

BUREAU INTERNATIONAL DES POIDS ET MESURES
ORGANISATION INTERGOUVERNEMENTALE DE LA CONVENTION DU METRE
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1 - Coordinated Universal Time UTC and its local realizations UTC(k). Computed values of $[UTC-UTC(k)]$ and uncertainties valid for the period of this Circular.
From 2012 July 1, 0h UTC, TAI-UTC = 35 s. From 2015 July 1, 0h UTC, TAI-UTC = 36 s.

| Date 2015 | 0h UTC | APR 27 | MAY 2 | MAY 7 | MAY 12 | MAY 17 | MAY 22 | MAY 27 | Uncertainty/ns Notes | | |
|-------------------------|--------|-------------------|---------|---------|---------|---------|---------|---------|----------------------|-------|---------|
| MJD | | 57139 | 57144 | 57149 | 57154 | 57159 | 57164 | 57169 | u_A | u_B | u |
| Laboratory k | | $[UTC-UTC(k)]/ns$ | | | | | | | | | |
| AOS (Borowiec) | | -3.0 | -3.5 | -2.8 | -2.1 | -1.0 | 0.8 | 1.7 | 0.3 | 5.1 | 5.1 |
| APL (Laurel) | | -4.2 | -3.8 | 2.6 | 3.6 | 4.2 | 5.3 | 6.4 | 0.3 | 4.9 | 4.9 |
| AUS (Sydney) | | -634.8 | -648.3 | -669.8 | -686.1 | -703.9 | -726.5 | -740.9 | 0.3 | 5.0 | 5.1 |
| BEV (Wien) | | -26.4 | -25.3 | -28.1 | -24.7 | -27.6 | -34.3 | -36.5 | 0.3 | 3.1 | 3.1 |
| BIM (Sofiya) | | 2286.5 | 2298.5 | 2295.6 | 2342.0 | 2351.2 | 2354.9 | 2362.1 | 1.5 | 7.0 | 7.2 |
| BIRM (Beijing) | | -46.8 | -56.9 | -67.4 | -76.0 | -83.2 | -86.1 | -100.0 | 1.5 | 20.0 | 20.1 |
| BY (Minsk) | | 3.7 | 4.3 | 3.8 | 5.5 | 5.2 | 4.9 | 5.7 | 1.5 | 7.0 | 7.2 |
| CAO (Cagliari) | | -5026.1 | -5137.9 | -5244.0 | -5340.6 | -5445.9 | -5555.5 | -5661.6 | 8.0 | 7.0 | 10.7 |
| CH (Bern-Wabern) | | -6.5 | -6.7 | -6.2 | -5.2 | -3.8 | -2.3 | 0.0 | 0.3 | 1.3 | 1.3 |
| CNM (Queretaro) | | 4.4 | 9.3 | 13.3 | 8.2 | 8.9 | 8.6 | 8.8 | 3.0 | 5.1 | 5.9 |
| CNMP (Panama) | | 15.1 | 14.4 | -10.7 | -18.5 | -37.9 | -43.8 | -44.4 | 3.5 | 5.1 | 6.2 |
| DFNT (Tunis) | | 8160.1 | 8349.9 | 8532.7 | 8734.7 | 8917.0 | 9105.3 | 9312.2 | 0.3 | 20.0 | 20.0 |
| DMDM (Belgrade) | | -13.6 | -15.7 | -8.7 | 0.7 | -3.6 | 4.2 | 7.9 | 0.3 | 7.0 | 7.0 |
| DTAG (Frankfurt/M) | | 28.7 | 27.1 | 27.4 | 21.3 | 24.6 | 24.8 | 28.9 | 0.3 | 9.9 | 9.9 |
| EIM (Thessaloniki) | | 13.8 | 14.5 | 16.4 | 13.6 | 13.4 | 14.8 | 7.1 | 7.5 | 5.1 | 9.0 |
| ESTC (Noordwijk) | | -1.2 | -1.7 | -3.0 | -3.4 | -1.8 | -1.1 | -1.6 | 0.3 | 5.1 | 5.1 |
| HKO (Hong Kong) | | 1915.2 | 1941.9 | 1967.5 | 1989.4 | 2014.6 | 2039.0 | 2056.8 | 1.0 | 5.0 | 5.1 |
| IFAG (Wetzell) | | -947.3 | -949.0 | -952.5 | -949.3 | -947.5 | -958.2 | -960.0 | 0.3 | 5.0 | 5.0 |
| IGNA (Buenos Aires) | | - | - | - | - | - | - | - | - | - | - |
| IMBH (Sarajevo) | | - | -418.9 | -434.9 | -446.8 | -448.6 | -455.4 | -460.6 | 0.3 | 7.0 | 7.1 (1) |
| INPL (Jerusalem) | | -7.3 | 0.5 | -5.7 | -3.5 | -1.2 | -5.0 | -6.6 | 0.5 | 7.0 | 7.0 |
| INTI (Buenos Aires) | | 93.3 | 99.2 | 94.3 | 78.4 | 74.1 | 53.9 | 58.9 | 2.5 | 20.0 | 20.2 |
| INXE (Rio de Janeiro) | | -12.7 | -11.2 | -8.6 | -20.6 | -21.6 | -34.1 | -48.5 | 0.3 | 20.0 | 20.0 |
| IT (Torino) | | -3.3 | -3.2 | -4.4 | -4.7 | -4.1 | -2.9 | -2.0 | 0.3 | 1.2 | 1.3 |
| JATC (Lintong) | | 2.9 | 0.2 | 0.4 | -1.3 | -0.4 | -1.9 | -1.5 | 0.4 | 4.8 | 4.8 |
| JV (Kjeller) | | -42.6 | -29.2 | -26.2 | -20.9 | -36.8 | -30.3 | -30.8 | 5.0 | 20.0 | 20.6 |
| KEBS (Nairobi) | | - | - | - | - | - | - | - | - | - | - |
| KIM (Serpong-Tangerang) | | 384.2 | 368.4 | 391.7 | 407.9 | 426.7 | 454.1 | 437.2 | 2.0 | 20.0 | 20.1 |
| KRIS (Daejeon) | | -33.4 | -34.7 | -35.2 | -35.4 | -34.3 | -29.0 | -16.8 | 0.3 | 4.9 | 5.0 (2) |
| KZ (Astana) | | -927.3 | -908.4 | -892.7 | -882.8 | -887.3 | -881.8 | -892.3 | 1.5 | 7.0 | 7.2 |

