BUREAU INTERNATIONAL DES POIDS ET MESURES

ISSN 1143-1393

Circular T 181 (2003 February 24)
Circulaire T 181

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

(From 1999 January 1, 0h UTC, *TAI-UTC* = 32 s)

Date 2002/2003 0h UTC		Dec 31	Jan 5	Jan 10	Jan 15
MJD		52639	52644	52649	52654
Laboratory *k*			[*UTC-UTC(k)*]/ns		
AOS (Borowiec)		6	5	-15	-25
AUS (Sydney)		-84	-98	-89	-95
BEV (Wien)		87	83	89	91
BIRM (Beijing)		786	797	793	799
CAO (Cagliari)		-	-	-	-
CH (Bern)		-40	-32	-30	-18
CNM (Queretaro)		169	164	159	164
CRL (Tokyo)		-31	-28	-28	-23
CSIR (Pretoria)		-	-	-	-
DLR (Oberpfaffenhofen)		-	-	-	-
DTAG (Darmstadt)		328	348	357	377
IEN (Torino)		5	10	6	0
IFAG (Wettzell)		-1672	-1693	-1713	-1729
IGMA (Buenos Aires)		-71	-79	-80	-74
INPL (Jerusalem)		-6553	-6590	-6632	-6679
IPQ (Monte de Caparica)		-	-	-	-
JATC (Lintong)		-11761	-11803	-11848	-11898
KRIS (Daejon)		-23	-16	-7	7
LDS (Leeds)		2685	2733	2762	2781
LT (Vilnius)		-254	-255	-248	-240
MSL (Lower Hutt)		-61	-58	-59	-56
NAO (Mizusawa)		-17	-25	-29	-27
NIM (Beijing)		-2618	-2613	-2616	-2615
NIMB (Bucharest)		312	303	304	287
NIMT (Bangkok)		-435	-469	-488	-476
NIST (Boulder)		-2	0	-1	4
NMC (Sofiya)		-2418	-2427	-2440	-2433
NMIJ (Tsukuba)		187	197	200	223
NMLS (Shah Alam)		326	296	283	264
NPL (Teddington)		26	32	34	38
NPLI (New-Delhi)		-	3006	3069	3118
NRC (Ottawa)		15	18	27	23
NTSC (Lintong)		-10	-8	-9	-13
OMH (Budapest)		7635	7632	7633	7634
ONBA (Buenos Aires)		-693	-532	-606	-622
ONRJ (Rio de Janeiro)		5158	5171	5187	5206
OP (Paris)		-22	-23	-25	-24
ORB (Bruxelles)		-30	-29	-31	-34
PL (Warszawa)	(1)	-208	-213	-219	-221
PTB (Braunschweig)		-15	-12	-12	-11
ROA (San Fernando)		30	40	48	58
SCL (Hong Kong)		37	40	38	40
SG (Singapore)		-55	-62	-61	-66
SMU (Bratislava)		-7455	-7478	-7512	-7546
SP (Boras)		-197	-199	-191	-185
SU (Moskva)		18	18	21	25
TCC (Concepcion)		-1616	-1651	-1725	-1782
TL (Chung-Li)		-22	-19	-13	-15
TP (Praha)		-54	-59	-57	-51
UME (Gebze-Kocaeli)		-794	-794	-795	-800
USNO (Washington DC)(USNO MC)		2	2	3	1
VSL (Delft)		-23	-10	-10	-16

1 - Coordinated Universal Time UTC. (Cont.)

