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BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 124 (1998 May 14)
Circulaire T 124

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

(From 1997 July 1, 0h UTC, *TAI-UTC* = 31 s)

Date 1998 0h UTC		Mar 27	Apr 1	Apr 6	Apr 11
MJD		50899	50904	50909	50914
Laboratory k		*UTC-UTC(k)* (Unit is one nanosecond)			
AOS (Borowiec)		-189	-118	-191	-270
APL (Laurel)		5686	5736	5781	5839
AUS (Canberra)		320	312	311	298
BEV (Wien)		-	-	2294	2433
BIRM (Beijing)		-9055	-9101	-9191	-9213
CAO (Cagliari)		-2462	-2478	-2503	-2508
CH (Bern)		61	39	23	3
CNM (Queretaro)		96	113	143	160
CRL (Tokyo)		-112	-113	-107	-108
CSAO (Lintong)		-60	-29	-41	-35
CSIR (Pretoria)		-3542	-3626	-3708	-3785
DLR (Oberpfaffenhofen)		-2607	-2653	-	-2636
DTAG (Darmstadt)		-110	-101	-76	-78
GUM (Warszawa)		999	1008	1017	1013
IEN (Torino)		27	24	11	-4
IFAG (Wettzell)		-2185	-2216	-2225	-2186
IGMA (Buenos Aires)		113	134	136	131
INPL (Jerusalem)		-252	-284	-310	-332
IPQ (Monte de Caparica)		246	263	276	288
JATC (Lintong)		3378	3413	3404	3414
KRIS (Taejon)		150	174	173	181
LDS (Leeds)		176	193	186	187
MSL (Lower Hutt)		-5205	-	-	-
NAO (Mizusawa)	(1)	1122	1185	1251	1304
NIM (Beijing)		-2677	-2701	-2756	-2760
NIST (Boulder)		25	27	25	25
NML (Sydney)		1122	1136	1149	1157
NPL (Teddington)		88	88	91	91
NRC (Ottawa)		20	14	2	16
NRLM (Tsukuba)		437	439	453	460
OMH (Budapest)		1698	1725	1739	1767
ONBA (Buenos Aires)		3324	3490	3795	4170
ONRJ (Rio de Janeiro)		564	567	595	608
OP (Paris)		15	15	12	14
ORB (Bruxelles)		242	241	250	254
PSB (Singapore)		201	234	265	290
PTB (Braunschweig)		52	56	59	64
ROA (San Fernando)		8	10	5	-5
SCL (Hong Kong)		-159	-121	-110	-99
SO (Shanghai)		746	751	721	720
SP (Boras)	(2)	726	723	724	722
SU (Moskva)		263	259	252	251
TL (Chung-Li)		342	332	331	329
TP (Praha)		213	217	216	224
TUG (Graz)	(3)	4879	-4065	-4016	-3958
UME (Gebze-Kocaeli)		1143	1153	1158	1165
USNO (Washington DC)(USNO MC)		18	20	21	24
VSL (Delft)		-6	9	19	25

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1 - Coordinated Universal Time UTC. (Cont.)