| Date 2015 | 0h UTC | APR 27 | MAY 2 | MAY 7 | MAY 12 | MAY 17 | MAY 22 | MAY 27 | Uncertainty/ns Notes | | | |
|-----------------------|--------|---------------------|----------|----------|----------|----------|----------|----------|----------------------|-------|------|--|
| MJD | | 57139 | 57144 | 57149 | 57154 | 57159 | 57164 | 57169 | u_A | u_B | u | |
| Laboratory k | | [UTC-UTC(k)]/ns | | | | | | | | | | |
| LT (Vilnius) | | 905.2 | 901.6 | 892.5 | 904.3 | 902.4 | 909.0 | 909.7 | 2.0 | 5.1 | 5.4 | |
| MASM (Bayanzurkh) | | -471.9 | -500.4 | -526.1 | -557.7 | -585.7 | - | - | 0.4 | 20.0 | 20.0 | |
| MIKE (Espoo) | | -0.6 | -0.1 | 1.2 | 1.9 | 1.6 | 1.5 | 1.2 | 0.3 | 7.0 | 7.1 | |
| MKEH (Budapest) | | -29981.9 | -30182.9 | -30380.5 | -30569.8 | -30786.3 | -30984.5 | -31175.0 | 1.5 | 20.0 | 20.1 | |
| MSL (Lower Hutt) | | - | - | - | - | - | - | - | - | - | - | |
| MTC (Makkah) | | 106.8 | 107.7 | 115.1 | 116.9 | 122.9 | 136.1 | 139.8 | 0.3 | 7.0 | 7.0 | |
| NAO (Mizusawa) | | -38.1 | -35.4 | -30.9 | -30.7 | -21.8 | -6.7 | -0.6 | 2.0 | 20.0 | 20.1 | |
| NICT (Tokyo) | | -12.9 | -14.5 | -15.5 | -14.8 | -13.3 | -11.3 | -9.5 | 0.3 | 4.7 | 4.7 | |
| NIM (Beijing) | | -2.0 | -1.8 | -0.7 | -1.3 | -1.4 | -0.9 | -0.5 | 0.3 | 4.9 | 4.9 | |
| NIMB (Bucharest) | | 944.6 | 953.6 | 970.7 | 986.3 | 996.5 | 998.3 | 1003.9 | 4.5 | 20.0 | 20.5 | |
| NIMT (Pathumthani) | | -5.9 | -13.6 | -15.9 | -41.3 | -47.5 | -49.3 | -57.4 | 1.0 | 20.0 | 20.0 | |
| NIS (Cairo) | | -7865.2 | -7856.2 | -7847.3 | -7841.2 | -7828.8 | -7815.5 | -7806.8 | 1.6 | 7.0 | 7.2 | |
| NIST (Boulder) | | 4.4 | 5.1 | 4.8 | 5.0 | 4.7 | 5.1 | 5.6 | 0.3 | 4.8 | 4.8 | |
| NMIJ (Tsukuba) | | -8.7 | -10.8 | -12.2 | -11.9 | -9.1 | -5.0 | -2.8 | 0.3 | 5.0 | 5.0 | |
| NMLS (Sepang) | | -303.0 | -289.9 | -286.6 | -282.7 | -284.5 | -269.8 | -263.8 | 1.0 | 20.0 | 20.0 | |
| NPL (Teddington) | | 24.5 | 25.2 | 25.7 | 26.6 | 27.6 | 29.6 | 31.8 | 0.3 | 6.9 | 7.0 | |
| NPLI (New-Delhi) | | 2.5 | 0.2 | -1.5 | -2.0 | -2.2 | -0.2 | 0.6 | 0.3 | 7.0 | 7.1 | |
| NRC (Ottawa) | | -27.3 | -29.9 | -32.6 | -38.9 | -40.0 | -33.8 | -31.9 | 0.3 | 5.1 | 5.1 | |
| NRL (Washington DC) | | 3.4 | 3.9 | 1.3 | -0.5 | -1.4 | 1.6 | -0.5 | 0.7 | 5.1 | 5.1 | |
