JAWL/TM.111 Sèvres, 21 December 2001

19th BIPM TWSTFT Report

To: TWSTFT Participating Stations

Dear Colleagues,

Please find enclosed the 19th BIPM TWSTFT Report. We report for the first time TWSTFT data from the Pacific Rim region, where the operational TWSTFT links are: CRL/NML using INTELSAT at 176° E, and CRL/CSAO, CRL/TL and CRL/NMIJ using JCSAT-1B at 150° E. The Pacific Rim TWSTFT data are available on the CRL ftp site: ftp.crl.go.jp/pub/dk/time/data/TWSTFT/AP/ . You will also note a new TWSTFT link IEN/PTB through INTELSAT 307° E.

This report covers the data for transatlantic and European links from March to October 2001, and for Pacific Rim links from April to October 2001. All TWSTFT links reported here are computed and compared with GPS C/A-code common-view data. Section IV presents an updated summary of the international time links.

The replacement of the INTELSAT 307° E transponders in late February and March 2001 caused time steps in the transatlantic TWSTFT links, which thus required a new calibration. The USNO/NPL link has been recalibrated and the USNO/PTB and NIST/PTB links are awaiting calibration.

Please note that the BIPM TWSTFT Reports are available by ftp (62.161.69.5, see the directory /Publication/), and via the BIPM web site http://www.bipm.fr/enus/5_Scientific/c_time/time_ftp.shtml Computer-readable data for all the TWSTFT links published in these reports are available from the same address. Reports of the two most recent meetings of the CCTF WG on TWSTFT can be found at http://www.bipm.org/pdf/cctf/wg_twstft.html .

With our best wishes for this festive season and the coming New Year,

Sincerely yours,

Jacques Azoubib and Włodzimierz Lewandowski

19th BIPM TWSTFT Report

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Section I

Comparison of TWSTFT and GPS CV links computed at the BIPM

Results of the computation for twelve time links are given in Tables 1 to 12. Plots showing the differences between the TWSTFT results and the GPS results are given in Figures 1 to 12.

- TWSTFT links

  Because the TWSTFT data are unevenly spaced by intervals of 2 or 3 days, they are linearly interpolated to give the data for the TAI standard dates at intervals of 5 days.

  When TWSTFT sessions are missing and data are interpolated between TWSTFT sessions more than 5 days apart, results are printed in bold characters. The upper limit for interpolation is 10 days.

- GPS C/A-code common-view links

  GPS C/A-code common-view links are computed using IGS precise ephemerides and IGS ionosphere maps.

Table 1. NIST/PTB link through INTELSAT 307° E

Date 2001 (MJD)	[*UTC(NIST) – UTC(PTB)*] /ns		TWSTFT – GPS
	TWSTFT	GPS (*Circular T*)	
1 March (51969)	**–27**	–13	–14
6 March (51974)	–39	–14	–25
11 March (51979)	–42	–25	–17
16 March (51984)	**–43**	–28	–15
21 March (51989)	**–38**	–35	–3
26 March (51994)	**–33**	–39	6
31 March (51999)	–30	–35	5
5 April (52004)	–22	–29	7
10 April (52009)	–16	–21	5
15 April (52014)	**–10**	–18	8
20 April (52019)	–3	–10	7
25 April (52024)	6	0	6
30 April (52029)	14	4	10
5 May (52034)	18	14	4
10 May (52039)	25	18	7
15 May (52044)	26	19	7
20 May (52049)	30	22	8
25 May (52054)	**33**	20	13
30 May (52059)	36	28	8
4 June (52064)	38	34	4
9 June (52069)	37	32	5
14 June (52074)	38	29	9
19 June (52079)	38	30	8
24 June (52084)	34	28	6
29 June (52089)	28	24	4
4 July (52094)	25	15	10
9 July (52099)	21	15	6
14 July (52104)	20	13	7
19 July (52109)	17	9	8
24 July (52114)	15	8	7
29 July (52119)	13	6	7
3 August (52124)	9	4	5
8 August (52129)	8	2	6
13 August (52134)	5	–3	8
18 August (52139)	–2	–7	5
23 August (52144)	–9	–16	7
28 August (52149)	–17	–24	7
2 September (52154)	–22	–28	6
7 September (52159)	–22	–28	6
12 September (52164)	–28	–33	5
17 September (52169)	–36	–42	6
22 September (52174)	–40	–49	9
27 September (52179)	–49	–55	6
2 October (52184)	–50	–59	9
7 October (52189)	–52	–60	8
12 October (52194)	–52	–57	5
17 October (52199)	–50	–57	7
22 October (52204)	–53	–58	5
27 October (52209)	–56	–62	6

