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BIPM

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 32 (1990 October 1)

1 - COORDINATED UNIVERSAL TIME UTC. Computed values of UTC-UTC(k)

(From 1990 January 1, 0h UTC, to 1991 January 1, 0h UTC, TAI-UTC=25s)
(From 1991 January 1, 0h UTC, until further notice, TAI-UTC=26s)

Date 1990 (0h UTC)			JUL 27	AUG 6	AUG 16	AUG 26
MJD			48099	48109	48119	48129
Laboratory k			UTC-UTC(k) (Unit = 1 microsecond)			
AOS	(Borowiec)	(1)	-12.72	5.56	3.78	1.97
APL	(Laurel)		0.17	0.18	-0.03	-0.13
ASMW	(Berlin)		-0.28	-0.16	-0.01	0.03
AUS	(Canberra)		-0.50	-0.47	-0.42	-0.38
BEV	(Wien)		-	-	-	-
CAO	(Cagliari)		6.77	6.52	6.25	5.68
CH	(Berne)		0.08	0.08	0.11	0.14
CRL	(Tokyo)		0.28	0.36	0.44	0.46
CSAO	(Shaanxi)	(2)	-7.76	-7.93	-8.03	-7.92
DPT	(Pretoria)		-21.36	-21.46	-21.53	-21.58
FTZ	(Darmstadt)		16.56	16.57	16.61	16.61
IEN	(Torino)		-0.77	-0.69	-0.53	-0.36
IFAG	(Wettzell)		0.03	0.51	0.76	0.96
IGMA	(San Martin)		9.33	9.41	9.42	9.41
INPL	(Jerusalem)		-	5.35	4.17	3.02
JATC	(Xian)		-19.36	-19.37	-19.38	-19.25
KSRI	(Taejon)		-66.66	-67.49	-68.35	-69.20
NAOM	(Mizusawa)		-4.52	-4.55	-4.59	-4.68
NIM	(Beijing)		9.47	9.64	9.61	9.48
NIST	(Boulder)		0.18	0.11	0.04	-0.04
NPL	(Teddington)		-1.75	-1.52	-1.38	-1.21
NPLI	(New-Delhi)		-29.01	-28.80	-28.52	-
NRC	(Ottawa)		1.41	1.50	1.35	1.20
NRLM	(Tsukuba)		-23.70	-23.24	-22.86	-22.47
OMH	(Budapest)		1.27	1.35	1.46	1.59
ONRJ	(Rio de Janeiro)		12.27	11.79	11.48	11.21
OP	(Paris)		-0.39	-0.41	-0.43	-0.42
ORB	(Bruxelles)		8.35	8.63	8.86	9.10
PEL	(Lower Hutt)		-	-	-	-
PKNM	(Warsaw)		-4.10	-3.53	-3.15	-2.61
PTB	(Braunschweig)		3.72	3.72	3.73	3.75
RC	(Havana)	(3)	-3.42	-	-	-
ROA	(San Fernando)		8.29	8.20	8.08	7.96
SO	(Shanghai)		3.34	3.31	3.42	3.42
STA	(Stockholm)		0.08	0.27	0.46	0.56
SU	(Moscow)	(4)	9.86	9.75	9.67	9.52
TAO	(Tokyo)		-2.15	-1.94	-1.72	-1.56
TL	(Taiwan)		4.30	4.51	4.61	4.48
TP	(Praha)		-0.22	-0.04	0.24	0.23
TUG	(Graz)		0.74	1.00	1.24	1.50
USNO	(Washington) (USNO MC)		-0.50	-0.47	-0.42	-0.38
VSL	(Delft)		3.13	3.30	3.43	3.53
YUZM	(Beograd)		20.06	-	-	-
ZIPE	(Potsdam)		0.02	0.15	0.30	0.32

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2 - INTERNATIONAL ATOMIC TIME TAI AND LOCAL ATOMIC TIME SCALES TA(k)

Computed values of TAI-TA(k)

