

Table 6. Measurements of the duration of the TAI scale interval

(File available on <ftp://ftp2.bipm.org/pub/tai/scale/UTAI/utail6.ar>)

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 (in practice the SI second on the geoid), i.e. the fractional frequency deviation of TAI with the opposite sign: $d = -y_{\text{TAI}}$.

In Table 6A, d is obtained on the given periods of estimation by comparison of the TAI frequency with that of the individual primary frequency standards (PFS) IT-CsF2, NIM5, NIST-F1, PTB-CS1, PTB-CS2, PTB-CSF1, PTB-CSF2, SU-CsFO2 and SYRTE-FO2 reported on the year 2016.

In Table 6B, d is obtained on the given periods of estimation by comparison of the TAI frequency with that of the individual secondary frequency standard (SFS) SYRTE-FORb reported on the year 2016.

Previous calibrations are available in the successive annual reports of the BIPM Time Section volumes 1 to 18 and in the BIPM Annual Report on Time Activities volumes 1 to 10 (web only since volume 4 for 2009).

Each comparison is provided with the following information:

u_A is the uncertainty originating in the instability of the PFS,

u_B is the combined uncertainty from systematic effects,

$u_{\text{link/lab}}$ is the uncertainty in the link between the PFS and the clock participating to TAI, including the uncertainty due to dead-time,

$u_{\text{link/TAI}}$ is the uncertainty in the link to TAI, computed using the standard uncertainty of [UTC-UTC(k)],

u is the quadratic sum of all four uncertainty values.

In addition, Table 6B includes the following information:

u_{SRep} is the recommended uncertainty of the secondary representation of the second, as specified in the CIPM Recommendation identified under Ref(u_B).

In these tables, a frequency over a time interval is defined as the ratio of the end-point phase difference to the duration of the interval.

The typical characteristics of the calibrations of the TAI frequency provided by the different primary and secondary standards reported in 2016 are indicated below. Reports of individual evaluations may be found at ftp://ftp2.bipm.org/pub/tai/data/PFS_reports. Ref(u_B) is a reference giving information on the value of u_B as stated in the 2015 reports, $u_B(\text{Ref})$ is the u_B value stated in this reference. Note that the current u_B values are generally not the same as the peer reviewed values given in Ref(u_B).

Primary Standard	Type /selection	Type B std. uncertainty/ 10^{-15}	$u_B(\text{Ref})/10^{-15}$	Ref(u_B)	Comparison with	Number/typical duration of comp.
IT-CsF2	Fountain	(0.17 to 0.48)	0.18	[1]	H maser	7 / 10 d to 35 d
NIM5	Fountain	1.4	1.4	[2]	H maser	4 / 20 d to 20 d
NIST-F1	Fountain	0.31	0.35	[3]	H maser	1 / 20 d
PTB-CS1	Beam /Mag.	8	8.	[4]	TAI	12 / 30 d to 35 d
PTB-CS2	Beam /Mag.	12	12.	[5]	TAI	12 / 30 d to 35 d
PTB-CSF1	Fountain	0.7 then (0.35-0.37)	1.4	[6]	H maser	6 / 15 d to 35 d
PTB-CSF2	Fountain	(0.20 to 0.22)	0.41	[7]	H maser	10 / 10 d to 30 d
SU-CsFO2	Fountain	0.25	0.50	[8]	H maser	4 / 15 d to 30 d
SYRTE-FO2	Fountain	(0.25 to 0.35)	0.23	[9]	H maser	12 / 10 d to 30 d

Secondary Standard	Type	Type B std. uncertainty/ 10^{-15}	$u_B(\text{Ref})/10^{-15}$	Ref(u_B)	Comparison with	Number/typical duration of comp.
SYRTE-FORb	Fountain	(0.28 to 0.35)	0.32	[10]	H maser	13 / 10 d to 35 d

More detailed information on the characteristics and operation of individual PFS and SFS may be found in the annexes supplied by the individual laboratories.