| NTSC (Lintong) | | 2.1 | -0.6 | -0.4 | -2.6 | -1.2 | -2.3 | -2.8 | 0.3 | 4.7 | 4.7 | |
| ONBA (Buenos Aires) | | -2461.2 | -2465.1 | -2474.6 | -2485.2 | -2501.8 | -2514.1 | -2538.3 | 2.5 | 5.1 | 5.6 | |
| ONRJ (Rio de Janeiro) | | -6.2 | -4.0 | -5.8 | 0.0 | 4.3 | 0.5 | -0.8 | 1.3 | 7.0 | 7.1 | |
| OP (Paris) | | 0.5 | 0.6 | 0.8 | 0.4 | -0.2 | -0.4 | -0.5 | 0.3 | 1.2 | 1.3 | |
| ORB (Bruxelles) | | 3.3 | 1.8 | 9.4 | 8.8 | 4.7 | -2.2 | -9.6 | 0.3 | 5.0 | 5.1 | |
| PL (Warszawa) | | -3.4 | -4.1 | -15.6 | -19.6 | -29.4 | -26.1 | -27.9 | 0.3 | 5.0 | 5.0 | |
| PTB (Braunschweig) | | 0.2 | 0.0 | -0.2 | -0.2 | -1.3 | -1.3 | -1.5 | 0.1 | 0.8 | 0.8 | |
| ROA (San Fernando) | | 3.2 | 0.9 | -0.1 | -0.6 | -1.9 | 0.6 | 2.4 | 0.3 | 1.3 | 1.3 | |
| SASO (Riyadh) | | -86.1 | -88.5 | -85.4 | -92.1 | -97.1 | -105.4 | -109.9 | 0.3 | 7.0 | 7.1 | |
| SCL (Hong Kong) | | 37.5 | 43.8 | 47.1 | 44.8 | 38.5 | 53.4 | 53.6 | 6.0 | 10.0 | 11.7 | |
| SG (Singapore) | | 4.5 | 9.9 | 13.1 | 13.3 | 13.9 | 12.1 | 11.4 | 0.7 | 5.0 | 5.1 | |
| SIQ (Ljubljana) | | -1498.8 | -1475.8 | -1488.7 | -1498.5 | -1491.0 | -1495.1 | -1480.7 | 0.3 | 7.0 | 7.1 | |
| SMD (Bruxelles) | | -0.3 | -3.7 | 3.0 | -1.8 | -4.1 | -5.8 | -1.0 | 0.3 | 7.0 | 7.0 | |
| SMU (Bratislava) | | -158.0 | -161.4 | -163.7 | -179.8 | -187.3 | -204.3 | -208.7 | 1.0 | 20.0 | 20.0 | |
| SP (Boras) | | -0.3 | -0.3 | 0.2 | 0.7 | 0.3 | 0.9 | 0.1 | 0.3 | 1.2 | 1.3 | |
| SU (Moskva) | | -0.1 | -1.7 | -0.9 | -1.5 | -0.8 | -2.2 | -3.8 | 0.9 | 4.7 | 4.8 | |
| TL (Chung-Li) | | -8.0 | -7.2 | -6.0 | -5.5 | -3.2 | -2.2 | -4.0 | 0.3 | 5.0 | 5.0 | |
| TP (Praha) | | -33.6 | -33.4 | -41.5 | -39.7 | -39.9 | -37.6 | -41.6 | 0.3 | 5.0 | 5.0 | |
| UA (Kharkov) | | -14.7 | -8.0 | 2.6 | 23.4 | 25.2 | 16.4 | 7.1 | 1.5 | 7.0 | 7.2 | |
| UME (Gebze-Kocaeli) | | -585.9 | -590.5 | -609.5 | -624.0 | -633.3 | -646.1 | -661.1 | 0.3 | 7.0 | 7.0 | |
| USNO (Washington DC) | | 1.3 | 1.0 | 1.3 | 1.6 | 1.5 | 2.1 | 2.2 | 0.2 | 1.0 | 1.0 | |
| VMI (Ha Noi) | | - | - | - | 24.4 | 40.9 | 71.2 | -9.1 | 2.0 | 20.0 | 20.1 | |
| VSL (Delft) | | 2.2 | 9.1 | 9.0 | 3.8 | -1.5 | 3.2 | -3.3 | 0.3 | 1.3 | 1.3 | |
| ZA (Pretoria) | | 3826.8 | 3798.5 | 3760.0 | 3736.6 | 3699.9 | 3661.4 | 3631.6 | 1.5 | 20.0 | 20.1 | |