Date 1998 0h UTC		Apr 16	Apr 21	Apr 26
MJD		50919	50924	50929
Laboratory k		*UTC-UTC(k)*	(Unit is one nanosecond)	
AOS (Borowiec)		-346	-443	-526
APL (Laurel)	(4)	5892	5938	4941
AUS (Canberra)		324	323	332
BEV (Wien)		2562	2695	2822
BIRM (Beijing)		-9316	-9381	-9371
CAO (Cagliari)		-2527	-2559	-2581
CH (Bern)		-23	-43	-60
CNM (Queretaro)		187	199	221
CRL (Tokyo)		-103	-102	-103
CSAO (Lintong)		-29	-13	-25
CSIR (Pretoria)		-3860	-3930	-4026
DLR (Oberpfaffenhofen)		-2684	-2734	-2778
DTAG (Darmstadt)		-68	-50	-40
GUM (Warszawa)		1013	1010	1002
IEN (Torino)		-12	-32	-59
IFAG (Wettzell)		-2191	-2202	-2218
IGMA (Buenos Aires)		135	139	147
INPL (Jerusalem)		-368	-398	-430
IPQ (Monte de Caparica)		315	343	360
JATC (Lintong)		3418	3438	3430
KRIS (Taejon)		226	246	258
LDS (Leeds)		201	211	211
MSL (Lower Hutt)		-	-	-
NAO (Mizusawa)	(1)	1734	1711	1692
NIM (Beijing)		-2774	-2778	-2822
NIST (Boulder)		26	25	27
NML (Sydney)		1192	1212	1227
NPL (Teddington)		94	93	92
NRC (Ottawa)		15	18	17
NRLM (Tsukuba)		468	477	482
OMH (Budapest)		1780	1787	1808
ONBA (Buenos Aires)		4570	4980	5364
ONRJ (Rio de Janeiro)		630	642	659
OP (Paris)		13	11	12
ORB (Bruxelles)		293	309	287
PSB (Singapore)		312	333	357
PTB (Braunschweig)		74	78	86
ROA (San Fernando)		-9	-9	-11
SCL (Hong Kong)		-84	-65	-46
SO (Shanghai)		708	727	733
SP (Boras)		723	724	727
SU (Moskva)		246	246	247
TL (Chung-Li)		324	323	321
TP (Praha)		234	234	249
TUG (Graz)		-3911	-3857	-3818
UME (Gebze-Kocaeli)		1168	1178	1185
USNO (Washington DC)(USNO MC)		24	25	25
VSL (Delft)		37	48	61

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

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

Date 1998 0h UTC		Mar 27	Apr 1	Apr 6	Apr 11
MJD		50899	50904	50909	50914
Laboratory k		*TAI-TA(k)* (Unit is one nanosecond)			
AMC (Col. Springs)		-365219	-365212	-365215	-365217
APL (Laurel)		7149	7199	7244	7302
AUS (Canberra)		-84767	-84883	-84985	-85063
CH (Bern)		-36509	-36340	-36165	-35994
CRL (Tokyo)		97879	98088	98304	98512
CSAO (Lintong)		-2063	-2082	-2144	-2188
F (Paris)		162688	162685	162682	162677
IEN (Torino)		6024	6069	6142	6212
INPL (Jerusalem)		-252	-284	-310	-332
JATC (Lintong)		9591	9612	9526	9451
KRIS (Taejon)		5730	5770	5789	5810
NIST (Boulder)		-45173842	-45174053	-45174265	-45174475
NML (Sydney)		1160	1174	1187	1195
NRC (Ottawa)		27004	26996	26985	26999
PTB (Braunschweig)		-361448	-361444	-361438	-361431
SU (Moskva)	(5)	27241263	27241259	27241252	27241251
USNO (Washington DC)		-34791668	-34791982	-34792296	-34792609

Date 1998 0h UTC		Apr 16	Apr 21	Apr 26
MJD		50919	50924	50929
Laboratory k		*TAI-TA(k)* (Unit is one nanosecond)		
AMC (Col. Springs)		-365222	-365226	-365231
APL (Laurel)		7355	7401	-
AUS (Canberra)		-85162	-85276	-85383
CH (Bern)		-35828	-35657	-35483
CRL (Tokyo)		98728	98940	99147
CSAO (Lintong)		-2232	-2266	-2328
F (Paris)		162675	162671	162667
IEN (Torino)		6274	6336	6389
INPL (Jerusalem)		-368	-398	-430
JATC (Lintong)		9378	9326	9250
KRIS (Taejon)		5868	5903	5933
NIST (Boulder)		-45174684	-45174895	-45175103
NML (Sydney)		1230	1250	1265
NRC (Ottawa)		26998	27001	27000
PTB (Braunschweig)		-361418	-361412	-361402
SU (Moskva)	(5)	27241246	27241246	27241247
USNO (Washington DC)		-34792923	-34793237	-34793551

3 - Notes on sections 1 and 2.

(1) NAO . Apparent time step of *UTC-UTC(NAO)* of + 400 ns between MJD = 50914 and MJD = 50919.

(2) SP . Erratum. MJD = 50889 *UTC-UTC(SP)* = 679 ns.
Apparent time step of *UTC-UTC(SP)* of + 43 ns between MJD = 50889 and MJD = 50894 due to GPS link calibration.

(3) TUG . Time step of UTC(TUG) of + 9000 ns on MJD = 50903.5

(4) APL . Apparent time step of *UTC-UTC(APL)* of -1050 ns between MJD = 50924 and MJD = 50929.