Table 6A. Measurements of the duration of the TAI scale interval by Primary Frequency Standards

Standard	Period of estimation		$d/10^{-15}$	$u_A/10^{-15}$	$u_B/10^{-15}$	$u_{\text{link/lab}}/10^{-15}$	$u_{\text{link/TAI}}/10^{-15}$	$u/10^{-15}$	Note
IT-CsF2	57404	57414	-0.23	0.61	0.17	0.10	0.53	0.83	
IT-CsF2	57414	57444	-0.87	0.45	0.17	0.13	0.20	0.54	
IT-CsF2	57444	57474	-0.62	0.34	0.17	0.13	0.20	0.45	
IT-CsF2	57474	57499	-1.13	0.34	0.17	0.14	0.23	0.47	
IT-CsF2	57504	57539	-0.94	0.31	0.48	0.10	0.17	0.60	
IT-CsF2	57639	57659	-0.60	0.34	0.17	0.22	0.28	0.52	
IT-CsF2	57659	57689	-0.80	0.43	0.17	0.22	0.20	0.55	
NIM5	57459	57479	-1.05	0.80	1.40	0.20	0.66	1.75	
NIM5	57604	57629	-0.53	0.50	1.40	0.20	0.23	1.52	
NIM5	57634	57654	0.68	0.50	1.40	0.20	0.28	1.53	
NIM5	57664	57684	-0.94	0.60	1.40	0.20	0.28	1.56	
NIST-F1	57419	57439	0.06	0.23	0.31	0.20	0.28	0.52	
PTB-CS1	57384	57414	-12.55	6.00	8.00	0.00	0.07	10.00	(1)
PTB-CS1	57414	57444	-14.41	6.00	8.00	0.00	0.07	10.00	
PTB-CS1	57444	57474	-2.14	6.00	8.00	0.00	0.07	10.00	
PTB-CS1	57474	57504	-7.35	6.00	8.00	0.00	0.07	10.00	
PTB-CS1	57504	57539	-6.46	6.00	8.00	0.00	0.06	10.00	
PTB-CS1	57539	57569	-8.04	6.00	8.00	0.00	0.07	10.00	
PTB-CS1	57569	57599	-6.61	6.00	8.00	0.00	0.07	10.00	
PTB-CS1	57599	57629	-7.42	6.00	8.00	0.00	0.07	10.00	
PTB-CS1	57629	57659	-14.21	6.00	8.00	0.00	0.10	10.00	
PTB-CS1	57659	57689	-20.97	6.00	8.00	0.00	0.13	10.00	
PTB-CS1	57689	57719	-9.16	6.00	8.00	0.00	0.13	10.00	
PTB-CS1	57719	57749	-21.05	6.00	8.00	0.00	0.13	10.00	
PTB-CS2	57384	57414	0.68	3.00	12.00	0.00	0.07	12.37	(1)
PTB-CS2	57414	57444	-2.22	3.00	12.00	0.00	0.07	12.37	
PTB-CS2	57444	57474	-1.02	3.00	12.00	0.00	0.07	12.37	
PTB-CS2	57474	57504	-8.54	3.00	12.00	0.00	0.07	12.37	
PTB-CS2	57504	57539	-5.37	3.00	12.00	0.00	0.06	12.37	
PTB-CS2	57539	57569	-9.51	3.00	12.00	0.00	0.07	12.37	
PTB-CS2	57569	57599	-6.03	3.00	12.00	0.00	0.07	12.37	
PTB-CS2	57599	57629	-4.95	3.00	12.00	0.00	0.07	12.37	
PTB-CS2	57629	57659	-5.42	3.00	12.00	0.00	0.10	12.37	
PTB-CS2	57659	57689	-8.74	3.00	12.00	0.00	0.13	12.37	
PTB-CS2	57689	57719	-4.22	3.00	12.00	0.00	0.13	12.37	
PTB-CS2	57719	57749	-4.42	3.00	12.00	0.00	0.13	12.37	
PTB-CSF1	57369	57384	-0.25	0.10	0.70	0.01	0.12	0.72	
PTB-CSF1	57384	57404	-0.46	0.09	0.70	0.02	0.09	0.71	
PTB-CSF1	57474	57504	-1.02	0.08	0.37	0.08	0.07	0.39	
PTB-CSF1	57564	57599	-0.40	0.06	0.35	0.05	0.06	0.36	
PTB-CSF1	57599	57629	-0.41	0.08	0.35	0.10	0.07	0.38	
PTB-CSF1	57699	57714	-1.95	0.12	0.35	0.05	0.24	0.45	
PTB-CSF2	57379	57389	-0.52	0.21	0.22	0.07	0.18	0.36	
PTB-CSF2	57459	57474	-1.21	0.15	0.20	0.02	0.12	0.28	
PTB-CSF2	57474	57504	-1.38	0.12	0.20	0.13	0.07	0.27	
PTB-CSF2	57539	57569	-0.58	0.12	0.20	0.04	0.07	0.25	
PTB-CSF2	57579	57599	-0.75	0.12	0.20	0.02	0.09	0.25	
PTB-CSF2	57599	57629	-0.89	0.13	0.20	0.07	0.07	0.26	
PTB-CSF2	57634	57649	-0.88	0.13	0.20	0.03	0.24	0.34	
PTB-CSF2	57659	57689	-1.51	0.13	0.20	0.04	0.13	0.27	
PTB-CSF2	57699	57719	-1.54	0.26	0.20	0.07	0.19	0.38	
PTB-CSF2	57719	57749	-1.40	0.12	0.20	0.04	0.13	0.27	
SU-CsFO2	57384	57414	-0.05	0.27	0.25	0.11	0.59	0.70	
SU-CsFO2	57444	57459	0.22	0.40	0.25	0.11	1.10	1.20	
SU-CsFO2	57474	57504	0.49	0.40	0.25	0.11	0.59	0.76	
SU-CsFO2	57509	57529	-0.75	0.27	0.25	0.11	0.85	0.93	