- Notes on section 1:

(1) IMBH : Institute of Metrology of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina.

(2) KRIS : Time step of UTC(KRIS) of -11.13 ns on MJD 57166.65.

2 - International Atomic Time TAI and Local atomic time scales TA(k). Computed values of $[TAI-TA(k)]$.

| Date 2015 | 0h UTC | APR 27 | MAY 2 | MAY 7 | MAY 12 | MAY 17 | MAY 22 | MAY 27 |
|-----------------------|--------|------------------|-------------|-------------|-------------|-------------|-------------|----------------|
| MJD | | 57139 | 57144 | 57149 | 57154 | 57159 | 57164 | 57169 |
| Laboratory <i>k</i> | | $[TAI-TA(k)]/ns$ | | | | | | |
| CH (Bern-Wabern) | | 20937.6 | 20865.8 | 20795.0 | 20724.5 | 20654.5 | 20584.6 | 20515.3 |
| CNM (Queretaro) | | -1087.9 | -1092.0 | -1094.5 | -1100.6 | -1105.2 | -1109.9 | -1113.2 |
| F (Paris) | | 167623.7 | 167622.3 | 167622.2 | 167622.5 | 167621.9 | 167621.3 | 167621.6 |
| JATC (Lintong) | | -57557.6 | -57583.2 | -57608.0 | -57635.2 | -57660.7 | -57684.1 | -57709.6 |
| KRIS (Daejeon) | | 46075.1 | 46087.3 | 46100.3 | 46113.6 | 46127.7 | 46145.5 | 46170.2 |
| NICT (Tokyo) | | 1339.2 | 1340.2 | 1342.4 | 1345.2 | 1346.2 | 1350.1 | 1351.9 |
| NIST (Boulder) | | -45417120.7 | -45417305.5 | -45417491.3 | -45417676.6 | -45417862.4 | -45418047.5 | -45418232.5 |
| NRC (Ottawa) | | 21384.7 | 21365.3 | 21343.7 | 21323.0 | 21305.2 | 21294.6 | 21279.7 |
| NTSC (Lintong) | | 20879.5 | 20913.9 | 20948.9 | 20982.8 | 21018.3 | 21055.4 | 21090.1 |
| ONRJ (Rio de Janeiro) | | -22139.8 | -22178.1 | -22220.7 | -22257.1 | -22295.4 | -22338.4 | -22379.1 |
| PL (Warszawa) | | -6984.6 | -6994.7 | -7013.5 | -7023.6 | -7027.7 | -7037.5 | -7048.2 |
| PTB (Braunschweig) | | 2005.1 | 2005.4 | 2006.2 | 2006.1 | 2005.3 | 2005.8 | 2005.6 |
| SG (Singapore) | | 19404.5 | 19469.9 | 19533.1 | 19593.3 | 19653.9 | 19712.1 | 19771.4 |
| SU (Moskva) | | 27291057.1 | 27291055.5 | 27291056.3 | 27291055.7 | 27291056.4 | 27291055.0 | 27291053.4 (1) |
| TL (Chung-Li) | | -118.4 | -117.7 | -114.0 | -111.4 | -105.8 | -100.3 | -97.4 |
| USNO (Washington DC) | | -35169712.8 | -35169998.9 | -35170286.0 | -35170573.6 | -35170861.3 | -35171148.6 | -35171435.9 |

- Note on section 2:

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

3 - Difference between the normalized frequencies of EAL (free atomic time scale) and TAI.

| | Interval of validity | $f(EAL)-f(TAI)$ | |
|-------------------------|----------------------|-------------------------|-----------------------------|
| Steering correction | 57139 - 57169 | 6.483×10^{-13} | (2015 APR 27 - 2015 MAY 27) |
| New correction | 57169 - 57199 | 6.483×10^{-13} | (2015 MAY 27 - 2015 JUN 26) |
| New correction foreseen | 57199 - 57234 | 6.483×10^{-13} | (2015 JUN 26 - 2015 JUL 31) |

4 - 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 with τ in days: (1) a white frequency noise of $1.7 \times 10^{-15} / \sqrt{\tau}$, (2) a flicker frequency noise of 0.35×10^{-15} and (3) a random walk frequency noise of $0.2 \times 10^{-16} \times \sqrt{\tau}$. The relation between EAL and TAI is given in *Circular T* and the *BIPM Annual Report on Time Activities*.