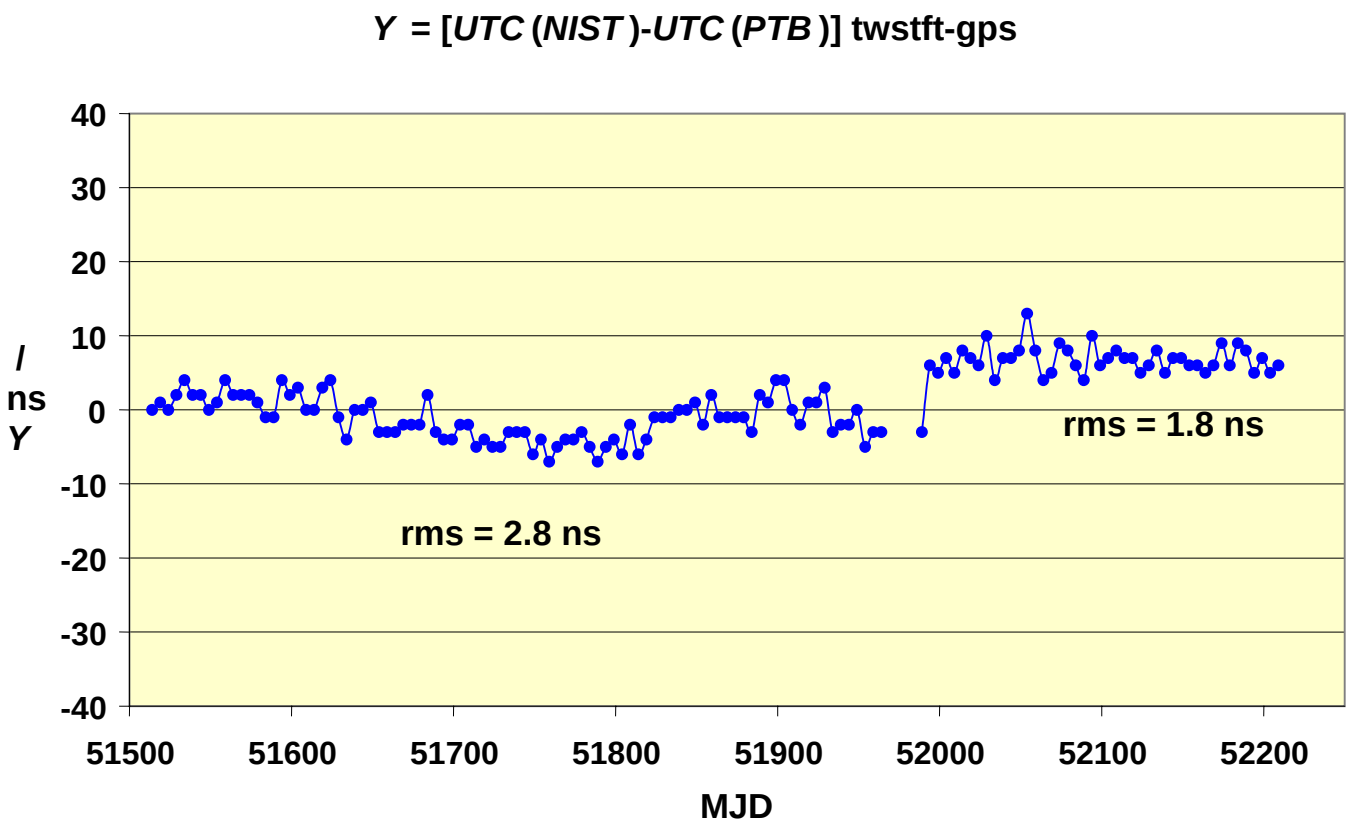


Figure 1. Differences between TWSTFT and GPS C/A-code common-view for NIST/PTB link.

Notes: A calibration of the NIST/PTB TWSTFT link derived from *Circular T* after July 1999 was applied starting from 29 November 1999 (MJD = 51511).

For the NIST/PTB link, the GPS data were used for the computation of TAI, and the corresponding TWSTFT data were stored as back-up. Since 4 January 2001 (MJD = 51914) the TWSTFT data are used for the computation of TAI and the corresponding GPS data are computed in parallel and kept as back-up.

Changes of INTELSAT 307° E transponders from 25 February to 17 March 2001 (MJD 51965-51985) causing time steps.

Several changes in PTB earth station hardware in March 2001 ending on 28 March 2001 (MJD 51996).

