# BIPM

BUREAU INTERNATIONAL DES POIDS ET MESURES
Circular T 67 (1993 August 26)

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

(From 1992 July 1, 0hUTC, to 1993 July 1, 0hUTC, TAI-UTC = 27 s)
(From 1993 July 1, 0hUTC, until further notice, TAI-UTC = 28 s)

| Date 1993  0hUTC<br>MJD<br>Laboratory k | | Jun 21<br>49159 | Jul 1<br>49169 | Jul 11<br>49179<br>UTC-UTC(k) (Unit = 1 microsecond) | Jul 21<br>49189 | Jul 31<br>49199 |
|---|---|---|---|---|---|---|
| AOS | (Borowiec) | -0.748 | -0.815 | -0.897 | -1.143 | -1.436 |
| APL | (Laurel) | 0.261 | 0.279 | 0.256 | 0.228 | 0.178 |
| AUS | (Canberra) | -0.076 | -0.082 | -0.099 | -0.104 | -0.114 |
| BEV | (Wien) | 1.75 | 0.81 | -0.21 | -1.30 | - |
| CAO | (Cagliari) (2) | -32.917 | -33.240 | -0.365 | -0.683 | -0.992 |
| CH | (Bern) | 0.044 | 0.106 | 0.144 | 0.207 | 0.262 |
| CRL | (Tokyo) | 2.595 | 2.576 | 2.598 | 2.611 | 2.604 |
| CSAO | (Lintong) | -0.597 | -0.623 | -0.647 | -0.706 | -0.781 |
| CSIR | (Pretoria) (3) | -17.109 | -4.076 | -4.130 | -4.162 | -4.138 |
| FTZ | (Darmstadt) | 0.295 | 0.457 | 0.522 | 0.644 | 0.756 |
| IEN | (Torino) | -0.358 | -0.323 | -0.308 | -0.274 | -0.260 |
| IFAG | (Wettzell) | 3.895 | 4.167 | 4.434 | 4.620 | 4.650 |
| IGMA | (Buenos Aires) | -0.08 | -0.12 | -0.17 | -0.22 | -0.29 |
| INPL | (Jerusalem) | -0.299 | -0.114 | 0.081 | 0.257 | 0.399 |
| JATC | (Lintong) | -0.656 | -0.829 | -0.680 | -0.697 | -0.669 |
| KRIS | (Taejon) | -0.598 | -0.566 | -0.528 | -0.530 | -0.561 |
| LDS | (Leeds) | -21.866 | -22.822 | -23.684 | -24.715 | - |
| MSL | (Lower Hutt) | -3.393 | -3.623 | -3.878 | -3.925 | -3.969 |
| NAOM | (Mizusawa) | -1.339 | -1.423 | -1.464 | -1.518 | -1.597 |
| NAOT | (Tokyo) | -2.817 | -2.997 | -3.117 | -3.276 | -3.456 |
| NIM | (Beijing) | 7.44 | 7.36 | 7.40 | 7.38 | 7.46 |
| NIST | (Boulder) | 0.008 | 0.002 | -0.027 | -0.045 | -0.071 |
| NMC | (Sofiya) | - | - | - | - | - |
| NPL | (Teddington) | 0.214 | 0.188 | 0.161 | 0.145 | 0.114 |
| NPLI | (New-Delhi) | -5.541 | -5.555 | -5.564 | -5.363 | -5.239 |
| NRC | (Ottawa) | 2.752 | 2.855 | 2.948 | 3.019 | 3.085 |
| NRLM | (Tsukuba) | -1.794 | -2.067 | -2.300 | -2.560 | -2.830 |
| OMH | (Budapest) | - | 3.964 | 3.975 | 4.000 | 4.050 |
| ONBA | (Buenos Aires) | -87.99 | -88.60 | -90.22 | -91.35 | -92.87 |
| ONRJ | (Rio de Janeiro) | -4.213 | -4.794 | -5.339 | -5.779 | -6.204 |
| OP | (Paris) | -0.223 | -0.166 | -0.172 | -0.178 | -0.196 |
| ORB | (Bruxelles) | -0.988 | -1.052 | -1.234 | -1.367 | -1.454 |
| PKNM | (Warszawa) | 0.492 | 0.458 | 0.272 | 0.136 | 0.196 |
| PTB | (Braunschweig) | 2.853 | 2.852 | 2.836 | 2.844 | 2.843 |
| RC | (Habana) | -3.56 | - | - | - | - |
| ROA | (San Fernando) | 2.728 | 2.728 | 2.728 | 2.738 | 2.749 |
| SCL | (Hong Kong) | -0.078 | -0.153 | -0.311 | -0.485 | -0.710 |
| SNT | (Stockholm) | 0.334 | 0.230 | 0.096 | 0.090 | 0.376 |
| SO | (Shanghai) | 2.37 | 2.17 | 2.04 | 2.02 | 2.12 |
| SU | (Moskva) | -0.733 | -0.825 | -0.930 | -1.023 | -1.130 |
| TL | (Chung-Li) | -0.624 | -0.755 | -0.783 | -0.853 | -0.986 |
| TP | (Praha) | -0.932 | -0.903 | -0.877 | -0.872 | -0.895 |
| TUG | (Graz) | 1.529 | 1.568 | 1.569 | 1.607 | 1.617 |
| USNO | (Washington DC)(USNO MC) | -0.076 | -0.082 | -0.099 | -0.104 | -0.114 |
| VSL | (Delft) | 0.449 | 0.525 | 0.566 | 0.730 | 0.837 |

