BUREAU INTERNATIONAL DES POIDS ET MESURES

ISSN 1143-1393

Circular T 180 (2003 January 14)
Circulaire T 180

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

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

Date 2002 0h UTC		Nov 26	Dec 1	Dec 6	Dec 11
MJD		52604	52609	52614	52619
Laboratory *k*			[*UTC-UTC*(*k*)]/ns		
AOS (Borowiec)		52	52	45	49
AUS (Sydney)		-68	-79	-75	-58
BEV (Wien)		43	51	54	56
BIRM (Beijing)		735	740	746	758
CAO (Cagliari)		-3789	-3788	-3823	-3840
CH (Bern)		-34	-37	-32	-38
CNM (Queretaro)		181	182	179	177
CRL (Tokyo)		-42	-40	-43	-41
CSIR (Pretoria)		-	-	-	-
DLR (Oberpfaffenhofen)		-	-	-	-
DTAG (Darmstadt)		317	318	338	329
IEN (Torino)		-20	-18	-21	-21
IFAG (Wettzell)		-1577	-1594	-1608	-1627
IGMA (Buenos Aires)		-62	-60	-53	-70
INPL (Jerusalem)		-6205	-6253	-6305	-6354
IPQ (Monte de Caparica)		-	-	-	-
JATC (Lintong)		-11456	-11496	-11542	-11583
KRIS (Daejon)		-42	-36	-39	-52
LDS (Leeds)		2488	2511	2540	2562
LT (Vilnius)		-267	-268	-265	-281
MSL (Lower Hutt)		-60	-69	-74	-69
NAO (Mizusawa)		1	-2	-9	-1
NIM (Beijing)		-	-2608	-2606	-2600
NIMB (Bucharest)		-404	-435	-456	-481
NIMT (Bangkok)		-268	-296	-321	-348
NIST (Boulder)		-1	-3	-1	-4
NMC (Sofiya)		-2360	-2375	-2378	-2367
NMIJ (Tsukuba)		125	132	143	153
NMLS (Shah Alam)	(1)	22	14	333	374
NPL (Teddington)		5	7	12	13
NPLI (New-Delhi)		-	-	-	-
NRC (Ottawa)		9	19	21	14
NTSC (Lintong)		-10	-9	-12	-7
OMH (Budapest)		7574	7578	7597	7619
ONBA (Buenos Aires)		-838	-779	-	-758
ONRJ (Rio de Janeiro)		5064	5088	5104	5112
OP (Paris)		-17	-18	-14	-11
ORB (Bruxelles)		-11	-15	-19	-28
PL (Warszawa)		-160	-162	-173	-182
PTB (Braunschweig)		-20	-22	-22	-25
ROA (San Fernando)		23	22	19	19
SCL (Hong Kong)		45	51	39	49
SG (Singapore)		-39	-38	-41	-43
SMU (Bratislava)		-7276	-7311	-7334	-7352
SP (Boras)		-45	-59	-80	-115
SU (Moskva)		11	10	15	18
TCC (Concepcion)		-1243	-1332	-1378	-1454
TL (Chung-Li)		-28	-22	-25	-30
TP (Praha)		-40	-41	-49	-52
UME (Gebze-Kocaeli)		-767	-777	-787	-793
USNO (Washington DC)(USNO MC)		-5	-5	-1	-2
VSL (Delft)		-26	-18	-16	-20

ORGANISATION INTERGOUVERNEMENTALE DE LA CONVENTION DU MÈTRE
PAVILLON DE BRETEUIL F-92312 SÈVRES CEDEX TÉL. + 33 1 45 07 70 70 FAX + 33 1 45 34 20 21

1 - Coordinated Universal Time UTC. (Cont.)