(5) 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)*
1998 Mar. 27 - 1998 Apr. 26	50899-50929	7.130×10^{-13}
No new steering correction foreseen for May 1998 and June 1998		
1998 Apr. 26 - 1998 June 30	50929-50994	7.130×10^{-13}

5 - Duration of the TAI scale interval.

The following table gives the duration u_{TAI} of the TAI scale interval expressed as its relative departure d from the SI second on the rotating geoid, u_0, together with its uncertainty σ : $d = (u_{TAI}-u_0)/u_0$. This is obtained, on the given period of estimation, by comparison of the TAI frequency :

- with the frequency of a given individual primary frequency standard (σ is then the last communicated estimate of the type B uncertainty of the standard), and

- with a combination computed by the BIPM of measurements from LPTF-F01, NIST-7, *NRLM-4, PTB CS2 and PTB CS3 (σ is then estimated by the BIPM taking into account the individual uncertainties and parameters characteristic of TAI stability).

Standard	Period of estimation	d (10^{-14})	σ (10^{-14})
*NRLM-4	50869-50874	-2.4	2.9
NRLM-4	50889-50894	-0.3	2.9
PTB-CS2	50899-50929	-0.1	1.5
PTB-CS3	50899-50929	0.5	1.4
BIPM estimate	50869-50929	+0.2	1.0

*NRLM-4 : primary frequency standard using optical pumping developed at the NRLM.

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

[*UTC-GPS time*] = -12 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 1998 0h UTC	MJD	C_0 (ns)	σ (ns)	$\sigma/\sqrt{N}$ (ns)
Mar 27	50899	16	49	12
Mar 28	50900	11	34	6
Mar 29	50901	9	39	7
Mar 30	50902	23	51	23
Mar 31	50903	27	47	7
Apr 1	50904	16	52	8
Apr 2	50905	11	40	6
Apr 3	50906	14	48	7
Apr 4	50907	17	40	6
Apr 5	50908	18	46	7
Apr 6	50909	16	47	7
Apr 7	50910	17	46	7
Apr 8	50911	17	47	7
Apr 9	50912	12	45	7
Apr 10	50913	7	37	6
Apr 11	50914	9	66	10
Apr 12	50915	14	34	5
Apr 13	50916	20	44	7
Apr 14	50917	22	49	7
Apr 15	50918	20	47	7
Apr 16	50919	18	46	7
Apr 17	50920	21	44	7
Apr 18	50921	22	44	7
Apr 19	50922	19	49	7
Apr 20	50923	15	43	6
Apr 21	50924	17	45	7
Apr 22	50925	20	42	6
Apr 23	50926	19	49	7
Apr 24	50927	15	36	5
Apr 25	50928	16	48	7
Apr 26	50929	23	48	7

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

[*UTC-GLONASS time*] = 0 s + C_1, [*TAI-GLONASS time*] = +31 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)*]. A time correction of + 1285 ns is also applied in order to ensure continuity of C_1 estimates on 1997, January 1 (MJD = 50449). 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 1998 0h UTC	MJD	C_1 (ns)	σ (ns)	$\sigma/\sqrt{N}$ (ns)
Mar 27	50899	386	16	3
Mar 28	50900	394	19	3
Mar 29	50901	398	19	4
Mar 30	50902	387	21	6
Mar 31	50903	377	15	3
Apr 1	50904	377	23	5
Apr 2	50905	376	17	3
Apr 3	50906	360	18	5
Apr 4	50907	334	17	4
Apr 5	50908	328	21	4
Apr 6	50909	331	12	3
Apr 7	50910	340	29	6
Apr 8	50911	352	28	6
Apr 9	50912	338	18	4
Apr 10	50913	314	31	10
Apr 11	50914	319	24	6
Apr 12	50915	330	16	3
Apr 13	50916	335	27	7
Apr 14	50917	334	23	6
Apr 15	50918	325	16	3
Apr 16	50919	313	16	3
Apr 17	50920	310	18	3
Apr 18	50921	310	17	3
Apr 19	50922	310	18	4
Apr 20	50923	309	22	4
Apr 21	50924	310	20	3
Apr 22	50925	310	17	3
Apr 23	50926	309	22	3
Apr 24	50927	311	22	4
Apr 25	50928	311	21	4
Apr 26	50929	311	21	3