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

The following table gives the computed  values of TAI-TA(k) (1).

| Date 1993  0hUTC<br>MJD<br>Laboratory k | | Jun 21<br>49159 | Jul  1<br>49169<br>TAI-TA(k) | Jul 11<br>49179<br>(Unit = 1 | Jul 21<br>49189<br>microsecond) | Jul 31<br>49199 |
|---|---|---|---|---|---|---|
| APL | (Laurel) | 1.724 | 1.742 | 1.719 | 1.691 | 1.641 |
| AUS | (Canberra) | -46.342 | -46.441 | -46.541 | -46.700 | -46.918 |
| CH | (Bern) | -76.291 | -76.320 | -76.370 | -76.395 | -76.431 |
| CRL | (Tokyo) | 25.290 | 25.645 | 26.052 | 26.439 | 26.811 |
| CSAO | (Lintong) | 19.106 | 18.994 | 18.884 | 18.738 | 18.577 |
| F | (Paris) | 117.260 | 117.647 | 118.012 | 118.390 | 118.745 |
| INPL | (Jerusalem) | -144.302 | -145.994 | -147.663 | -149.338 | -151.030 |
| JATC | (Lintong) | 8.824 | 8.230 | 8.115 | 8.040 | 8.111 |
| KRIS | (Taejon) | -4.428 | -4.766 | -5.028 | -5.320 | -5.621 |
| NIM | (Beijing) | -9.60 | -9.66 | -9.60 | -9.60 | -9.50 |
| NISA | (Boulder)    (4)(5) | -100.687 | -101.043 | -101.417 | -101.780 | -102.151 |
| NIST | (Boulder)       (5) | -214.851 | -215.472 | -216.109 | -216.735 | -217.368 |
| NRC | (Ottawa) | 18.821 | 18.924 | 19.017 | 19.088 | 19.154 |
| PTB | (Braunschweig) | -360.547 | -360.548 | -360.564 | -360.556 | -360.557 |
| RC | (Habana)       (6) | -321.43 | - | - | - | - |
| SO | (Shanghai) | -45.21 | -45.39 | -45.52 | -45.52 | -45.44 |
| SU | (Moskva)       (7) | 27249.267 | 27249.175 | 27249.070 | 27248.977 | 27248.870 |
| USNO | (Washington DC) (8) | -676.729 | -677.406 | -678.095 | -678.777 | -679.469 |

3 - Notes on sections 1 and 2.

(1) Values UTC-UTC(k) and TAI-TA(k) are published within 1 ns except
    for laboratories which are not linked through GPS common views.

(2) CAO . Time step of UTC(CAO) of -33.0 μs on MJD = 49170.31

(3) CSIR. Time step of UTC(CSIR) of -13.0 μs on MJD = 49163.28

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

(5) NISA and NIST. Listed values are TAI-TA(k) + 45 microseconds.

(6) RC  . Listed values are TAI-TA(RC) - 18 seconds.

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

(8) TA(USNO) designates the scale A1(MEAN) of USNO. Listed values are
    TAI-TA(USNO) + 33 microseconds.

4 - UTC - GPS time and TAI - GPS time.

UTC - GPS time = -8 s + CO (until 1993 July 1, 0hUTC)
UTC - GPS time = -9 s + CO (from  1993 July 1, 0hUTC)
TAI - GPS time = 19 s + CO.