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 and Secondary Frequency Standards (PFS/SFS). In this table: u_A is the uncertainty originating in the instability of the standard, u_B is the combined uncertainty from systematic effects, $u_{1/Lab}$ is the uncertainty in the link between the standard and the clock participating to TAI, including the uncertainty due to the dead-time, $u_{1/TAI}$ is the uncertainty in the link to TAI, u is the quadratic sum of all four uncertainty values. Ref(u_B) is a reference giving information on the values of u_B or is the *Circular T* where the reference was first given. $u_B(Ref)$ is the u_B value stated in this reference. Note that all uncertainties may vary over time and that the current u_B values are generally not the same as the peer reviewed values given in Ref(u_B). See "<http://www.bipm.org/jsp/en/TimeFtp.jsp>" for previous issues of *Circular T* and individual Reports of Evaluation of Primary and Secondary Frequency Standards that explain changes in uncertainties. For the SFS, u_{Srep} represents the recommended uncertainty of the secondary representation of the second and Ref(u_S) provides the reference for the frequency of the transition and its uncertainty u_{Srep} , these two fields are not applicable to PFS. All values are expressed in 10^{-15} and are valid only for the stated period of estimation.

| Standard | Period of Estimation | d | u_A | u_B | $u_{1/Lab}$ | $u_{1/TAI}$ | u | u_{Srep} | Ref(u_S) | Ref(u_B) | $u_B(Ref)$ | Note |
|------------|----------------------|-------|-------|-------|-------------|-------------|-------|------------|--------------|--------------|------------|------|
| PTB-CS1 | 57139 57169 | -5.69 | 6.00 | 8.00 | 0.00 | 0.07 | 10.00 | PFS/NA | | T148 | 8. | (1) |
| PTB-CS2 | 57139 57169 | -3.87 | 3.00 | 12.00 | 0.00 | 0.07 | 12.37 | PFS/NA | | T148 | 12. | (1) |
| IT-CsF2 | 57139 57169 | 0.08 | 0.34 | 0.17 | 0.11 | 0.27 | 0.48 | PFS/NA | | T315 | 0.18 | (2) |
| PTB-CSF2 | 57149 57169 | 0.51 | 0.17 | 0.31 | 0.03 | 0.09 | 0.37 | PFS/NA | | T287 | 0.41 | (3) |
| SU-CsFO2 | 57139 57169 | 0.68 | 0.17 | 0.25 | 0.13 | 0.59 | 0.67 | PFS/NA | | T315 | 0.50 | (4) |
| SYRTE-F02 | 57139 57169 | 0.41 | 0.30 | 0.28 | 0.11 | 0.20 | 0.47 | PFS/NA | | T301 | 0.23 | (5) |
| SYRTE-F0Rb | 57139 57169 | 0.38 | 0.30 | 0.30 | 0.11 | 0.20 | 0.48 | 1.3 [1] | | T328 | 0.32 | (5) |

Notes:

(1) Continuously operating as a clock participating to TAI

(2) Report 03 JUN. 2015 by INRIM

(3) Report 29 MAY. 2015 by PTB

(4) Report 29 MAY. 2015 by SU

(5) Report 03 JUN. 2015 by LNE-SYRTE

[1] CIPM Recommendation 1 (CI-2013) : Updates to the list of standard frequencies in *Procès-Verbaux des Séances du Comité International des Poids et Mesures*, 102nd meeting (2013), 2014, 188 p.

The second table gives the BIPM estimate of d , based on all available PFS and SFS measurements over the period MJD 56779-57169, 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 |
|----------------------|------------------------|--|
| 57139-57169 | 0.29×10^{-15} | 0.23×10^{-15} (2015 APR 27 - 2015 MAY 27) |

5 - Relations of UTC and TAI with predictions of UTC(k) disseminated by GNSS and their System Times.

$$\begin{aligned}
 [UTC-GPS \text{ time}] &= -16 \text{ s} + C_0, & [TAI-GPS \text{ time}] &= 19 \text{ s} + C_0, & \text{global uncertainty is of the order of 10 ns.} \\
 [UTC-UTC(USNO)_GPS] &= C_0', & [TAI-UTC(USNO)_GPS] &= 35 \text{ s} + C_0', & \text{global uncertainty is of the order of 10 ns.} \\
 [UTC-GLONASS \text{ time}] &= C_1, & [TAI-GLONASS \text{ time}] &= 35 \text{ s} + C_1, & \text{global uncertainty is of the order of hundreds ns.} \\
 [UTC-UTC(SU)_GLONASS] &= C_1', & [TAI-UTC(SU)_GLONASS] &= 35 \text{ s} + C_1', & \text{global uncertainty is of the order of hundreds ns.}
 \end{aligned}$$

[UTC(USNO)_GPS] and [UTC(SU)_GLONASS] are, respectively, UTC(USNO) and UTC(SU) as predicted by USNO and SU and disseminated by GPS and GLONASS. The C_0 and C_0' values provide realizations of GPS time and of the prediction of UTC(USNO) broadcast by GPS, as obtained using the values [UTC-UTC(OP)] and the GPS data taken at the Paris Observatory, corrected for IGS precise orbits, clocks and ionosphere maps. The C_1 and C_1' values provide realizations of GLONASS time and of the prediction of UTC(SU) broadcast by GLONASS, as obtained using the values [UTC-UTC(AOS)] and the GLONASS data taken at the Astrogeodynamical Observatory Borowiec (AOS). N_0 , N_0' , N_1 and N_1' are the numbers of measurements; when N_0 , N_0' , N_1 or N_1' is 0, the corresponding values in the table are interpolated. The standard deviations σ_0 , σ_0' , σ_1 and σ_1' characterize the dispersion of individual measurements. The actual uncertainty of users' access to GPS and GLONASS times may differ from these values. For this edition of circular, $\sigma_0 = 1.2$ ns, $\sigma_0' = 1.3$ ns, $\sigma_1 = 6.3$ ns, $\sigma_1' = 6.3$ ns