Date 1990 (0h UTC)			JUL 27	AUG 6	AUG 16	AUG 26
MJD			48099	48109	48119	48129
Laboratory k			TAI-TA(k) (Unit = 1 microsecond)			
AOS	(Borowiec)		-12.72	-	-	-
APL	(Laurel)		-0.34	-0.32	-0.54	-0.64
AUS	(Canberra)		-29.24	-29.55	-29.78	-30.02
CH	(Berne)		-66.33	-66.51	-66.68	-66.83
CRL	(Tokyo)		-0.65	-0.54	-0.45	-0.36
CSAO	(Shaanxi)	(2)	28.29	27.91	27.61	27.53
DDR	(Berlin)		-27.41	-27.64	-27.88	-28.16
F	(Paris)		82.90	83.21	83.52	83.83
JATC	(Xian)		-1.16	-1.04	-0.96	-0.84
NIM	(Beijing)		-10.13	-9.91	-9.87	-9.95
NISA	(Boulder)	(5)	-45066.07	-45066.33	-45066.59	-45066.85
NIST	(Boulder)		-45146.88	-45147.53	-45148.17	-45148.83
NRC	(Ottawa)		17.48	17.56	17.42	17.27
PTB	(Braunschweig)		-359.68	-359.68	-359.67	-359.65
RC	(Havana)	(3)(6)	-266.05	-	-	-
SO	(Shanghai)		-44.05	-44.05	-43.95	-43.96
SU	(Moscow)	(4)	2827259.85	-	-	-
USNO	(Washington)	(7)	-34605.91	-34606.56	-34607.21	-34607.85

3 - NOTES ON SECTIONS 1 AND 2

(1) AOS . Time step of UTC(AOS) of -20 µs on MJD = 48104 .

(2) CSAO. Corrected values :

MJD	UTC-UTC(CSAO)	TAI-TA(CSAO)
48079	-7.56	28.83
48089	-7.67	28.57
48099	-7.76	28.29

(3) RC .

MJD	UTC-UTC(RC)	TAI-TA(RC) - 18s
48079	-3.25	-265.08
48089	-3.45	-265.64

(4) SU . Data obtained from GLONASS satellite tracking at the University of Leeds (U.K.). See Section 5.

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

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

(7) TA(USNO) designates the scale A1(MEAN) of USNO.

4 - UTC-GPS TIME and TAI-GPS TIME

UTC-GPS TIME = -6 seconds + Co ; TAI-GPS TIME = 19 seconds + Co.

Co is obtained from measurements made at Paris Observatory on satellites of Block I, usually corrected for the measured ionospheric delay, and from linear interpolation of UTC-UTC(OP). DC is the synchronization offset between satellites, as measured at Paris Observatory at the instant T of the tracking. T is given for the middle of the tracking period of 13 minutes, for the first tabular date and must be decremented by 4 minutes per day (8 minutes when moving from 0h.. to 23h..).

For most of the applications it is sufficient to derive UTC from the observations of any of the listed satellites, at any time, by interpolating Co. However, in case of large values of DC, one might obtain better values of UTC by using, instead of Co, C=Co+DC.

		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	4h36m	7h32m	8h 4m	8h20m	11h32m
JUL 27	48099	-542	12	6	-2	-21	0
JUL 28	48100	-549	-2	24	-4	-	-13
JUL 29	48101	-554	-1	13	-14	-23	0
JUL 30	48102	-555	0	-	2	22	3
JUL 31	48103	-557	7	-6	-5	9	-13
AUG 1	48104	-558	-3	21	2	-16	2
AUG 2	48105	-562	-10	21	-3	3	-7
AUG 3	48106	-573	-4	20	3	-1	-19
AUG 4	48107	-583	-	15	-6	4	-14
AUG 5	48108	-589	-	22	6	-9	-5
AUG 6	48109	-590	-	35	-3	32	0
AUG 7	48110	-590	-	11	-2	-4	-2
AUG 8	48111	-585	-	6	1	3	-4
AUG 9	48112	-579	-	19	-23	3	-10
AUG 10	48113	-573	-21	13	16	-3	-1
AUG 11	48114	-568	-9	21	2	-25	-8
AUG 12	48115	-565	-7	11	4	6	-2
AUG 13	48116	-562	-21	1	-1	0	8
AUG 14	48117	-553	-1	5	-24	-4	-7
AUG 15	48118	-541	-7	4	19	-1	0
AUG 16	48119	-531	-7	4	9	-12	-10
AUG 17	48120	-519	-5	4	4	0	2
AUG 18	48121	-503	1	6	-8	0	-2
AUG 19	48122	-487	2	-1	7	-2	0
AUG 20	48123	-472	-7	-1	7	1	-8
AUG 21	48124	-458	-12	-17	2	4	-1
AUG 22	48125	-445	9	-3	0	-2	0
AUG 23	48126	-438	-5	-4	0	1	5
AUG 24	48127	-429	5	5	-9	-14	-5
AUG 25	48128	-417	-1	-22	12	-3	-4
AUG 26	48129	-401	1	-16	25	-1	4

Section 4 (Cont.)