Table 2. USNO/NPL link with NPL TWSTFT Station 02 through INTELSAT 307° E

Date 2001 (MJD)	[*UTC(USNO) – UTC(NPL)*] /ns		TWSTFT– GPS
	TWSTFT (*Circular T*)	GPS	
21 March (51989)	**13**	13	0
26 March (51994)	13	16	–3
31 March (51999)	12	20	–8
5 April (52004)	11	5	6
10 April (52009)	9	6	3
15 April (52014)	8	1	7
20 April (52019)	8	3	5
25 April (52024)	7	–5	12
30 April (52029)	7	–1	8
5 May (52034)	6	–4	10
10 May (52039)	5	–9	14
15 May (52044)	**5**	–3	8
20 May (52049)	5	–6	11
25 May (52054)	2	–8	10
30 May (52059)	**0**	–10	10
4 June (52064)	**–5**	–13	8
9 June (52069)	–11	–21	10
14 June (52074)	–16	–26	10
19 June (52079)	–20	–31	11
24 June (52084)	–23	–31	8
29 June (52089)	–25	–35	10
4 July (52094)	–26	–36	10
9 July (52099)	–28	–40	12
14 July (52104)	**–28**	–36	8
19 July (52109)	–27	–33	6
24 July (52114)	–19	–28	9
29 July (52119)	–14	–24	10
3 August (52124)	–12	–21	9
8 August (52129)	–12	–18	6
13 August (52134)	–10	–17	7
18 August (52139)	–9	–16	7
23 August (52144)	–7	–18	11
28 August (52149)	**–7**	–16	9
2 September (52154)	–6	–8	2
7 September (52159)	–7	–8	1
12 September (52164)	–5	–6	1
17 September (52169)	–5	–8	3
22 September (52174)	**–3**	–8	5
27 September (52179)	–1	–7	6
2 October (52184)	**2**	–3	5
7 October (52189)	**3**	–2	5
12 October (52194)	**5**	4	1
17 October (52199)	7	5	2
22 October (52204)	9	6	3
27 October (52209)	12	8	4

