BUREAU INTERNATIONAL DES POIDS ET MESURES

ISSN 1143-1393

Circular T 178 (2002 November 14)
Circulaire T 178

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	Sep 27	Oct 2	Oct 7	Oct 12
MJD	52544	52549	52554	52559
Laboratory *k*		[*UTC-UTC*(*k*)]/ns		
AOS (Borowiec)	70	82	99	115
AUS (Sydney)	-81	-99	-97	-90
BEV (Wien)	30	28	31	31
BIRM (Beijing)	627	636	656	660
CAO (Cagliari)	-3785	-3775	-3766	-3792
CH (Bern)	-14	-15	-14	-21
CNM (Queretaro)	168	171	171	176
CRL (Tokyo)	-31	-26	-32	-32
CSIR (Pretoria)	-	-	-	-
DLR (Oberpfaffenhofen)	-	-	-	-
DTAG (Darmstadt)	43	54	56	70
IEN (Torino)	67	42	39	34
IFAG (Wettzell)	-1449	-1456	-1457	-1480
IGMA (Buenos Aires)	-32	-28	-41	-42
INPL (Jerusalem)	-5533	-5584	-5638	-5694
IPQ (Monte de Caparica)	-	-	-	-
JATC (Lintong)	-10967	-11001	-11046	-11092
KRIS (Daejeon)	-68	-77	-88	-85
LDS (Leeds)	2249	2276	2298	2323
LT (Vilnius)	-288	-264	-271	-282
MSL (Lower Hutt)	274	206	149	84
NAO (Mizusawa)	37	51	43	38
NIM (Beijing)	-2626	-2614	-2618	-2627
NIMB (Bucharest) (1)	-	-1	-10	11
NIMT (Bangkok)	40	12	-10	-36
NIST (Boulder)	4	4	4	4
NMC (Sofiya)	-2183	-2190	-2212	-2226
NMIJ (Tsukuba)	266	284	287	299
NMLS (Shah Alam)	92	78	81	71
NPL (Teddington)	-9	-9	-8	-7
NPLI (New-Delhi)	2069	2115	2179	2236
NRC (Ottawa)	0	10	13	17
NTSC (Lintong)	9	14	10	0
OMH (Budapest)	7311	7344	7377	7389
ONBA (Buenos Aires)	-759	-793	-697	-700
ONRJ (Rio de Janeiro)	4919	4924	4946	4955
OP (Paris)	6	6	7	-1
ORB (Bruxelles)	53	50	45	41
PL (Warszawa)	-66	-66	-67	-74
PTB (Braunschweig)	-6	-9	-7	-9
ROA (San Fernando)	21	28	34	39
SCL (Hong Kong)	-17	-23	-13	-7
SG (Singapore)	-32	-40	-32	-37
SMU (Bratislava)	-6917	-6935	-6972	-6997
SP (Boras)	195	177	165	152
SU (Moskva)	23	22	21	22
TL (Chung-Li)	-52	-38	-40	-35
TP (Praha)	11	9	-2	-12
UME (Gebze-Kocaeli)	-681	-689	-690	-691
USNO (Washington DC)(USNO MC)	-4	-4	-4	-4
VSL (Delft)	-27	-23	-25	-24

