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BIPM

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 34 (1990 December 3)

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)		Sep 25	Oct 5	Oct 15	Oct 25
MJD		48159	48169	48179	48189
Laboratory k		UTC-UTC(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-1.36	-2.80	-4.31	-5.80
APL (Laurel)		-0.31	-0.35	-0.40	-0.44
AUS (Canberra)		-0.26	-0.23	-0.18	-0.12
BEV (Wien)		3.80	3.01	2.26	1.48
CAO (Cagliari)		4.20	3.93	3.50	3.16
CH (Bern)		0.24	0.27	0.28	0.34
CRL (Tokyo)		0.61	0.68	0.76	0.86
CSAO (Lintong)		-7.63	-7.35	-7.20	-7.13
DPT (Pretoria)		-21.83	-	-	-22.14
FTZ (Darmstadt)		16.69	16.86	17.05	17.19
IEN (Torino)		0.06	0.20	0.35	0.50
IFAG (Wettzell)		1.39	1.55	1.85	1.96
IGMA (Buenos Aires)		9.39	9.42	9.44	9.53
INPL (Jerusalem)		-0.46	-1.19	-1.93	-2.67
JATC (Lintong)		-18.30	-18.34	-18.23	-18.23
KSRI (Taejon)		-71.78	-72.50	-73.38	-74.28
NAOM (Mizusawa)		-5.00	-5.11	-5.26	-5.43
NIM (Beijing)		9.17	8.91	8.62	8.39
NIST (Boulder)		-0.22	-0.26	-0.29	-0.31
NPL (Teddington)		-0.92	-0.95	-0.88	-0.73
NPLI (New-Delhi)		-30.42	-	-	-
NRC (Ottawa)		0.85	0.78	0.70	0.66
NRLM (Tsukuba)		-21.91	-21.83	-21.77	-21.65
OMH (Budapest)		1.47	-	1.24	-
ONRJ (Rio de Janeiro)		10.21	9.82	9.78	9.84
OP (Paris)		-0.41	-0.41	-0.36	-0.30
ORB (Bruxelles)		9.81	10.10	10.35	10.65
PEL (Lower Hutt)		-	-	-	-
PKNM (Warszawa)		-0.28	0.45	1.24	2.09
PTB (Braunschweig)		3.73	3.73	3.72	3.75
RC (Habana)		-3.09	-3.12	-3.25	-3.44
ROA (San Fernando)		7.73	7.77	7.85	7.91
SO (Shanghai)		3.06	2.98	2.78	2.82
STA (Stockholm)		0.11	-0.12	-0.37	-0.58
SU (Moskva)	(1)	9.02	9.01	9.00	8.90
TAO (Tokyo)		-0.99	-0.81	-0.60	-0.40
TL (Chung-Li)		3.96	3.80	3.63	3.50
TP (Praha)		0.28	0.40	0.64	0.99
TUG (Graz)		2.21	2.46	2.71	2.96
USNO (Washington DC)	(USNO MC)	-0.26	-0.23	-0.18	-0.12
VSL (Delft)		3.72	3.78	3.80	3.84
YUZM (Beograd)	(2)	28.11	28.46	28.65	28.64
ZIPE (Potsdam)		0.01	0.06	0.10	0.08

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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 1990 (0hUTC)		Sep 25	Oct 5	Oct 15	Oct 25
MJD		48159	48169	48179	48189
Laboratory k		TAI-TA(k) (Unit = 1 microsecond)			
AOS (Borowiec)		-21.36	-22.80	-24.31	-25.80
APL (Laurel)		-0.82	-0.86	-0.91	-0.95
AUS (Canberra)		-30.62	-30.78	-30.94	-31.15
CH (Bern)		-67.29	-67.45	-67.63	-67.78
CRL (Tokyo)		-0.02	0.10	0.23	0.39
CSAO (Lintong)		27.21	27.29	27.24	27.11
F (Paris)		84.69	84.96	85.24	85.53
JATC (Lintong)		-0.25	-0.40	-0.40	-0.28
NIM (Beijing)		-10.09	-10.30	-10.53	-10.71
NISA (Boulder)	(3)	-45067.61	-45067.85	-45068.09	-45068.32
NIST (Boulder)		-45150.75	-45151.38	-45152.00	-45152.63
NRC (Ottawa)		16.91	16.85	16.77	16.73
PTB (Braunschweig)		-359.67	-359.67	-359.68	-359.65
RC (Habana)	(4)	-269.00	-269.54	-270.19	-270.89
SO (Shanghai)		-44.31	-44.41	-44.62	-44.59
SU (Moskva)	(1)	2827259.02	2827259.01	2827259.00	2827258.90
USNO (Washington DC)	(5)	-34609.75	-34610.37	-34611.01	-34611.65

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.

(2) YUZM. Time step of UTC(YUZM) of -5 μs on MJD = 48103.5

MJD	UTC-UTC(YUZM)
48109	25.92
48119	26.77
48129	27.23
48139	27.79
48149	27.97

(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 = -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.