| 2015 | 0h UTC | MJD | C_0 /ns | N_0 | C_0' /ns | N_0' | C_1 /ns | N_1 | C_1' /ns | N_1' |
|------|--------|-------|-----------|-------|------------|--------|-----------|-------|------------|--------|
| | APR 27 | 57139 | 2.8 | 90 | 2.1 | 90 | 208.7 | 88 | 204.4 | 88 |
| | APR 28 | 57140 | 2.2 | 89 | 2.6 | 89 | 205.4 | 87 | 200.7 | 87 |
| | APR 29 | 57141 | 3.0 | 89 | 2.7 | 89 | 204.7 | 88 | 199.3 | 87 |
| | APR 30 | 57142 | 3.5 | 88 | 3.4 | 88 | 205.9 | 86 | 200.1 | 86 |
| | MAY 1 | 57143 | 3.3 | 90 | 4.2 | 90 | 203.5 | 89 | 198.2 | 89 |
| | MAY 2 | 57144 | 2.3 | 89 | 3.1 | 89 | 201.1 | 84 | 196.1 | 84 |
| | MAY 3 | 57145 | 2.2 | 89 | 2.4 | 88 | 199.6 | 89 | 194.7 | 89 |
| | MAY 4 | 57146 | 1.9 | 89 | 3.0 | 89 | 200.2 | 82 | 196.0 | 83 |
| | MAY 5 | 57147 | 1.5 | 90 | 3.0 | 90 | 201.5 | 88 | 199.0 | 87 |
| | MAY 6 | 57148 | 3.5 | 43 | 4.4 | 43 | 203.1 | 88 | 202.4 | 88 |
| | MAY 7 | 57149 | 3.9 | 44 | 2.9 | 44 | 201.3 | 87 | 202.4 | 84 |
| | MAY 8 | 57150 | 2.5 | 89 | 2.2 | 89 | 200.9 | 87 | 202.9 | 87 |
| | MAY 9 | 57151 | 1.6 | 90 | 2.6 | 90 | 204.4 | 89 | 206.9 | 89 |
| | MAY 10 | 57152 | 1.6 | 89 | 3.8 | 88 | 205.7 | 86 | 208.7 | 86 |
| | MAY 11 | 57153 | 3.0 | 89 | 4.3 | 89 | 204.3 | 77 | 206.8 | 75 |
| | MAY 12 | 57154 | 4.1 | 89 | 4.0 | 89 | 203.2 | 79 | 204.6 | 80 |
| | MAY 13 | 57155 | 4.2 | 90 | 2.4 | 90 | 202.0 | 86 | 202.3 | 86 |
| | MAY 14 | 57156 | 3.6 | 88 | 3.5 | 88 | 200.4 | 86 | 199.7 | 88 |
| | MAY 15 | 57157 | 3.8 | 89 | 4.2 | 89 | 203.0 | 89 | 200.4 | 87 |
| | MAY 16 | 57158 | 3.6 | 89 | 1.9 | 89 | 207.0 | 89 | 204.4 | 88 |
| | MAY 17 | 57159 | 3.1 | 90 | 2.0 | 90 | 209.2 | 90 | 209.6 | 90 |
| | MAY 18 | 57160 | 2.9 | 89 | 1.6 | 89 | 210.5 | 87 | 214.1 | 87 |
| | MAY 19 | 57161 | 1.7 | 89 | 1.0 | 89 | 210.5 | 88 | 216.8 | 88 |
| | MAY 20 | 57162 | 0.6 | 89 | 0.8 | 89 | 209.9 | 82 | 216.8 | 81 |
| | MAY 21 | 57163 | -0.3 | 90 | 2.1 | 90 | 212.5 | 87 | 218.6 | 88 |
| | MAY 22 | 57164 | -0.8 | 89 | 4.0 | 85 | 215.3 | 89 | 221.4 | 89 |
| | MAY 23 | 57165 | -0.1 | 89 | 3.6 | 89 | 217.2 | 87 | 222.7 | 88 |
| | MAY 24 | 57166 | 0.5 | 89 | 3.6 | 89 | 218.6 | 84 | 221.8 | 85 |
| | MAY 25 | 57167 | 1.9 | 90 | 5.3 | 90 | 218.1 | 90 | 219.1 | 89 |
| | MAY 26 | 57168 | 2.1 | 89 | 3.4 | 89 | 218.5 | 89 | 218.5 | 89 |
| | MAY 27 | 57169 | 1.9 | 89 | 1.1 | 89 | 220.1 | 84 | 218.1 | 84 |

6 - Time links used for the computation of TAI and their uncertainties.