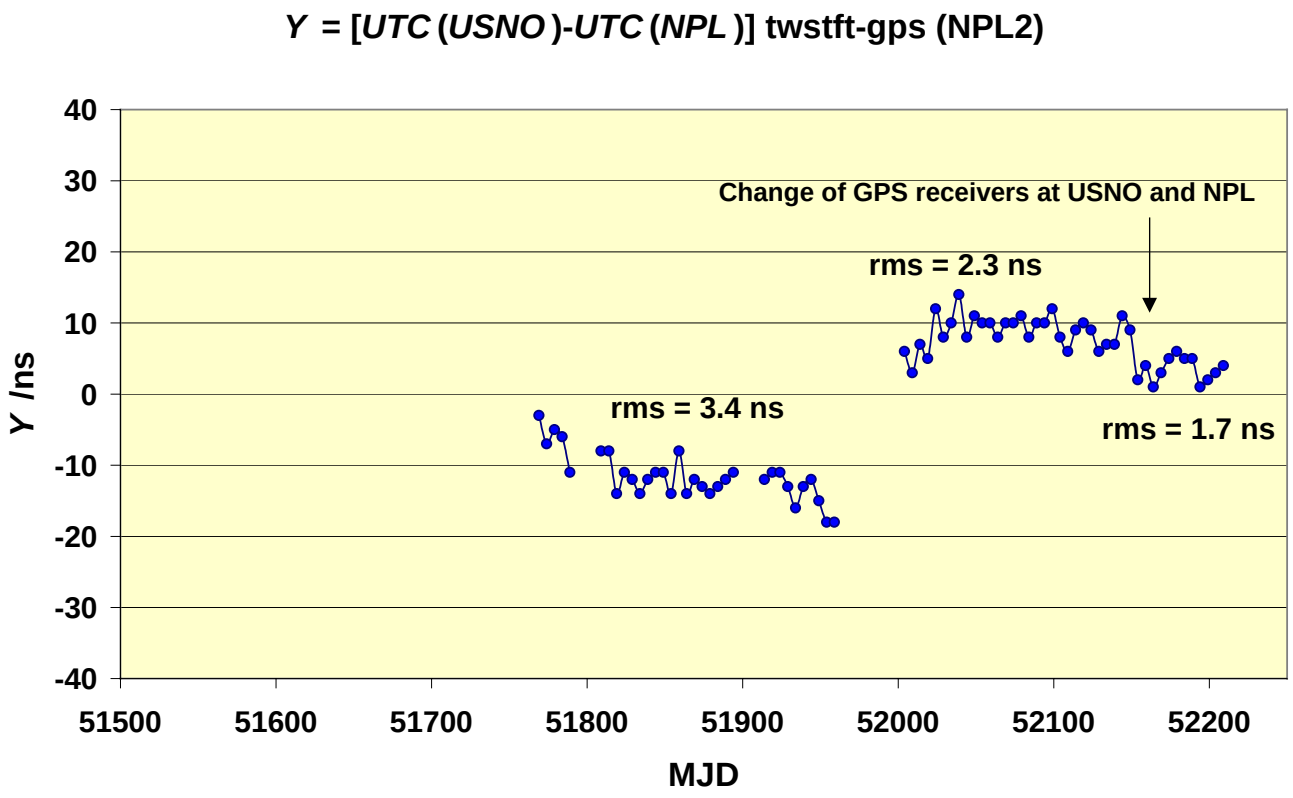


Figure 2. Differences between TWSTFT (NPL station 02) and GPS C/A-code common-view for USNO/NPL link.

Notes: Changes of INTELSAT 307° E transponders from 25 February to 17 March 2001 (MJD 51965-51985) causing time steps.

A new calibration of the USNO/NPL02 TWSTFT link derived from *Circular T* after 17 March 2001 was applied starting from 19 March 2001 (MJD 51987).

Change of GPS receivers at the NPL and USNO at the beginning of September 2001 (about MJD 52154).

Change of USNO modem from Mitrex to Satre on 4 May 2001 (MJD 52033).

Table 3. USNO/PTB link through INTELSAT 307° E

Date 2001 (MJD)	[*UTC(USNO) – UTC(PTB)*] /ns		TWSTFT – GPS
	TWSTFT	GPS	
1 March (51969)	**–35**	–4	–31
6 March (51974)	–43	–8	–35
11 March (51979)	–45	–13	–32
16 March (51984)	**–44**	–18	–26
21 March (51989)	**–37**	–25	–12
26 March (51994)	**–31**	–27	–4
31 March (51999)	–27	–21	–6
5 April (52004)	–23	–25	2
10 April (52009)	–20	–22	2
15 April (52014)	**–17**	–22	5
20 April (52019)	–13	–16	3
25 April (52024)	–8	–9	1
30 April (52029)	–3	–7	4
5 May (52034)	10	–7	17
10 May (52039)	25	–4	29
15 May (52044)	23	–1	24
20 May (52049)	26	2	24
25 May (52054)	27	–2	29
30 May (52059)	27	0	27
4 June (52064)	**26**	3	23
9 June (52069)	22	–2	24
14 June (52074)	**19**	–5	24
19 June (52079)	18	–9	27
24 June (52084)	11	–13	24
29 June (52089)	4	–21	25
4 July (52094)	4	–28	32
9 July (52099)	–2	–30	28
14 July (52104)	–3	–30	27
19 July (52109)	–4	–32	28
24 July (52114)	–4	–30	26
29 July (52119)	–4	–30	26
3 August (52124)	–4	–31	27
8 August (52129)	**–2**	–23	21
13 August (52134)	**–1**	–22	21
18 August (52139)	**0**	–20	20
23 August (52144)	**2**	–20	22
28 August (52149)	**3**	–22	25
2 September (52154)	**4**	–20	24
7 September (52159)	**5**	–17	22
12 September (52164)	**7**	–17	24
17 September (52169)	3	–23	26
22 September (52174)	3	–26	29
27 September (52179)	**–4**	–31	27
2 October (52184)	**–5**	–30	25
7 October (52189)	**–5**	–32	27
12 October (52194)	**–6**	–27	21
17 October (52199)	–5	–32	27
22 October (52204)	–9	–33	24
27 October (52209)	–14	–40	26