For satellites of Block II, the synchronization offset DC is computed with respect to Co obtained from Block I only.

Date 1990	MJD	Co (ns) 0hUTC	DC(ns) PRN14 NAV14 22h56m	PRN20 NAV20 8h36m	Block II PRN16 NAV16 12h52m	PRN17 NAV17 16h20m	PRN 2 NAV13 18h12m
JUL 27	48099	-542	-196	60	-86	-90	-123
JUL 28	48100	-549	224	-	63	173	95
JUL 29	48101	-554	-259	-133	0	-16	103
JUL 30	48102	-555	114	38	-154	-64	122
JUL 31	48103	-557	2	188	-143	32	-68
AUG 1	48104	-558	327	-166	1	159	209
AUG 2	48105	-562	137	-77	-93	75	-155
AUG 3	48106	-573	162	84	-147	112	-60
AUG 4	48107	-583	-66	62	28	129	131
AUG 5	48108	-589	93	-5	134	425	-140
AUG 6	48109	-590	-311	176	-61	-74	-
AUG 7	48110	-590	-37	37	-130	223	-92
AUG 8	48111	-585	-129	-193	-5	157	-1
AUG 9	48112	-579	108	18	-38	21	335
AUG 10	48113	-573	5	-26	-2	0	-7
AUG 11	48114	-568	-18	-2	2	13	2
AUG 12	48115	-565	-5	-3	1	19	-13
AUG 13	48116	-562	8	-5	0	-4	-3
AUG 14	48117	-553	4	-11	-2	10	1
AUG 15	48118	-541	5	11	1	15	-6
AUG 16	48119	-531	3	-2	4	5	-14
AUG 17	48120	-519	11	-1	-2	3	-12
AUG 18	48121	-503	1	11	-4	-10	-13
AUG 19	48122	-487	-4	0	-5	10	-8
AUG 20	48123	-472	1	-9	5	6	5
AUG 21	48124	-458	0	-5	33	-1	-8
AUG 22	48125	-445	5	1	11	4	-13
AUG 23	48126	-438	5	-3	-2	7	-
AUG 24	48127	-429	17	2	-13	25	-6
AUG 25	48128	-417	-6	13	-28	-12	-17
AUG 26	48129	-401	0	8	-31	-20	-20

5 - UTC-GLONASS TIME

Measurements are currently in progress at the University of Leeds by Prof. P. Daly to establish system time references of both GPS and GLONASS.

C1 = UTC-GLONASS time is derived from these measurements after interpolation at 0 h UTC and from UTC-GPS time of section 4. The standard deviation is SD.

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

Date 1990 (0 h UTC)	MJD (0 h UTC)	C1 (µs)	SD (µs)	UTC(USNO)-UTC(SU) (µs)
JUL 27	48099	9.50	0.08	10.36
AUG 6	48109	9.29	0.06	10.22
AUG 16	48119	9.06	0.05	10.10
AUG 26	48129	8.75	0.06	9.90

6 - DURATION OF THE TAI SCALE INTERVAL : 1 second + D

D and its standard deviation s are expressed in 1*10**-14 second.

The following data are given :

- for continuously operating primary standards (primary clocks), the average of D for the two previous months, with the last available estimate of the inaccuracy of the standard;
- for occasional measurements, the value D for the measurement interval, as computed by BIPM (the BIPM uncertainty may be larger than the reported uncertainty on account of the time comparisons);
- the BIPM evaluation from all available measurements (from CRL, NIST, NRC, PTB, SU), with the uncertainty based on those of individual measurements, as reported.

Standards,	Interval(MJD)	D	s
NRC-CsV	48069-48129	-2.0	10.0
PTB-CS1	48069-48129	-0.8	3.0
PTB-CS2	48069-48129	+1.3	1.5
BIPM estimate	48069-48129	+1	2