Table 6A. (Cont.)

Standard	Period of estimation		$d/10^{-15}$	$u_A/10^{-15}$	$u_B/10^{-15}$	$u_{\text{link/lab}}/10^{-15}$	$u_{\text{link/TAI}}/10^{-15}$	$u/10^{-15}$
SYRTE-FO2	57394	57414	-0.48	0.25	0.35	0.12	0.28	0.53
SYRTE-FO2	57414	57424	-0.23	0.33	0.34	0.10	0.53	0.72
SYRTE-FO2	57459	57474	-1.58	0.30	0.29	0.11	0.37	0.57
SYRTE-FO2	57474	57504	-1.09	0.35	0.26	0.10	0.20	0.49
SYRTE-FO2	57509	57539	-1.21	0.35	0.27	0.10	0.20	0.49
SYRTE-FO2	57539	57569	-0.19	0.20	0.27	0.10	0.20	0.40
SYRTE-FO2	57569	57599	-0.15	0.26	0.26	0.12	0.20	0.43
SYRTE-FO2	57599	57629	-0.86	0.20	0.25	0.10	0.20	0.39
SYRTE-FO2	57629	57659	-0.97	0.27	0.28	0.11	0.20	0.45
SYRTE-FO2	57689	57709	-1.71	0.25	0.29	0.12	0.28	0.49
SYRTE-FO2	57709	57719	-1.18	0.30	0.29	0.14	0.53	0.69
SYRTE-FO2	57719	57749	-1.12	0.30	0.34	0.11	0.20	0.51

Note:

(1) Continuously operating as a clock participating in TAI.

Table 6B. Measurements of the duration of the TAI scale interval by Secondary Frequency Standards

Standard	Period of estimation		$d/10^{-15}$	$u_A/10^{-15}$	$u_B/10^{-15}$	$u_{\text{link/lab}}/10^{-15}$	$u_{\text{link/TAI}}/10^{-15}$	$u/10^{-15}$	u_{SRep}	Ref (u_s)
SYRTE-FORb	57389	57409	-0.22	0.20	0.35	0.11	0.28	0.50	1.3	[11]
SYRTE-FORb	57414	57444	-0.28	0.25	0.29	0.11	0.20	0.44	1.3	[11]
SYRTE-FORb	57444	57474	-0.16	0.20	0.28	0.13	0.20	0.42	0.7	[12]
SYRTE-FORb	57474	57504	-0.50	0.30	0.28	0.10	0.20	0.47	0.7	[12]
SYRTE-FORb	57504	57539	-0.23	0.20	0.28	0.10	0.17	0.40	0.7	[12]
SYRTE-FORb	57539	57569	0.02	0.20	0.28	0.10	0.20	0.41	0.7	[12]
SYRTE-FORb	57569	57599	-0.36	0.24	0.28	0.11	0.20	0.43	0.7	[12]
SYRTE-FORb	57599	57629	-0.04	0.20	0.30	0.10	0.20	0.42	0.7	[12]
SYRTE-FORb	57629	57659	-0.46	0.20	0.31	0.11	0.20	0.43	0.7	[12]
SYRTE-FORb	57659	57689	-0.80	0.20	0.28	0.10	0.20	0.41	0.7	[12]
SYRTE-FORb	57689	57709	-0.84	0.30	0.29	0.10	0.28	0.51	0.7	[12]
SYRTE-FORb	57709	57719	-1.16	0.30	0.29	0.15	0.53	0.69	0.7	[12]
SYRTE-FORb	57719	57749	-0.48	0.20	0.30	0.11	0.20	0.42	0.7	[12]

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