The time links used in the elaboration of this *Circular T* are listed in this section. The technique for the link is indicated as follows:

GPS SC for GPS all-in-view single-channel C/A data; GPS MC for GPS all-in-view multi-channel C/A data; GPS P3 for GPS all-in-view multi-channel dual-frequency P code data; GPS PPP for GPS Precise Point Positioning technique; GPS GT for 'GPS time' observations; GLN MC for GLONASS common-view multi-channel C/A data; GPSGLN for the combination of GPS MC and GLN MC links; TWGPPP/TWGPP3 for the combined smoothing of TWSTFT and GPS PPP/GPS P3; INT LK for internal cable link and TWSTFT for two-way satellite time and frequency transfer data.

For each link, the following uncertainties are provided: u_A is the standard uncertainty accounting for measurement noise and random effects with typical duration between 1 day and 30 days. u_B is the estimated uncertainty of the calibration.

The calibration type of the link is indicated as: GPS EC for GPS equipment calibration; TW EC for two-way equipment calibration; LC (technique) for a link calibrated using 'technique'; BC (technique) for a link calibrated using 'technique' to transfer a past equipment calibration through a discontinuity of link operation. DIC is used for direct internal calibration.

The calibration dates indicate: the most recent calibration results for the two laboratories in the case of EC and the most recent calibration of the link in the case of LC and BC. NA stands for not available, in this case estimated values are provided.

| Link | Type | u_A /ns | u_B /ns | Calibration Type | Calibration Dates |
|----------|--------|-----------|-----------|------------------------|-------------------|
| AOS /PTB | GPSPPP | 0.3 | 5.0 | LC(GPS P3) | 2011 Jun |
| APL /PTB | GPSPPP | 0.3 | 5.0 | LC(GPS MC) | 2012 Sep |
| AUS /PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2010 Oct/2004 Aug |
| BEV /PTB | GPSPPP | 0.3 | 3.0 | BC(GPS MC) | 2012 Mar |
| BIM /PTB | GPS MC | 1.5 | 7.0 | GPS EC/GPS EC | 2007 Nov/2006 Sep |
| BIRM/PTB | GPS MC | 1.5 | 20.0 | NA /GPS EC | NA /2006 Sep |
| BY /PTB | GPS MC | 1.5 | 7.0 | GPS EC/GPS EC | 2008 Jun/2006 Sep |
| CAO /PTB | GPS MC | 8.0 | 7.0 | GPS EC/GPS EC | 2004 Nov/2006 Sep |
| CH /PTB | TWGPPP | 0.3 | 1.0 | LC(TWSTFT)/BC(GPS PPP) | 2008 Sep/2009 Aug |
| CNM /PTB | GPS MC | 3.0 | 5.0 | BC(GPS SC) | 2008 May |
| CNMP/PTB | GPS MC | 3.5 | 5.0 | GPS EC/GPS EC | 2004 May/2006 Sep |
| DFNT/PTB | GPSPPP | 0.3 | 20.0 | NA /GPS EC | NA /2006 Sep |
| DMDM/PTB | GPSPPP | 0.3 | 7.0 | LC(GPS MC) | 2012 Jul |
| DTAG/PTB | GPSPPP | 0.3 | 10.0 | LC(GPS MC) | 2009 Jul |
| EIM /PTB | GPS MC | 7.5 | 5.0 | GPS EC/GPS EC | 2007 May/2003 Aug |
| ESTC/PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2012 Nov/2004 Aug |
| HKO /PTB | GPS P3 | 1.0 | 5.0 | LC(GPS MC) | 2013 Apr |
| IFAG/PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2003 Jun/2004 Aug |
| IGNA/PTB | NA | | | | |
| IMBH/PTB | GPSPPP | 0.3 | 7.0 | GPS EC/GPS EC | 2014 Nov/2004 Aug |

