6.24
DPT (Pretoria)		-22.65	-22.84	-23.07	-23.29
FTZ (Darmstadt)		17.74	17.93	18.12	18.33
IEN (Torino)		0.86	0.79	0.67	0.56
IFAG (Wetzell)		2.29	2.52	2.56	2.61
IGMA (Buenos Aires)		9.97	10.16	10.18	10.31
INPL (Jerusalem)		-4.53	-5.37	-	-
JATC (Lintong)		-18.35	-18.64	-18.82	-19.15
KSRI (Taejon)		-77.00	-77.91	-78.83	-79.77
NAOM (Mizusawa)		-5.63	-5.72	-5.83	-5.91
NIM (Beijing)		7.98	7.66	7.79	7.51
NIST (Boulder)		-0.47	-0.50	-0.54	-0.58
NPL (Teddington)		-0.72	-0.79	-0.90	-1.01
NPLI (New-Delhi)		-31.51	-31.23	-30.98	-30.57
NRC (Ottawa)		0.49	0.52	0.61	0.65
NRLM (Tsukuba)		-21.71	-21.78	-21.90	-22.29
OMH (Budapest)		1.68	2.08	2.33	2.27
ONRJ (Rio de Janeiro)		9.99	9.76	9.61	-
OP (Paris)		-0.20	-0.19	-0.23	-0.26
ORB (Bruxelles)		11.54	11.84	12.15	12.57
PEL (Lower Hutt)		-	-	-	-
PKNM (Warszawa)		3.87	4.38	4.79	5.41
PTB (Braunschweig)		3.70	3.68	3.65	3.66
RC (Habana)		-3.41	-3.44	-3.28	-3.13
ROA (San Fernando)		7.99	8.00	7.96	7.91
SO (Shanghai)		2.60	2.35	2.30	2.08
STA (Stockholm)		-0.55	-0.46	-0.39	-0.31
SU (Moskva)	(2)	8.54	8.26	8.20	8.15
TAO (Tokyo)		0.27	0.50	0.73	0.75
TL (Chung-Li)		2.68	2.49	2.24	2.02
TP (Praha)		1.47	1.39	1.40	1.34
TUG (Graz)	(3)	3.76	4.03	4.28	-4.44
USNO (Washington DC)(USNO MC)		0.02	0.07	0.09	0.11
VSL (Delft)		3.91	3.94	3.99	4.06
YUZM (Beograd)		28.33	28.22	27.82	27.59
ZIPE (Potsdam)		-0.10	-0.03	0.02	0.03

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 (0hUTC)	Nov 24	Dec 4	Dec 14	Dec 24
MJD	48219	48229	48239	48249
Laboratory k	TAI-TA(k) (Unit = 1 microsecond)			
AOS (Borowiec)	-31.03	-32.35	-33.84	-35.34
APL (Laurel)	-1.04	-1.05	-1.12	-1.16
AUS (Canberra)	-31.70	-31.83	-32.02	-32.16
CH (Bern)	-68.29	-68.43	-68.56	-68.68
CRL (Tokyo)	0.85	0.99	1.12	1.29
CSAO (Lintong)	27.14	27.04	26.92	26.80
F (Paris)	86.41	86.72	87.01	87.30
JATC (Lintong)	-0.12	-0.26	-0.25	-0.41
NIM (Beijing)	-11.00	-11.30	-11.13	-11.38
NISA (Boulder) (4)	-45069.12	-45069.38	-45069.65	-45069.92
NIST (Boulder)	-45154.58	-45155.22	-45155.88	-45156.53
NRC (Ottawa)	16.56	16.59	16.68	16.72
PTB (Braunschweig)	-359.70	-359.72	-359.75	-359.74
RC (Habana) (5)	-272.78	-273.53	-274.07	-274.62
SO (Shanghai)	-44.79	-45.01	-45.06	-45.25
SU (Moskva) (2)	2827258.54	2827258.26	2827258.20	2827258.15
USNO (Washington DC)(6)	-34613.54	-34614.20	-34614.86	-34615.51

3 - Notes on sections 1 and 2.

- (1) AOS . Time step of UTC(AOS) of - 20 μ s on MJD = 48233.57
- (2) SU . Time transfer data obtained from GLONASS satellite trackings at the University of Leeds (U.K.). See Section 5.
- (3) TUG . Time step of UTC(TUG) of 9 μ s on MJD = 48244.326
- (4) TA(NISA) designates the scale AT1 of NIST.
- (5) RC . Listed values are TAI-TA(RC) - 18 seconds.
- (6) TA(USNO) designates the scale A1(MEAN) of USNO.

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

UTC - GPS time = -6s + Co, TAI - GPS time = 19s + Co.

The GPS data taken at the Paris Observatory, from Block I satellites only, are usually corrected for the measured ionospheric delays and then smoothed to obtain daily values, at 0hUTC, of UTC(OP) - GPS time. Co is derived from them using linear interpolation of UTC - UTC(OP).

The DC values are the residuals to the smoothed data for the middle of the 13-minute tracking period. This time is given for the first date of the table. The DC values are reported here only to show the quality of the synchronization.

UTC may be derived from observation at any site of any listed satellite, by interpolating Co. The quality of the access to UTC mainly depends upon local conditions of observation.