Date 2003 0h UTC	Jan 20	Jan 25	Jan 30
MJD	52659	52664	52669
Laboratory *k*		[*UTC*-*UTC*(*k*)]/ns	
AOS (Borowiec)	-48	-62	-71
AUS (Sydney)	-111	-123	-145
BEV (Wien)	86	100	104
BIRM (Beijing)	790	793	800
CAO (Cagliari)	-	-	-
CH (Bern)	-18	-17	-16
CNM (Queretaro)	146	139	136
CRL (Tokyo)	-22	-19	-18
CSIR (Pretoria)	-	-	-
DLR (Oberpfaffenhofen)	-	-	-
DTAG (Darmstadt)	382	405	408
IEN (Torino)	-6	1	4
IFAG (Wettzell)	-1741	-1760	-1781
IGMA (Buenos Aires)	-89	-91	-92
INPL (Jerusalem)	-6739	-6786	-6834
IPQ (Monte de Caparica)	-	-	-
JATC (Lintong)	-11934	-11975	-12009
KRIS (Daejon)	-19	-23	-
LDS (Leeds)	2808	2833	2870
LT (Vilnius)	-248	-221	-223
MSL (Lower Hutt)	-60	-66	-66
NAO (Mizusawa)	-24	-24	-17
NIM (Beijing)	-2617	-2615	-2616
NIMB (Bucharest)	278	283	258
NIMT (Bangkok)	-483	-485	-476
NIST (Boulder)	-1	0	2
NMC (Sofiya)	-2463	-2460	-2470
NMIJ (Tsukuba)	238	243	233
NMLS (Shah Alam)	252	231	222
NPL (Teddington)	31	32	33
NPLI (New-Delhi)	3145	3195	3246
NRC (Ottawa)	39	42	47
NTSC (Lintong)	-11	-11	-13
OMH (Budapest)	7632	7644	7649
ONBA (Buenos Aires)	-709	-641	-679
ONRJ (Rio de Janeiro)	5207	5231	5243
OP (Paris)	-29	-29	-31
ORB (Bruxelles)	-38	-31	-25
PL (Warszawa) (1)	27	32	43
PTB (Braunschweig)	-16	-15	-14
ROA (San Fernando)	65	73	85
SCL (Hong Kong)	38	30	29
SG (Singapore)	-57	-69	-70
SMU (Bratislava)	-7588	-7625	-7655
SP (Boras)	-179	-172	-170
SU (Moskva)	19	22	23
TCC (Concepcion)	-1882	-1940	-2004
TL (Chung-Li)	-13	-18	-26
TP (Praha)	-46	-51	-49
UME (Gebze-Kocaeli)	-805	-822	-828
USNO (Washington DC)(USNO MC)	3	3	4
VSL (Delft)	-28	-29	-34

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

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

Date 2002/2003 0h UTC		Dec 31	Jan 5	Jan 10	Jan 15
MJD		52639	52644	52649	52654
Laboratory *k*		[*TAI*-*TA*(*k*)]/ns			
AUS (Sydney)		-118853	-118951	-119027	-119108
CH (Bern)		27604	27782	27953	28134
CRL (Tokyo)		167288	167489	167691	167895
F (Paris)		168663	168683	168701	168721
IEN (Torino)		23981	24109	24228	24349
JATC (Lintong)		-27088	-27201	-27307	-27416
KRIS (Taejon)		6082	6079	6077	6084
NIST (Boulder)		-45244179	-45244380	-45244584	-45244781
NRC (Ottawa)		28399	28407	28420	28421
NTSC (Lintong)		-69	-72	-67	-71
PL (Warszawa)		-1073	-1086	-1099	-1108
PTB (Braunschweig)		-359655	-359647	-359642	-359636
SU (Moskva)	(2)	27241018	27241018	27241021	27241025
USNO (Washington DC)		-34900658	-34900971	-34901282	-34901594

Date 2003 0h UTC		Jan 20	Jan 25	Jan 30
MJD		52659	52664	52669
Laboratory k		[*TAI*-*TA*(*k*)]/ns		
AUS (Sydney)		-119184	-119266	-119344
CH (Bern)		28304	28474	28645
CRL (Tokyo)		168091	168294	168496
F (Paris)		168733	168750	168765
IEN (Torino)		24459	24578	24699
JATC (Lintong)		-27528	-27183	-27674
KRIS (Taejon)		6064	6060	-
NIST (Boulder)		-45244989	-45245191	-45245392
NRC (Ottawa)		28441	28448	28457
NTSC (Lintong)		-65	-64	-59
PL (Warszawa)		-1131	-1139	-1151
PTB (Braunschweig)		-359636	-359630	-359624
SU (Moskva)	(2)	27241019	27241022	27241023
USNO (Washington DC)		-34901903	-34902214	-34902523

3 - Notes on sections 1 and 2.