| Link | Type | u_A /ns | u_B /ns | Calibration Type | Calibration Dates |
|-----------|--------|-----------|-----------|------------------------|-------------------|
| INPL/PTB | GPSPPP | 0.5 | 7.0 | GPS EC/GPS EC | 2009 Jun/2004 Aug |
| INTI/PTB | GPS MC | 2.5 | 20.0 | NA /GPS EC | NA /2006 Sep |
| INXE/PTB | GPSPPP | 0.3 | 20.0 | NA /GPS EC | NA /2006 Sep |
| IT /PTB | TWGPPP | 0.3 | 1.0 | TW EC | 2014 Jul |
| JATC/NTSC | INT LK | 0.2 | 1.0 | DIC | /2006 Sep |
| JV /PTB | GPS GT | 5.0 | 20.0 | NA /GPS EC | NA /2003 Aug |
| KEBS/PTB | NA | | | | |
| KIM /PTB | GPS MC | 2.0 | 20.0 | NA /GPS EC | NA /2006 Sep |
| KRIS/PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2005 Aug/2004 Aug |
| KZ /PTB | GPSGLN | 1.5 | 7.0 | GPS EC/GPS EC | 2012 Dec/2006 Sep |
| LT /PTB | GPS MC | 2.0 | 5.0 | GPS EC/GPS EC | 2006 Oct/2006 Sep |
| MASM/PTB | GPSPPP | 0.4 | 20.0 | NA /GPS EC | NA /2004 Aug |
| MIKE/PTB | GPSPPP | 0.3 | 7.0 | NA /GPS EC | NA /2004 Aug |
| MKEH/PTB | GPS MC | 1.5 | 20.0 | NA /GPS EC | NA /2006 Sep |
| MSL /PTB | NA | | | | |
| MTC /PTB | GPSPPP | 0.3 | 7.0 | GPS EC/GPS EC | 2013 Aug/2004 Aug |
| NAO /PTB | GPS MC | 2.0 | 20.0 | NA /GPS EC | NA /2006 Sep |
| NICT/PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2005 Jun/2004 Aug |
| NIM /PTB | GPSPPP | 0.3 | 5.0 | LC(TWSTFT) | 2013 May |
| NIMB/PTB | GPS MC | 4.5 | 20.0 | NA /GPS EC | NA /2006 Sep |
| NIMT/PTB | GPS P3 | 1.0 | 20.0 | NA /GPS EC | NA /2004 Aug |
| NIS /PTB | GPS P3 | 1.6 | 7.0 | LC(GPS MC) | 2010 Jun |
| NIST/PTB | TWGPPP | 0.3 | 5.0 | LC(TWSTFT)/BC(GPS PPP) | 2005 May/2009 Aug |
| NMIJ/PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2002 Apr/2004 Aug |
| NMLS/PTB | GPS P3 | 1.0 | 20.0 | NA /GPS EC | NA /2006 Sep |
| NPL /PTB | GPSPPP | 0.3 | 7.0 | LC(GPS P3) | 2008 Sep/2009 Nov |
| NPLI/PTB | GPSPPP | 0.3 | 7.0 | LC(GPS P3) | 2012 Jun |
| NRC /PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2003 Nov/2004 Aug |
| NRL /PTB | GPS P3 | 0.7 | 5.0 | GPS EC/GPS EC | 2002 May/2004 Aug |
| NTSC/PTB | GPSPPP | 0.3 | 5.0 | LC(TWSTFT) | 2014 Nov |
| ONBA/PTB | GPS MC | 2.5 | 5.0 | GPS EC/GPS EC | 2004 Jul/2006 Sep |
| ONRJ/PTB | GPS P3 | 1.3 | 7.0 | GPS EC/GPS EC | 2011 Dec/2006 Sep |
| OP /PTB | TWGPPP | 0.3 | 1.0 | TW EC | 2014 Jul |
| ORB /PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2012 Oct/2004 Aug |
| PL /PTB | GPSPPP | 0.3 | 5.0 | LC(GPS MC) | 2012 Mar |
| ROA /PTB | TWGPPP | 0.3 | 1.0 | TW EC | 2014 Jul |
| SASO/PTB | GPSPPP | 0.3 | 7.0 | GPS EC/GPS EC | 2012 Nov/2006 Sep |
| SCL /PTB | GPS MC | 6.0 | 10.0 | LC(GPS SC) | 1993 May |
| SG /PTB | GPS P3 | 0.7 | 5.0 | GPS EC/GPS EC | 2010 Mar/2004 Aug |
| SIQ /PTB | GPSPPP | 0.3 | 7.0 | GPS EC/GPS EC | 2014 Aug/2009 Nov |

| Link | Type | u_A /ns | u_B /ns | Calibration Type | Calibration Dates |
|----------|--------|-----------|-----------|------------------------|-------------------|
| SMD /PTB | GPSPPP | 0.3 | 7.0 | GPS EC/GPS EC | 2011 Sep/2006 Sep |
| SMU /PTB | GPSGLN | 1.0 | 20.0 | NA /GPS EC | NA /2006 Sep |
| SP /PTB | TWGPPP | 0.3 | 1.0 | TW EC | 2014 Jul |
| SU /PTB | GPSGLN | 1.0 | 5.0 | LC(TWSTFT) | 2014 Nov |
| TL /PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2005 May/2004 Aug |
| TP /PTB | GPSPPP | 0.3 | 5.0 | GPS EC/GPS EC | 2009 Feb/2004 Aug |
| UA /PTB | GPS MC | 1.5 | 7.0 | GPS EC/GPS EC | 2011 Mar/2006 Sep |
| UME /PTB | GPSPPP | 0.3 | 7.0 | GPS EC/GPS EC | 2005 Dec/2006 Sep |
| USNO/PTB | TWGPPP | 0.3 | 1.0 | TW EC | 2014 Jun |
| VMI /PTB | GPS P3 | 2.0 | 20.0 | NA /GPS EC | NA /2004 Aug |
| VSL /PTB | TWGPPP | 0.3 | 1.0 | LC(TWSTFT)/BC(GPS PPP) | 2006 Mar/2009 Aug |
| ZA /PTB | GPS P3 | 1.5 | 20.0 | NA /GPS EC | NA /2004 Aug |