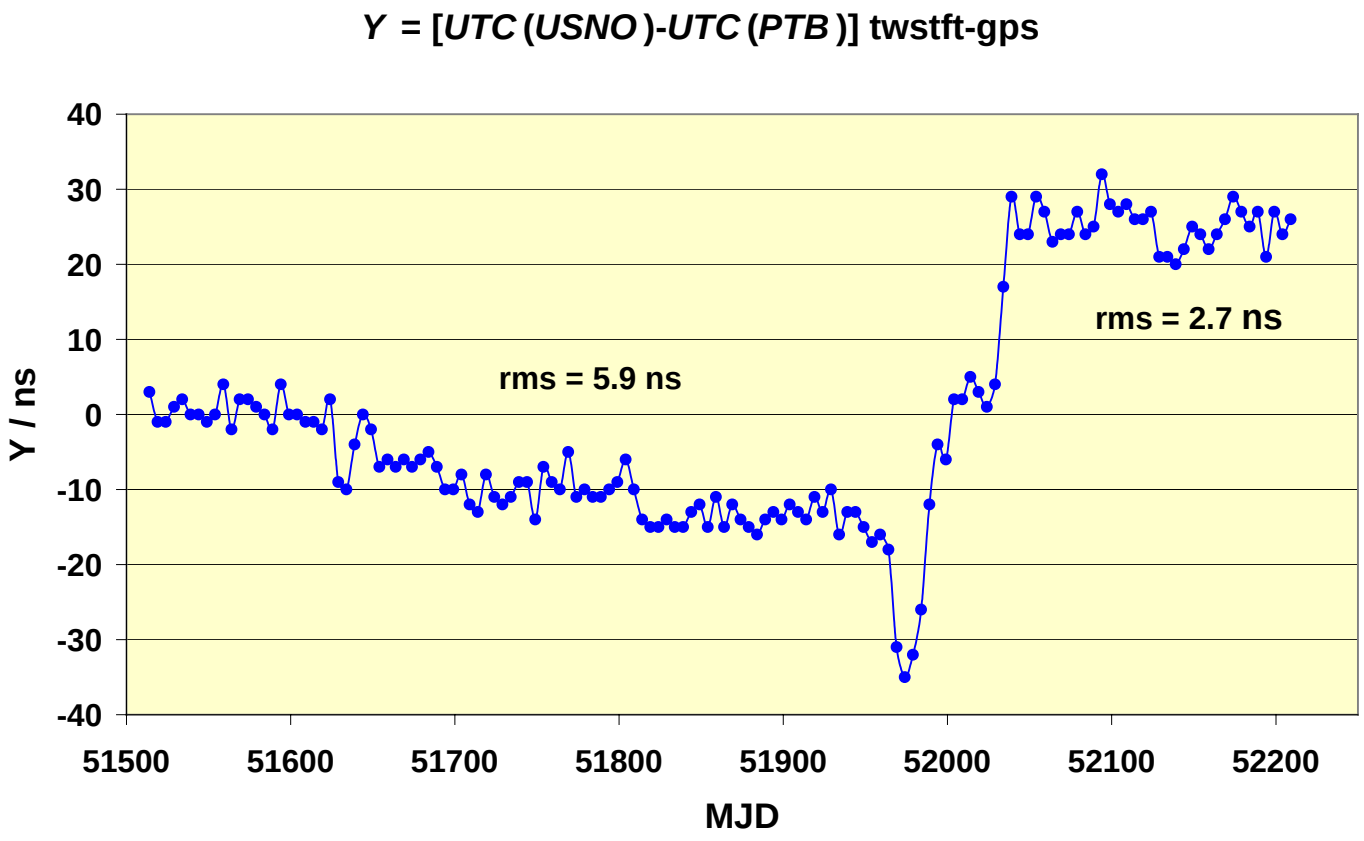


Table 3. Differences between TWSTFT and GPS C/A-code common-view for USNO/PTB link

Note: A calibration of the USNO/PTB TWSTFT link derived from *Circular T* values from July 1999 was applied starting from 29 November 1999 (MJD = 51511).

Changes of INTELSAT 307° E transponders from 25 February to 17 March 2001 (MJD 51965-51985) causing time steps.

Several changes in PTB earth station hardware in March 2001 ending on 28 March 2001 (MJD 51996).

Change of USNO modem from Mitrex to Satre on 4 May 2001 (MJD 52033).

Change of GPS receiver at the USNO at the beginning of September 2001 (about MJD 52154).