(1) PL . Time step of UTC(PL) of -250 ns on MJD = 52655.38

(2) SU . Listed values are *TAI*-*TA*(*SU*) - 2.80 seconds.

4 - Difference between the normalized frequencies of EAL and TAI.

Interval of validity		$f(EAL)-f(TAI)$
2002 Nov. 26 - 2003 Jan. 30	52604-52669	6.990×10^{-13}
New steering correction foreseen for February and March 2003		
2003 Jan. 30 - 2003 Mar. 31	52669-52729	6.980×10^{-13}

5 - Duration of the TAI scale interval.

TAI is a realization of coordinate time TT. The following tables give the fractional deviation d of the scale interval of TAI from that of TT (the SI second on the geoid), i.e. the fractional frequency deviation of TAI with the opposite sign: $d = -y_{TAI}$. In this section, a frequency over a time interval is defined as the ratio of the end-point phase difference to the duration of the interval. Whenever needed, the instability of EAL should be expressed as the quadratic sum of three components:

- a white frequency noise $6.0 \times 10^{-15} / \sqrt{\tau}$,
- a flicker frequency noise 0.6×10^{-15},
- a random walk frequency noise $1.6 \times 10^{-16} \times \sqrt{\tau}$,

with τ in days. The relation between EAL and TAI is given in *Circular T* and the *Annual Report of the BIPM Time Section*.

In the first table, d is obtained, on the given periods of estimation by comparison of the TAI frequency with that of the given individual primary standards (PFS). In this table

- u_B is the combined uncertainty from systematic effects,
- Ref(u_B) is a reference giving information on the stated value of u_B or is the *Circular T* where this reference was first given,
- u_A is the uncertainty originating in the instability of the PFS,
- $u_{l/lab}$ is the uncertainty in the link between the PFS and the clock participating to TAI,
- $u_{l/TAI}$ is the uncertainty in the link to TAI,
- u is the quadratic sum of all four uncertainty values.

Standard	Period of estimation	$10^{15}d$	$10^{15}u_B$	Ref(u_B)	$10^{15}u_A$	$10^{15}u_{l/lab}$	$10^{15}u_{l/TAI}$	Notes	$10^{15}u$
SYRTE-JPO	52609-52639	14.5	8.	T160	1.7	0.3	1.	(1)	8.2
SYRTE-JPO	52639-52659	13.1	8.	T160	2.	0.3	1.5		8.4
PTB CS1	52639-52669	-4.6	8.	T148	5.	0.	1.	(2)	9.
PTB CS2	52639-52669	5.1	12.	T148	3.	0.	1.	(2)	12.

Notes:

(1) BNM-SYRTE, previoulsly LPTF.
(2) Continuously operating as a clock participating to TAI

The second table gives the BIPM estimate of d, based on measurements of CRL-O1, SYRTE-JPO, NIST-F1, PTB CS1, PTB CS2 and PTBCSF1 over the period MJD 52279-52669, taking into account their individual uncertainties and characterizing the instability of EAL as noted above. u is the computed standard uncertainty of d.

Period of estimation	d	u
52639-52669	$+7.7 \times 10^{-15}$	2.6×10^{-15}

6 - [*UTC-GPS time*] and [*TAI-GPS time*].

[*UTC-GPS time*] = -13 s + C_0, [*TAI-GPS time*] = 19 s + C_0.

