

BIPM

BUREAU INTERNATIONAL DES POIDS ET MESURES

Circular T 21 (1989 November 2)

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

(From 1988 January 1, 0h UTC, to 1990 January 1, 0h UTC, TAI-UTC = 24s)
 (From 1990 January 1, 0h UTC, until further notice, TAI-UTC = 25s)

Date 1989 (0h UTC)	AUG 31	SEP 10	SEP 20	SEP 30
MJD	47769	47779	47789	47799
Laboratory k	UTC-UTC(k) (Unit = 1 microsecond)			
	(1)			
AOS (Borowiec) (2)	16.13	17.36	-11.56	-11.38
APL (Laurel)	-2.03	-2.12	-2.05	-
ASMW (Berlin)	-0.19	0.00	0.19	0.15
AUS (Canberra)	-0.97	-0.98	-0.98	-0.96
BEV (Wien)	-4.16	-5.01	-6.28	-7.34
CAO (Cagliari)	9.80	9.81	9.94	10.12
CH (Berne)	-0.29	-0.39	-0.47	-0.55
CRL (Tokyo)	-1.15	-1.07	-1.04	-1.02
CSAO (Shaanxi)	-1.06	-1.25	-1.36	-1.39
DPT (Pretoria)	-14.87	-14.99	-15.12	-15.26
FTZ (Darmstadt)	16.83	16.76	16.74	16.69
IEN (Torino)	0.38	0.35	0.30	0.26
IFAG (Wetzell)	-2.04	-1.76	-1.52	-1.21
INPL (Jerusalem)	131.19	132.47	133.80	135.11
JATC (Xian)	-5.56	-5.98	-6.34	-6.70
KSRI (Taejon)	-9.62	-9.47	-9.40	-9.32
NAOM (Mizusawa)	-35.17	-35.10	-35.02	-35.10
NIM (Beijing)	10.09	10.34	10.44	10.18
NIST (Boulder)	-0.32	-0.28	-0.24	-0.22
NPL (Teddington)	-1.02	-1.10	-1.23	-1.32
NPLI (New-Delhi)	-14.44	-14.61	-14.80	-14.96
NRC (Ottawa)	-14.75	-14.91	-15.07	-15.21
NRLM (Tsukuba)	-43.41	-43.87	-44.34	-44.80
OMH (Budapest)	-9.15	-9.57	-9.52	-9.57
ONRJ (Rio de Janeiro)	12.63	11.83	11.63	11.71
OP (Paris)	-0.85	-0.74	-0.64	-0.53
ORB (Bruxelles)	1.87	2.14	2.39	2.58
PEL (Lower Hutt)	1.63	1.54	1.54	1.61
PKNM (Warsaw)	2.82	2.63	2.15	1.54
PTB (Braunschweig)	4.02	4.01	3.97	3.93
ROA (San Fernando)	8.70	8.78	8.88	8.95
SO (Shanghai)	2.68	2.68	2.78	2.86
STA (Stockholm)	0.21	0.04	-0.08	-0.07
SU (Moscow) (3)	-	-	-	-
TAO (Tokyo)	-3.96	-4.04	-4.15	-4.23
TL (Taiwan)	2.37	2.27	2.20	2.12
TP (Praha)	-0.81	-0.84	-0.60	-0.58
TUG (Graz)	1.78	2.01	2.23	2.47
USNO (Washington) (USNO MC)	-0.97	-0.98	-0.98	-0.96
VSL (Delft)	1.69	1.75	1.82	1.89
YUZM (Beograd)	18.75	19.24	19.96	20.41
ZIPE (Potsdam)	-0.02	0.03	0.12	0.02

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

Computed values of TAI-TA(k)

Date 1989 (0h UTC)	AUG 31	SEP 10	SEP 20	SEP 30
MJD	47769	47779	47789	47799
Laboratory k	TAI-TA(k) (Unit = 1 microsecond)			
APL (Laurel)	-1.63	-1.72	-1.65	-
AUS (Canberra)	-22.84	-23.09	-23.31	-23.58
CH (Berne)	-59.57	-59.84	-60.11	-60.36
CRL (Tokyo)	-2.46	-2.38	-2.34	-2.30
CSAO (Shaanxi)	37.92	37.74	37.62	37.60
DDR (Berlin)	-28.55	-28.58	-28.58	-28.71
F (Paris)	72.87	73.18	73.49	73.79
JATC (Xian)	-1.28	-1.25	-1.27	-1.26
NIM (Beijing)	-9.48	-9.38	-9.32	-9.49
NISA (Boulder) (4)	-45058.95	-45059.19	-45059.43	-45059.68
NIST (Boulder)	-45129.81	-45130.25	-45130.69	-45131.17
NRC (Ottawa)	16.32	16.16	16.00	15.86
PTB (Braunschweig)	-359.38	-359.39	-359.43	-359.47
SO (Shanghai)	-44.60	-44.61	-44.53	-44.47
SU (Moscow) (3)	-	-	-	-
USNO (Washington) (5)	-34585.08	-34585.66	-34586.24	-34586.77