		Co	DC(ns) Block I				
		(ns)	PRN 6	PRN 9	PRN13	PRN12	PRN 3
Date			NAV 3	NAV 6	NAV 9	NAV10	NAV11
1990	MJD	0hUTC	0h36m	3h32m	4h 4m	4h20m	7h32m
Sep 25	48159	-138	-13	-4	-15	20	2
Sep 26	48160	-137	-2	-1	-11	-	6
Sep 27	48161	-140	-2	-3	-3	32	6
Sep 28	48162	-149	-6	-2	7	6	-4
Sep 29	48163	-161	11	-14	18	-3	3
Sep 30	48164	-173	-5	7	5	-5	10
Oct 1	48165	-181	1	-8	-4	26	0
Oct 2	48166	-191	1	4	-4	6	-1
Oct 3	48167	-209	-	-5	8	0	6
Oct 4	48168	-230	-8	-15	-14	4	3
Oct 5	48169	-244	-5	0	12	1	3
Oct 6	48170	-251	-13	-8	4	8	5
Oct 7	48171	-256	-6	-2	-8	-2	6
Oct 8	48172	-260	-1	2	15	6	4
Oct 9	48173	-268	5	-12	-5	8	1
Oct 10	48174	-276	-2	-5	-11	-	-1
Oct 11	48175	-280	-	-7	-9	17	6
Oct 12	48176	-284	-6	-3	4	-27	0
Oct 13	48177	-291	-2	-4	4	7	-
Oct 14	48178	-295	2	-14	3	2	2
Oct 15	48179	-296	-1	-13	-10	20	4
Oct 16	48180	-298	-9	3	-1	-	-
Oct 17	48181	-304	-2	-5	-15	15	3
Oct 18	48182	-302	8	-6	-14	19	2
Oct 19	48183	-296	0	-1	-10	17	0
Oct 20	48184	-289	-2	3	-3	-8	10
Oct 21	48185	-282	-9	-9	-6	-4	13
Oct 22	48186	-270	-6	-13	-24	11	6
Oct 23	48187	-257	3	-10	12	-30	7
Oct 24	48188	-253	3	-5	-8	3	1
Oct 25	48189	-250	-	5	-16	1	3

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 18h56m	PRN20 NAV20 4h36m	PRN16 NAV16 8h52m	PRN17 NAV17 12h20m	PRN 2 NAV13 14h12m
SEP 25	48159	-138	-2	13	28	0	-11
SEP 26	48160	-137	3	0	55	7	-15
SEP 27	48161	-140	7	4	43	23	-19
SEP 28	48162	-149	5	-4	40	-6	-11
SEP 29	48163	-161	-8	-4	40	-14	-10
SEP 30	48164	-173	9	9	32	4	-10
OCT 1	48165	-181	3	9	19	-3	-14
OCT 2	48166	-191	3	14	18	-10	-2
OCT 3	48167	-209	13	-1	26	5	6
OCT 4	48168	-230	-8	6	28	-4	-8
OCT 5	48169	-244	18	5	27	-12	-14
OCT 6	48170	-251	5	11	9	-4	-5
OCT 7	48171	-256	8	-4	-7	-2	-7
OCT 8	48172	-260	-13	3	5	20	-7
OCT 9	48173	-268	9	-2	3	-3	1
OCT 10	48174	-276	19	10	12	-8	0
OCT 11	48175	-280	-2	-4	9	1	-17
OCT 12	48176	-284	7	11	16	-3	-10
OCT 13	48177	-291	8	3	11	-3	-16
OCT 14	48178	-295	-6	5	40	-11	-10
OCT 15	48179	-296	16	9	52	-4	-5
OCT 16	48180	-298	-9	6	43	-2	-9
OCT 17	48181	-304	9	14	26	-12	-14
OCT 18	48182	-302	11	5	4	-1	-20
OCT 19	48183	-296	25	-1	32	-50	-9
OCT 20	48184	-289	-4	12	39	-1	-3
OCT 21	48185	-282	0	-11	15	3	-10
OCT 22	48186	-270	14	16	-3	4	0
OCT 23	48187	-257	13	2	0	-6	-6
OCT 24	48188	-253	-6	7	-13	15	-15
OCT 25	48189	-250	0	1	-1	-14	-7

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 (μs)	SD (μs)	UTC(USNO)-UTC(SU) (μs)
Sep 25	48159	7.28	0.06	9.28
Oct 5	48169	6.69	0.08	9.24
Oct 15	48179	6.05	0.06	9.18
Oct 25	48189	5.49	0.06	9.02

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

Date 1990	MJD	Time comparisons (Unit : 1 microsecond)		uncert.	source	meth.
Jun 22	48064.00	UTC(OP) - UTC(SU)	= 10.661	0.019	OP report	(1)

(1) GPS receiver transportation and common-view method.

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	48129-48189	+10.3	10.0
PTB-CS1	48129-48189	+0.1	3.1
PTB-CS2	48129-48189	+4.8	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 + 4*10**-14 +or- 2*10**-14

in SI second at sea level, for the two-month interval 48129-48189 .