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	Oct 17	Oct 22	Oct 27
MJD	52564	52569	52574
Laboratory *k*		[*UTC*-*UTC*(*k*)]/ns	
AOS (Borowiec)	110	106	99
AUS (Sydney)	-70	-62	-72
BEV (Wien)	32	32	32
BIRM (Beijing)	667	675	678
CAO (Cagliari)	-3778	-3791	-3779
CH (Bern)	-29	-30	-27
CNM (Queretaro)	183	185	190
CRL (Tokyo)	-35	-35	-43
CSIR (Pretoria)	-	-	-
DLR (Oberpfaffenhofen)	-	-	-
DTAG (Darmstadt)	83	130	231
IEN (Torino)	24	9	-1
IFAG (Wettzell)	-1479	-1496	-1490
IGMA (Buenos Aires)	-44	-50	-46
INPL (Jerusalem)	-5748	-5811	-5865
IPQ (Monte de Caparica)	-	-	-
JATC (Lintong)	-11138	-11168	-11204
KRIS (Daejeon)	-66	-63	-59
LDS (Leeds)	2348	2366	2386
LT (Vilnius)	-266	-242	-241
MSL (Lower Hutt)	65	32	6
NAO (Mizusawa)	23	15	14
NIM (Beijing)	-2622	-2626	-2623
NIMB (Bucharest)	-36	-17	-19
NIMT (Bangkok)	-53	-84	-120
NIST (Boulder)	5	5	6
NMC (Sofiya)	-2245	-2273	-2275
NMIJ (Tsukuba) (2)	305	321	71
NMLS (Shah Alam)	70	79	70
NPL (Teddington)	-5	-6	-4
NPLI (New-Delhi)	2303	2342	2383
NRC (Ottawa)	24	22	26
NTSC (Lintong)	-10	-13	-14
OMH (Budapest)	7404	7424	7440
ONBA (Buenos Aires)	-598	-711	-744
ONRJ (Rio de Janeiro)	4971	4969	4984
OP (Paris)	0	-4	-9
ORB (Bruxelles)	37	28	24
PL (Warszawa)	-79	-88	-103
PTB (Braunschweig)	-10	-11	-12
ROA (San Fernando)	32	27	27
SCL (Hong Kong)	-7	3	15
SG (Singapore)	-45	-39	-50
SMU (Bratislava)	-7007	-7049	-7090
SP (Boras)	139	110	94
SU (Moskva)	25	20	22
TL (Chung-Li)	-33	-27	-30
TP (Praha)	-11	-14	-19
UME (Gebze-Kocaeli)	-695	-703	-711
USNO (Washington DC)(USNO MC)	-3	-4	-3
VSL (Delft)	-22	-16	-15

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		Sep 27	Oct 2	Oct 7	Oct 12
MJD		52544	52549	52554	52559
Laboratory *k*		[*TAI*-*TA*(*k*)]/ns			
AUS (Sydney)		-117263	-117344	-117434	-117521
CH (Bern)		24286	24468	24652	24828
CRL (Tokyo)		163484	163692	163887	164085
F (Paris)		168269	168294	168318	168337
IEN (Torino)		21773	21877	22003	22121
JATC (Lintong)		-25131	-25222	-25324	-25415
KRIS (Daejeon)		6069	6071	6072	6074
NIST (Boulder)		-45240329	-45240531	-45240734	-45240936
NRC (Ottawa)		28301	28316	28323	28332
NTSC (Lintong)		-117	-108	-104	-100
PL (Warszawa)		-888	-894	-901	-911
PTB (Braunschweig)		-359741	-359739	-359732	-359729
SU (Moskva)	(3)	27241023	27241022	27241021	27241022
USNO (Washington DC)		-34894752	-34895064	-34895375	-34895686

Date 2002 0h UTC		Oct 17	Oct 22	Oct 27
MJD		52564	52569	52574
Laboratory *k*		[*TAI*-*TA*(*k*)]/ns		
AUS (Sydney)		-117598	-117682	-117780
CH (Bern)		25000	25174	25353
CRL (Tokyo)		164286	164485	164681
F (Paris)		168359	168382	168402
IEN (Torino)		22240	22356	22467
JATC (Lintong)		-25510	-25604	-25708
KRIS (Daejeon)		6090	6093	6090
NIST (Boulder)		-45241138	-45241340	-45241542
NRC (Ottawa)		28343	28346	28353
NTSC (Lintong)		-98	-92	-89
PL (Warszawa)		-917	-927	-939
PTB (Braunschweig)		-359725	-359721	-359717
SU (Moskva)	(3)	27241025	27241020	27241022
USNO (Washington DC)		-34895997	-34896310	-34896619

3 - Notes on sections 1 and 2.