(1)

3 - NOTES ON SECTIONS 1 AND 2

(1) No GPS time links available for MJD 47798 to 47801.
The computations of UTC and TAI have been made with interpolated values.

(2) AOS . Time step of UTC(AOS) of +30000 ns on MJD = 47787.

(3) SU	MJD	UTC-UTC(SU)	TAI-TA(SU)
	47679	14.52	2827264.52
	47689	14.50	2827264.50
	47699	14.29	2827264.29

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

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

4 - UTC-GPS TIME and TAI-GPS TIME

UTC-GPS TIME = -5 seconds + Co ; TAI-GPS TIME = 19 seconds + Co.

Co is obtained from measurements made at Paris Observatory, 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.

Date 1989	MJD	Co (ns) 0hUTC	DC(ns)						
			PRN11 NAV 8 20h 0m	PRN14 NAV14 22h24m	PRN 6 NAV 3 2h12m	PRN 9 NAV 6 3h32m	PRN12 NAV10 6h28m	PRN13 NAV 9 7h32m	PRN 3 NAV11 8h52m
AUG 31	47769	-1268	15	-16	2	11	-18	6	-4
SEP 1	47770	-1266	-4	-3	-7	12	-19	-6	-2
SEP 2	47771	-1268	5	-7	7	0	17	18	9
SEP 3	47772	-1268	-	-6	-	-	-	-	-
SEP 4	47773	-1267	13	1	-1	-9	7	-2	0
SEP 5	47774	-1264	7	7	-3	-8	-1	-10	-1
SEP 6	47775	-1261	23	-15	1	0	-4	2	-1
SEP 7	47776	-1258	19	-1	-3	-6	-6	-21	-11
SEP 8	47777	-1254	-12	-1	11	0	0	-1	-1
SEP 9	47778	-1252	22	21	-8	-25	12	-3	-2
SEP 10	47779	-1251	17	-	2	-8	-20	-5	-4
SEP 11	47780	-1251	-4	-	5	0	4	-5	1
SEP 12	47781	-1252	4	-	8	4	-9	-11	0
SEP 13	47782	-1251	12	-	4	-3	-8	-27	2
SEP 14	47783	-1246	6	-	-4	6	-9	-21	-45
SEP 15	47784	-1241	6	-	1	-1	9	-4	15
SEP 16	47785	-1237	-7	-	-4	1	-3	-28	-6
SEP 17	47786	-1234	4	-	2	-2	6	-8	10
SEP 18	47787	-1228	1	-	28	6	4	-12	1
SEP 19	47788	-1225	8	-	3	4	-2	-5	-2
SEP 20	47789	-1225	5	-	-2	2	6	-28	-12
SEP 21	47790	-1222	6	-	4	7	-10	-8	-6
SEP 22	47791	-1218	8	-	3	9	5	-12	-3
SEP 23	47792	-1215	9	-	-7	6	-3	-8	1
SEP 24	47793	-1212	5	-	-6	5	-30	4	-6
SEP 25	47794	-1212	8	-	-1	5	6	-10	-1
SEP 26	47795	-1216	11	-	-5	3	3	-10	-1
SEP 27	47796	-1224	1	-	-2	1	-18	4	-5
SEP 28	47797	-1234	5	-	1	8	2	-7	2
SEP 29	47798	-1243	-	-	-	-	-	-	-
SEP 30	47799	-1250	-	-	-	-	-	-	-

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

D and its standard deviation s are expressed in $1 \cdot 10^{-14}$ 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	47729-47799	+36.1	10.0
PTB-CS1	47729-47799	+3.4	3.0
PTB-CS2	47729-47799	+5.6	1.5
BIPM estimate	47729-47799	+5	2