Table 4. VSL/PTB link through INTELSAT 307° E

Date 2001 (MJD)	[*UTC(VSL) – UTC(PTB)*] /ns		TWSTFT – GPS
	TWSTFT (*Circular T*)	GPS	
1 March (51969)	–25	–28	3
6 March (51974)	–23	–26	3
11 March (51979)	**–23**	–30	7
16 March (51984)	**–26**	–39	13
21 March (51989)	**–28**	–41	13
26 March (51994)	**–31**	–47	16
31 March (51999)	**–36**	–47	11
5 April (52004)	–35	–40	5
10 April (52009)	–31	–37	6
15 April (52014)	**–33**	–40	7
20 April (52019)	–32	–36	4
25 April (52024)	–17	–17	0
30 April (52029)	**–15**	25	10
5 May (52034)	–13	–17	4
10 May (52039)	–3	–5	2
15 May (52044)	1	–4	5
20 May (52049)	5	5	0
25 May (52054)	8	3	5
30 May (52059)	12	10	2
4 June (52064)	14	14	0
9 June (52069)	17	16	1
14 June (52074)	22	18	4
19 June (52079)	27	22	5
24 June (52084)	28	24	4
29 June (52089)	26	25	1
4 July (52094)	28	19	9
9 July (52099)	25	17	8
14 July (52104)	15	11	4
19 July (52109)	15	8	7
24 July (52114)	13	9	4
29 July (52119)	11	5	6
3 August (52124)	7	4	3
8 August (52129)	16	11	5
13 August (52134)	21	17	4
18 August (52139)	24	20	4
23 August (52144)	13	11	2
28 August (52149)	1	–6	5
2 September (52154)	–1	0	–1
7 September (52159)	8	3	5
12 September (52164)	5	4	1
17 September (52169)	3	–1	4
22 September (52174)	2	–4	6
27 September (52179)	–3	–8	5
2 October (52184)	2	–3	5
7 October (52189)	–6	–12	6
12 October (52194)	–1	–3	2
17 October (52199)	0	–6	6
22 October (52204)	3	–4	7
27 October (52209)	8	5	3

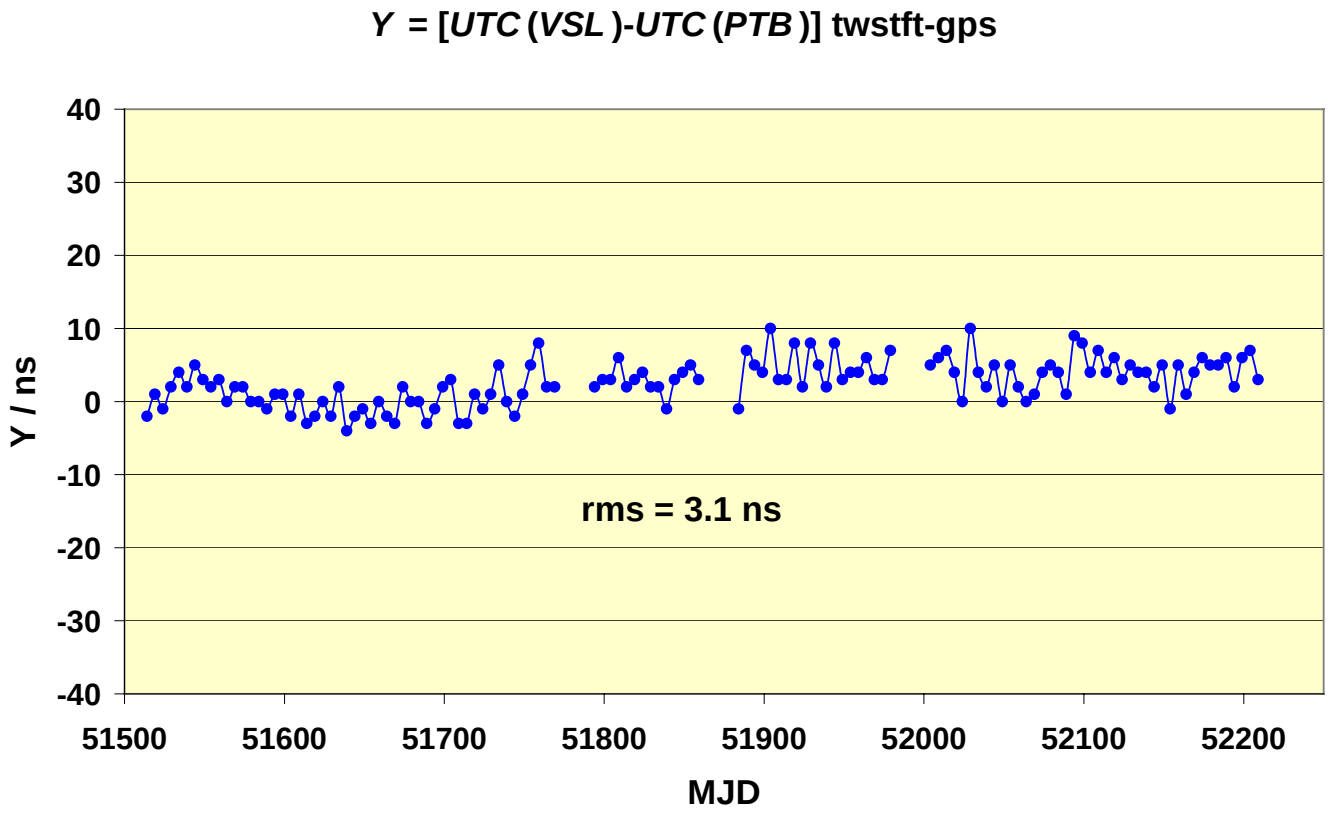


Figure 4. Differences between TWSTFT and GPS C/A-code common-view for VSL/PTB link

Notes: The VSL/PTB TWSTFT link was calibrated by *Circular T*.