Daily values of CO are given in the following table. They are obtained as follows: the GPS data taken at the Paris Observatory, from Block I only, are first corrected for the measured ionospheric delays, and then smoothed to obtain daily values of UTC(OP) - GPS time at 0hUTC; daily values of CO are derived from them using linear interpolation of UTC - UTC(OP).
This procedure also allows the computation of daily standard deviations obtained from Block I and Block II data as observed at Paris Observatory according to the International GPS Common-View Schedule, and after correction for the measured ionospheric delays. They are given in the following table in order to show the quality of the dissemination of GPS time from Block I and Block II satellites.

| Date 1993 0hUTC | MJD | CO (ns) | SD(ns) Block I | Block II |
|---|---|---|---|---|
| Jun 21 | 49159 | 73 | 4 | 51 |
| Jun 22 | 49160 | 63 | 6 | 42 |
| Jun 23 | 49161 | 55 | 3 | 34 |
| Jun 24 | 49162 | 49 | 7 | 57 |
| Jun 25 | 49163 | 44 | 9 | 37 |
| Jun 26 | 49164 | 42 | 12 | 54 |
| Jun 27 | 49165 | 29 | 11 | 42 |
| Jun 28 | 49166 | 14 | 7 | 31 |
| Jun 29 | 49167 | -5 | 1 | 29 |
| Jun 30 | 49168 | -20 | 10 | 35 |
| Jul 1 | 49169 | -26 | 11 | 44 |
| Jul 2 | 49170 | -40 | 8 | 64 |
| Jul 3 | 49171 | -57 | 7 | 29 |
| Jul 4 | 49172 | -73 | 6 | 53 |
| Jul 5 | 49173 | -83 | 5 | 48 |
| Jul 6 | 49174 | -91 | 17 | 59 |
| Jul 7 | 49175 | -102 | 20 | 36 |
| Jul 8 | 49176 | -111 | 13 | 47 |
| Jul 9 | 49177 | -116 | 18 | 42 |
| Jul 10 | 49178 | -123 | 14 | 32 |
| Jul 11 | 49179 | -133 | 16 | 38 |
| Jul 12 | 49180 | -137 | 11 | 40 |
| Jul 13 | 49181 | -133 | 20 | 39 |
| Jul 14 | 49182 | -135 | 17 | 52 |
| Jul 15 | 49183 | -142 | 6 | 34 |
| Jul 16 | 49184 | -147 | 13 | 49 |
| Jul 17 | 49185 | -144 | 15 | 24 |
| Jul 18 | 49186 | -137 | 14 | 39 |
| Jul 19 | 49187 | -132 | 15 | 55 |
| Jul 20 | 49188 | -120 | 15 | 39 |
| Jul 21 | 49189 | -108 | 16 | 47 |
| Jul 22 | 49190 | -98 | 12 | 54 |
| Jul 23 | 49191 | -92 | 17 | 27 |
| Jul 24 | 49192 | -87 | 9 | 42 |
| Jul 25 | 49193 | -81 | 10 | 60 |
| Jul 26 | 49194 | -73 | 13 | 57 |
| Jul 27 | 49195 | -67 | - | - |
| Jul 28 | 49196 | -68 | - | - |
| Jul 29 | 49197 | -76 | 11 | 48 |
| Jul 30 | 49198 | -88 | 8 | 31 |
| Jul 31 | 49199 | -92 | 4 | 55 |

5 - UTC - GLONASS time.

UTC - GLONASS time = C1 (modulo 1 s).

From his current observations of both the GPS and GLONASS satellite systems Prof. P. Daly, University of Leeds, establishes and reports GPS time - GLONASS time at ten-day intervals, together with the standard deviation SD of his daily GLONASS data. C1 is then derived using UTC - GPS time of section 4.

| Date 1993 0hUTC | MJD | C1 (µs) | SD (µs) |
|---|---|---|---|
| Jun 21 | 49159 | -14.81 | 0.04 |
| Jul 1 | 49169 | -14.88 | 0.05 |
| Jul 11 | 49179 | -14.98 | 0.04 |
| Jul 21 | 49189 | -15.01 | 0.15 |
| Jul 31 | 49199 | -15.11 | 0.05 |

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

| Interval of validity | | f(EAL)-f(TAI) |
|---|---|---|
| 1993 Apr. 22 - 1993 Jul. 31 | 49099-49199 | $7.40 \times 10^{-13}$ |

7 - Duration of the TAI scale interval.

The following table gives the departure D of the duration of the TAI scale interval from the SI second on the rotating geoid as realized by a given primary standard occasionally evaluated or continuously operating as a clock. In the later case the chosen two-month period of observation is also indicated. The last communicated estimate of the inaccuracy of the standard provides the uncertainty $\sigma$ of the D value.

D and $\sigma$ are expressed in units of $10^{-14}$ second.

| Standard | Obs. period | D | $\sigma$ |
|---|---|---|---|
| PTB-CS1 | 49129-49199 | -0.7 | 3.0 |
| PTB-CS2 | 49129-49199 | +0.8 | 1.5 |

The estimate of the duration of the TAI scale interval, computed by the BIPM, from all the available measurements of the TAI frequency, obtained by comparison with primary frequency standards continuously observed or occasionally evaluated (CRL, LPTF, NIST, NRC, PTB, SU), is:

$$1 + 0 \times 10^{-14} \pm 2 \times 10^{-14}$$

in SI second on the rotating geoid, for the two-month interval 49129-49199 .