Daily values of C_0 are given in the following table. They are obtained as follows: the GPS data taken at the Paris Observatory, for highest elevation, are first corrected for precise satellite ephemerides and for measured ionospheric delays, and then smoothed to obtain daily values of [*UTC*(*OP*)-*GPS time*] at 0h UTC; daily values of C_0 are derived from them using linear interpolation of [*UTC-UTC*(*OP*)].
The global uncertainty of daily C_0 values is of order 10 ns.

In the following table, the standard deviation σ characterizes the dispersion of individual measurements, and N is the number of measurements used on a given day for estimation of the corresponding daily C_0 value.

Date 2002 0h UTC	MJD	C_0/ns	σ/ns	$(\sigma/\sqrt{N})$/ns
Dec 31	52639	-11	2	0
Jan 1	52640	-8	2	0
Jan 2	52641	-9	-	-
Jan 3	52642	-9	3	0
Jan 4	52643	-10	3	0
Jan 5	52644	-8	3	0
Jan 6	52645	-6	3	0
Jan 7	52646	-2	3	0
Jan 8	52647	-1	3	0
Jan 9	52648	0	3	0
Jan 10	52649	-1	3	0
Jan 11	52650	-1	3	0
Jan 12	52651	3	3	0
Jan 13	52652	3	3	0
Jan 14	52653	2	3	0
Jan 15	52654	4	3	0
Jan 16	52655	3	3	0
Jan 17	52656	0	3	0
Jan 18	52657	-2	3	0
Jan 19	52658	-5	3	0
Jan 20	52659	-7	3	1
Jan 21	52660	-5	3	0
Jan 22	52661	-4	3	0
Jan 23	52662	-8	3	0
Jan 24	52663	-4	3	0
Jan 25	52664	-3	3	0
Jan 26	52665	0	2	0
Jan 27	52666	2	3	0
Jan 28	52667	1	3	0
Jan 29	52668	-3	3	0
Jan 30	52669	-2	3	0

7 - [*UTC-GLONASS time*] and [*TAI-GLONASS time*].

[*UTC-GLONASS time*] = 0 s + C_1, [*TAI-GLONASS time*] = +32 s + C_1.

Daily values of C_1 are given in the following table. They are obtained as follows: the GLONASS data taken at the NMi Van Swinden Laboratorium, Delft, The Netherlands, for highest elevation, are smoothed to obtain daily values of [*UTC*(*VSL*)-*GLONASS time*] at 0h UTC; daily values of C_1 are then derived from them using linear interpolation of [*UTC-UTC*(*VSL*)]. The global uncertainty of daily C_1 values is of order several hundreds of nanoseconds.

In the following table, the standard deviation σ characterizes the dispersion of individual measurements, and N is the number of measurements used on a given day for estimation of the corresponding daily C_1 value.

Date 2002/2003 0h UTC	MJD	C_1/ns	σ/ns	$(\sigma/\sqrt{N})$/ns
Dec 31	52639	10	-	-
Jan 1	52640	48	-	-
Jan 2	52641	33	-	-
Jan 3	52642	-9	26	8
Jan 4	52643	29	30	10
Jan 5	52644	12	-	-
Jan 6	52645	-12	35	11
Jan 7	52646	56	5	1
Jan 8	52647	49	26	8
Jan 9	52648	1	13	4
Jan 10	52649	32	30	10
Jan 11	52650	0	8	3
Jan 12	52651	28	20	6
Jan 13	52652	27	14	4
Jan 14	52653	47	23	7
Jan 15	52654	66	6	2
Jan 16	52655	30	27	8
Jan 17	52656	23	19	6
Jan 18	52657	19	41	13
Jan 19	52658	10	27	8
Jan 20	52659	19	23	7
Jan 21	52660	50	16	5
Jan 22	52661	53	22	7
Jan 23	52662	59	11	4
Jan 24	52663	51	31	10
Jan 25	52664	21	13	4
Jan 26	52665	27	18	6
Jan 27	52666	29	26	8
Jan 28	52667	55	15	5
Jan 29	52668	60	16	5
Jan 30	52669	55	38	12