The VSL/PTB TWSTFT link has been included in the computation of TAI since 1 January 2000 (MJD = 51544).

Several changes in PTB earth station hardware in March 2001 ending on 28 March 2001 (MJD 51996).

Table 5. NPL/PTB link with NPL TWSTFT Station 01 through INTELSAT 307° E

Date 2001 (MJD)	[*UTC(NPL) – UTC(PTB)*] /ns		TWSTFT – GPS
	TWSTFT (*Circular T*)	GPS	
1 March (51969)	–24	–24	0
6 March (51974)	–28	–26	–2
11 March (51979)	–28	–30	2
16 March (51984)	–29	–35	6
21 March (51989)	–31*	–38	7
26 March (51994)	–34*	–42	8
31 March (51999)	–37	–41	4
5 April (52004)	–31	–31	0
10 April (52009)	–26	–28	2
15 April (52014)	–22*	–23	1
20 April (52019)	–18	–19	1
25 April (52024)	–12	–9	–3
30 April (52029)	–7	–6	–1
5 May (52034)	–3	–3	0
10 May (52039)	3	5	–2
15 May (52044)	2	2	0
20 May (52049)	4	8	–4
25 May (52054)	8	6	2
30 May (52059)	9	10	–1
4 June (52064)	13	16	–3
9 June (52069)	16	19	–3
14 June (52074)	19	21	–2
19 June (52079)	21	23–2	
24 June (52084)	18	19	–1
29 June (52089)	12	16	–4
4 July (52094)	12	9	3
9 July (52099)	9	12	–3
14 July (52104)	9	6	3
19 July (52109)	6	3	3
24 July (52114)	–2	–1	–1
29 July (52119)	–7	–6	–1
3 August (52124)	–9	–8	–1
8 August (52129)	–4	–7	3
13 August (52134)	–1	–3	2
18 August (52139)	–2	–2	0
23 August (52144)	–4	–1	–3
28 August (52149)	–7	–5	–2
2 September (52154)	–5	–2	–3
7 September (52159)	–1	–1	0
12 September (52164)	–5	–2	–3
17 September (52169)	–10	–9	–1
22 September (52174)	–12	–10	–2
27 September (52179)	–20	–19	–1
2 October (52184)	–21	–20	–1
7 October (52189)	–23	–22	–1
12 October (52194)	–27	–23	–4
17 October (52199)	–29	–29	0
22 October (52204)	–36	–34	–2
27 October (52209)	–44	–41	–3