Date 2002 0h UTC		Dec 16	Dec 21	Dec 26	Dec 31
MJD		52624	52629	52634	52639
Laboratory *k*			[*UTC*-*UTC*(*k*)]/ns		
AOS (Borowiec)		31	25	15	6
AUS (Sydney)		-60	-67	-84	-84
BEV (Wien)		59	70	77	87
BIRM (Beijing)		761	769	778	786
CAO (Cagliari)		-	-	-	-
CH (Bern)		-41	-45	-43	-40
CNM (Queretaro)		176	168	165	169
CRL (Tokyo)		-37	-40	-34	-31
CSIR (Pretoria)		-	-	-	-
DLR (Oberpfaffenhofen)		-	-	-	-
DTAG (Darmstadt)		333	336	334	328
IEN (Torino)		-9	-8	1	5
IFAG (Wettzell)		-1626	-1633	-1652	-1672
IGMA (Buenos Aires)		-52	-56	-55	-71
INPL (Jerusalem)		-6401	-6455	-6503	-6553
IPQ (Monte de Caparica)		-	-	-	-
JATC (Lintong)		-11627	-11676	-11722	-11761
KRIS (Daejon)		-41	-38	-39	-23
LDS (Leeds)		2601	2621	2652	2685
LT (Vilnius)		-287	-281	-269	-254
MSL (Lower Hutt)		-68	-69	-62	-61
NAO (Mizusawa)		-2	-9	-13	-17
NIM (Beijing)		-2606	-2626	-2616	-2618
NIMB (Bucharest)	(2)	332	319	324	312
NIMT (Bangkok)		-363	-389	-415	-435
NIST (Boulder)		0	-3	-1	-2
NMC (Sofiya)		-2400	-2407	-2416	-2418
NMIJ (Tsukuba)		165	171	179	187
NMLS (Shah Alam)		372	348	339	326
NPL (Teddington)		13	16	21	26
NPLI (New-Delhi)		-	-	-	-
NRC (Ottawa)		11	19	17	15
NTSC (Lintong)		-3	-7	-11	-10
OMH (Budapest)		7631	7630	7637	7635
ONBA (Buenos Aires)		-746	-	-	-693
ONRJ (Rio de Janeiro)		5131	5123	5148	5158
OP (Paris)		-10	-13	-16	-22
ORB (Bruxelles)		-33	-35	-31	-30
PL (Warszawa)		-189	-196	-204	-208
PTB (Braunschweig)		-24	-19	-13	-15
ROA (San Fernando)		31	28	28	30
SCL (Hong Kong)		47	49	37	37
SG (Singapore)		-48	-48	-47	-55
SMU (Bratislava)		-7387	-7417	-7433	-7455
SP (Boras)		-131	-155	-173	-197
SU (Moskva)		20	15	17	18
TCC (Concepcion)		-1487	-1529	-1581	-1616
TL (Chung-Li)		-28	-28	-24	-22
TP (Praha)		-43	-39	-44	-54
UME (Gebze-Kocaeli)		-788	-804	-796	-794
USNO (Washington DC)(USNO MC)		-4	-2	0	2
VSL (Delft)		-22	-29	-33	-23

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 0h UTC		Nov 26	Dec 1	Dec 6	Dec 11
MJD		52604	52609	52614	52619
Laboratory *k*		[*TAI*-*TA*(*k*)]/ns			
AUS (Sydney)		-118283	-118379	-118465	-118546
CH (Bern)		26398	26571	26751	26921
CRL (Tokyo)		165881	166079	166279	166479
F (Paris)		168530	168552	168575	168591
IEN (Torino)		23150	23277	23393	23511
JATC (Lintong)		-26349	-26448	-26562	-26669
KRIS (Taejon)		6079	6074	6073	6068
NIST (Boulder)		-45242763	-45242967	-45243167	-45243372
NRC (Ottawa)		28363	28376	28383	28381
NTSC (Lintong)		-71	-66	-72	-73
PL (Warszawa)		-1010	-1014	-1021	-1039
PTB (Braunschweig)		-359695	-359692	-359687	-359685
SU (Moskva)	(3)	27241011	27241010	27241015	27241018
USNO (Washington DC)		-34898487	-34898799	-34899105	-34899417

Date 2002 0h UTC		Dec 16	Dec 21	Dec 26	Dec 31
MJD		52624	52629	52634	52639
Laboratory *k*		[*TAI*-*TA*(*k*)]/ns			
AUS (Sydney)		-118626	-118704	-118784	-118853
CH (Bern)		27093	27260	27431	27604
CRL (Tokyo)		166682	166879	167083	167288
F (Paris)		168611	168626	168646	168663
IEN (Torino)		23626	23744	23866	23981
JATC (Lintong)		-26771	-26884	-26988	-27088
KRIS (Taejon)		6070	6071	6074	6082
NIST (Boulder)		-45243570	-45243775	-45243975	-45244179
NRC (Ottawa)		28382	28395	28397	28399
NTSC (Lintong)		-68	-72	-74	-69
PL (Warszawa)		-1047	-1055	-1068	-1073
PTB (Braunschweig)		-359679	-359669	-359658	-359655
SU (Moskva)	(3)	27241020	27241015	27241017	27241018
USNO (Washington DC)		-34899729	-34900039	-34900348	-34900658

3 - Notes on sections 1 and 2.