Date 1990	MJD	Co (ns) 0hUTC	DC(ns)		Block I		
			PRN 6 NAV 3 20h32m	PRN 9 NAV 6 23h28m	PRN13 NAV 9 0h 4m	PRN12 NAV10 0h20m	PRN 3 NAV11 3h32m
Nov 24	48219	-84	7	-10	-	31	15
Nov 25	48220	-81	-4	1	3	-29	-1
Nov 26	48221	-81	3	-14	-1	-4	2
Nov 27	48222	-85	1	4	-13	23	-8
Nov 28	48223	-87	7	-10	1	-	-7
Nov 29	48224	-83	-	-	-	-	-
Nov 30	48225	-76	11	-15	4	7	-10
Dec 1	48226	-74	-9	-2	-20	-8	8
Dec 2	48227	-73	4	-9	-1	18	12
Dec 3	48228	-68	0	-5	-5	-1	-3
Dec 4	48229	-59	9	-12	11	8	-4
Dec 5	48230	-53	-7	-29	-4	18	10
Dec 6	48231	-45	-3	5	-9	12	-1
Dec 7	48232	-34	20	-8	-21	-13	6
Dec 8	48233	-24	4	-6	7	-11	16
Dec 9	48234	-18	-5	-4	4	-14	7
Dec 10	48235	-10	10	-21	6	-10	13
Dec 11	48236	5	4	-12	15	22	1
Dec 12	48237	19	-2	16	-25	-5	-3
Dec 13	48238	30	-12	-	-12	2	-3
Dec 14	48239	45	7	-	-4	17	8
Dec 15	48240	59	-23	-	-17	-14	20
Dec 16	48241	69	20	-	-13	9	5
Dec 17	48242	80	-16	16	-11	-2	9
Dec 18	48243	84	1	-	-20	-	11
Date 1990	MJD	Co (ns) 0hUTC	DC(ns)		Block I		
			PRN 3 NAV11 1h44m	PRN11 NAV 8 6h32m	PRN 6 NAV 3 18h 0m	PRN12 NAV10 22h 0m	PRN13 NAV 9 22h16m
Dec 19	48244	90	5	-7	10	19	-7
Dec 20	48245	88	0	-2	-2	-5	-4
Dec 21	48246	90	4	1	0	8	-4
Dec 22	48247	91	14	1	-10	2	-8
Dec 23	48248	89	-3	5	-4	-15	-13
Dec 24	48249	91	15	3	-2	10	9

Section 4 (Cont.)

For Block II satellites, the DC values are computed with respect to Co obtained from Block I only.

Date 1990	MJD	Co (ns) 0hUTC	DC(ns)		Block II		
			PRN14 NAV14 14h56m	PRN20 NAV20 0h36m	PRN16 NAV16 4h52m	PRN17 NAV17 8h20m	PRN 2 NAV13 10h12m
Nov 24	48219	-84	-14	6	30	-10	-2
Nov 25	48220	-81	0	-1	41	0	6
Nov 26	48221	-81	2	14	-9	0	-5
Nov 27	48222	-85	0	17	26	-1	5
Nov 28	48223	-87	10	-7	-4	7	0
Nov 29	48224	-83	-	-	-	-	-
Nov 30	48225	-76	21	10	30	22	-6
Dec 1	48226	-74	-12	14	19	-9	2
Dec 2	48227	-73	11	-	0	-3	3
Dec 3	48228	-68	13	3	16	-10	-8
Dec 4	48229	-59	-21	-3	7	2	1
Dec 5	48230	-53	5	19	20	-8	1
Dec 6	48231	-45	2	3	-4	4	1
Dec 7	48232	-34	6	9	35	-19	2
Dec 8	48233	-24	1	-7	22	-12	7
Dec 9	48234	-18	-20	-3	-2	-7	-1
Dec 10	48235	-10	-18	-10	26	-21	-8
Dec 11	48236	5	-6	2	38	-27	-6
Dec 12	48237	19	-8	-8	-5	-11	2
Dec 13	48238	30	-	1	37	-20	10
Dec 14	48239	45	4	-2	47	-22	1
Dec 15	48240	59	0	-13	-3	-18	8
Dec 16	48241	69	-3	-4	24	-17	9
Dec 17	48242	80	-3	6	5	0	2
Dec 18	48243	84	-17	-	27	-4	-10
Date 1990	MJD	Co (ns) 0hUTC	DC(ns)		Block II		
			PRN14 NAV14 10h32m	PRN18 NAV18 12h40m	PRN16 NAV16 16h24m	PRN 2 NAV13 19h36m	PRN20 NAV20 23h 4m
Dec 19	48244	90	-6	-14	1	-5	11
Dec 20	48245	88	5	16	4	22	0
Dec 21	48246	90	-18	0	11	25	-1
Dec 22	48247	91	-3	-16	-25	2	11
Dec 23	48248	89	3	-10	-5	9	-7
Dec 24	48249	91	-14	0	12	7	-18

5 - UTC - GLONASS time.

UTC - GLONASS time = C1.

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 (0hUTC)	MJD (0hUTC)	C1 (μ s)	SD (μ s)	UTC(USNO)-UTC(SU) (μ s)
Nov 24	48219	3.85	0.05	8.51
Dec 4	48229	3.41	0.07	8.20
Dec 14	48239	2.96	0.06	8.11
Dec 24	48249	2.58*	0.06	8.04*

* interpolated value

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

Date 1990	MJD	Time comparisons (Unit : 1 microsecond)	uncert.	source	meth.
Dec 6	48231.06	UTC(CRL) - UTC(TA0) = -0.759	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 10^{-14} second.

Standard	Obs. period	D	s
NRC-CsV	48189-48249	+0.5	10.0
PTB-CS1	48189-48249	+1.9	3.0
PTB-CS2	48189-48249	+1.0	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:

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

in SI second at sea level, for the two-month interval 48189-48249 .