(1) NIMB. National Institute of Metrology, Bucharest, Romania.

(2) NMIJ. Time step of UTC(NMIJ) of 250ns on MJD = 52569.01

(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 Sep. 27 - 2002 Nov. 26	52544-52604	7.000×10^{-13}
New steering correction foreseen for December 2002		
2002 Nov. 26 - 2002 Dec. 31	52604-52639	6.990×10^{-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 $6.0\times10^{-15} / \sqrt{\tau}$,
a flicker frequency noise 0.6×10^{-15},
a random walk frequency noise $1.6\times10^{-16} \times \sqrt{\tau}$,

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	52544-52574	4.7	8.	T148	5.	0.	1.	(1)	9.
PTB CS2	52544-52574	7.8	12.	T148	3.	0.	1.	(1)	12.

Note:
(1) Continuously operating as a clock participating to TAI

The second table gives the BIPM estimate of d, based on measurements of CRL-O1, LPTF-JPO, NIST-F1,PTB CS1, PTB CS2 over the period MJD 52184-52574, 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
52544-52574	$+7.2\times10^{-15}$	2.4×10^{-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
Sep 27	52544	-14	3	0
Sep 28	52545	-11	3	1
Sep 29	52546	-9	3	0
Sep 30	52547	-7	4	1
Oct 1	52548	-7	3	1
Oct 2	52549	-4	3	1
Oct 3	52550	-3	3	0
Oct 4	52551	-5	4	1
Oct 5	52552	-3	3	1
Oct 6	52553	-6	3	1
Oct 7	52554	-10	3	0
Oct 8	52555	-10	3	0
Oct 9	52556	-6	3	0
Oct 10	52557	-6	3	0
Oct 11	52558	-6	4	1
Oct 12	52559	-10	3	0
Oct 13	52560	-11	3	1
Oct 14	52561	-14	4	1
Oct 15	52562	-17	4	1
Oct 16	52563	-16	4	1
Oct 17	52564	-13	4	1
Oct 18	52565	-14	4	1
Oct 19	52566	-12	4	1
Oct 20	52567	-10	3	1
Oct 21	52568	-8	4	1
Oct 22	52569	-11	3	1
Oct 23	52570	-13	4	1
Oct 24	52571	-11	4	1
Oct 25	52572	-6	4	1
Oct 26	52573	-2	-	-
Oct 27	52574	-5	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 0h UTC	MJD	C_1/ns	σ/ns	$(\sigma/\sqrt{N})$/ns
Sep 27	52544	-236	-	-
Sep 28	52545	-225	9	4
Sep 29	52546	-198	20	8
Sep 30	52547	-191	-	-
Oct 1	52548	-188	25	8
Oct 2	52549	-184	19	6
Oct 3	52550	-203	27	6
Oct 4	52551	-158	53	18
Oct 5	52552	-161	38	27
Oct 6	52553	-250	-	-
Oct 7	52554	-239	-	-
Oct 8	52555	-183	1	1
Oct 9	52556	-145	-	-
Oct 10	52557	-150	38	19
Oct 11	52558	-137	49	22
Oct 12	52559	-142	35	18
Oct 13	52560	-148	12	6
Oct 14	52561	-163	28	16
Oct 15	52562	-179	9	4
Oct 16	52563	-176	-	-
Oct 17	52564	-156	-	-
Oct 18	52565	-126	-	-
Oct 19	52566	-99	-	-
Oct 20	52567	-74	5	3
Oct 21	52568	-69	13	8
Oct 22	52569	-150	-	-
Oct 23	52570	-162	14	7
Oct 24	52571	-72	10	6
Oct 25	52572	-38	-	-
Oct 26	52573	-48	12	5
Oct 27	52574	-77	-	-