(1) NMLS. Time step of UTC(NMLS) of -359 ns between MJD = 52609 and MJD = 52614

(2) NIMB. Apparent time step of *UTC*-*UTC*(*NIMB*) between MJD = 52619 and MJD = 52624

(3) 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 2003		
2003 Jan. 30 - 2003 Feb. 24	52669-52694	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	$10^{15}u$
PTB CS1	52604-52639	-2.2	8.	T148	5.	0.	1.	(1)	9.
PTB CS2	52604-52639	4.1	12.	T148	3.	0.	1.	(1)	12.
PTBCSF1	52604-52619	12.7	0.9	T162	1.0	0.0	2.0	(2)	2.4

Notes:

(1) Continuously operating as a clock participating to TAI
(2) Report 6 January 2003 by PTB.

The second table gives the BIPM estimate of d, based on measurements of CRL-O1, NIST-F1, PTB CS1, PTB CS2 and PTBCSF1 over the period MJD 52244-52639, 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
52604-52639	8.6×10^{-15}	2.0×10^{-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
Nov 26	52604	-8	3	0
Nov 27	52605	-11	3	0
Nov 28	52606	-6	3	0
Nov 29	52607	-7	3	0
Nov 30	52608	-7	3	0
Dec 1	52609	-3	3	0
Dec 2	52610	-5	3	0
Dec 3	52611	-5	3	0
Dec 4	52612	-6	3	0
Dec 5	52613	-8	3	0
Dec 6	52614	-1	2	0
Dec 7	52615	2	3	0
Dec 8	52616	4	3	0
Dec 9	52617	11	3	0
Dec 10	52618	13	3	0
Dec 11	52619	15	3	0
Dec 12	52620	16	3	0
Dec 13	52621	13	3	0
Dec 14	52622	11	3	0
Dec 15	52623	11	3	0
Dec 16	52624	8	2	0
Dec 17	52625	5	3	0
Dec 18	52626	7	3	0
Dec 19	52627	5	4	1
Dec 20	52628	2	3	0
Dec 21	52629	-8	3	0
Dec 22	52630	-7	3	0
Dec 23	52631	-5	3	0
Dec 24	52632	-4	3	0
Dec 25	52633	-2	3	0
Dec 26	52634	-1	2	0
Dec 27	52635	-3	3	0
Dec 28	52636	-3	3	1
Dec 29	52637	-4	2	0
Dec 30	52638	-11	3	0
Dec 31	52639	-11	2	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 0h UTC	MJD	C_1/ns	σ/ns	$(\sigma/\sqrt{N})$/ns
Nov 26	52604	-8	6	4
Nov 27	52605	2	-	-
Nov 28	52606	-2	1	1
Nov 29	52607	-27	23	6
Nov 30	52608	-14	21	6
Dec 1	52609	15	-	-
Dec 2	52610	-25	9	6
Dec 3	52611	-66	28	20
Dec 4	52612	-38	-	-
Dec 5	52613	10	-	-
Dec 6	52614	26	16	9
Dec 7	52615	-11	-	-
Dec 8	52616	-30	35	20
Dec 9	52617	11	-	-
Dec 10	52618	45	-	-
Dec 11	52619	67	-	-
Dec 12	52620	72	-	-
Dec 13	52621	58	-	-
Dec 14	52622	2	-	-
Dec 15	52623	-19	17	10
Dec 16	52624	-19	-	-
Dec 17	52625	-32	-	-
Dec 18	52626	-44	-	-
Dec 19	52627	-47	-	-
Dec 20	52628	-39	-	-
Dec 21	52629	-31	-	-
Dec 22	52630	-34	-	-
Dec 23	52631	-42	-	-
Dec 24	52632	-42	9	6
Dec 25	52633	-32	-	-
Dec 26	52634	-14	-	-
Dec 27	52635	9	-	-
Dec 28	52636	22	-	-
Dec 29	52637	20	-	-
Dec 30	52638	10	-	-
Dec 31	52639	10	-	-