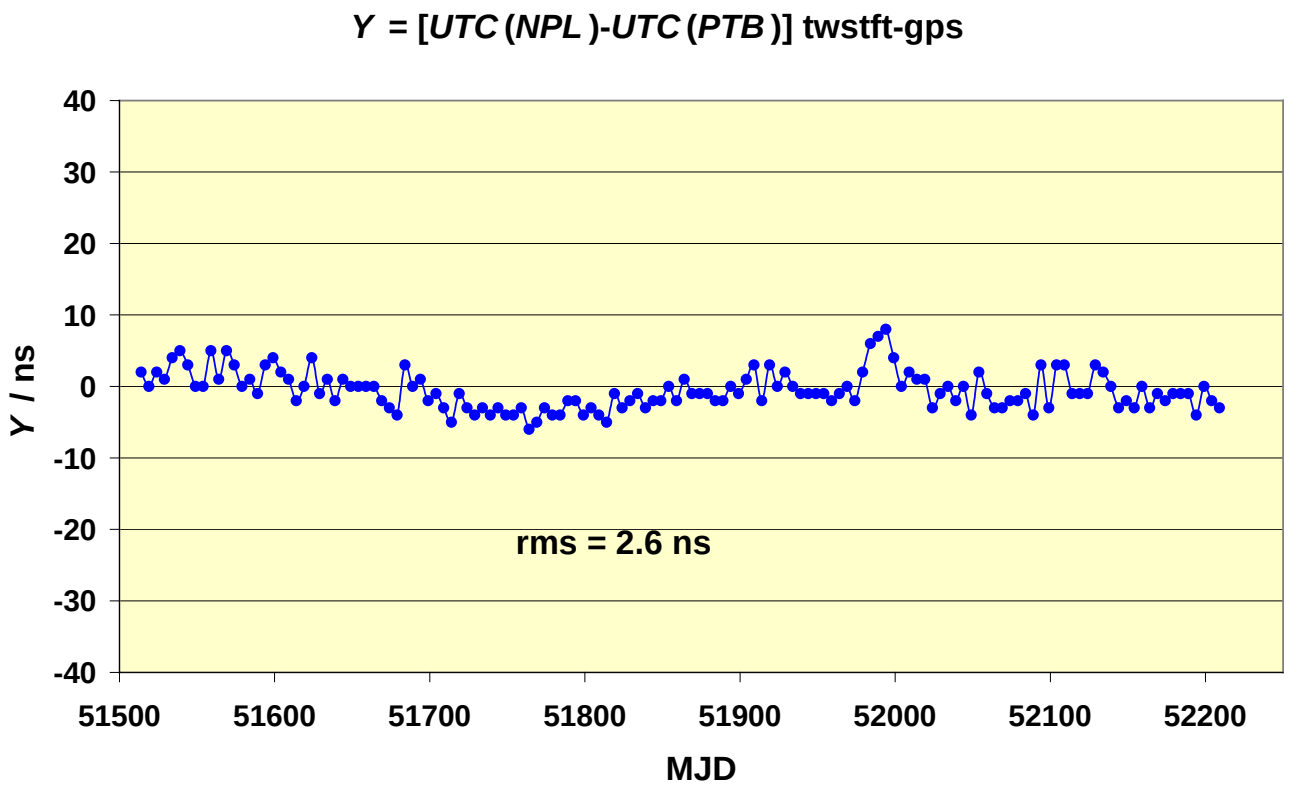


Figure 5. Differences between TWSTFT (NPL station 01) and GPS C/A-code common-view for NPL/PTB link.

Notes: A new calibration of the NPL/PTB TWSTFT link using *Circular T* was applied on 29 November 1999 (MJD = 51511).

The NPL/PTB TWSTFT link has been included in the computation of TAI since 4 July 2000 (MJD = 51729).

Several changes in PTB earth station hardware in March 2001 ending on 28 March 2001 (MJD 51996).

Change of GPS receiver at the NPL at the beginning of September 2001 (about MJD 52154).

Table 6. NPL/VSL link with NPL TWSTFT Station 01 through INTELSAT 307° E

Date 2001 (MJD)	[*UTC(NPL) – UTC(VSL)*] /ns		TWSTFT – GPS
	TWSTFT	GPS	
1 March (51969)	2	4	–2
6 March (51974)	–4	–1	–3
11 March (51979)	**–5**	–1	–4
16 March (51984)	**–2**	4	–6
21 March (51989)	**0**	3	–3
26 March (51994)	2	3	–1
31 March (51999)	3	5	–2
5 April (52004)	4	13	–9
10 April (52009)	5	9	–4
15 April (52014)	**10**	18	–8
20 April (52019)	14	18	–4
25 April (52024)	5	8	–3
30 April (52029)	**7**	14	–7
5 May (52034)	9	13	–4
10 May (52039)	5	10	–5
15 May (52044)	0	6	–6
20 May (52049)	–1	3	–4
25 May (52054)	**–2**	4	–6
30 May (52059)	**–4**	1	–5
4 June (52064)	1	2	–1
9 June (52069)	–1	3	–4
14 June (52074)	–3	3	–6
19 June (52079)	–6	1	–7
24 June (52084)	**–8**	–5	–3
29 June (52089)	–13	–9	–4
4 July (52094)	–16	–10	–6
9 July (52099)	–16	–10	–6
14 July (52104)	–6	–6	0
19 July (52109)	–9	–5	–4
24 July (52114)	–14	–10	–4
29 July (52119)	–18	–12	–6
3 August (52124)	–16	–12	–4
8 August (52129)	–21	–18	–3
13 August (52134)	–23	–20	–3
18 August (52139)	–24	–22	–2
23 August (52144)	–18	–12	–6
28 August (52149)	–6	1	–7
2 September (52154)	–5	–2	–3
7 September (52159)	–9	–4	–5
12 September (52164)	–11	–6	–5
17 September (52169)	–14	–7	–7
22 September (52174)	–14	–7	–7
27 September (52179)	–18	–10	–8
2 October (52184)	–22	–17	–5
7 October (52189)	–18	–10	–8
12 October (52194)	–27	–20	–7
17 October (52199)	–35	–23	–12
22 October (52204)	–39	–30	–9
27 October (52209)	–53	–46	–7

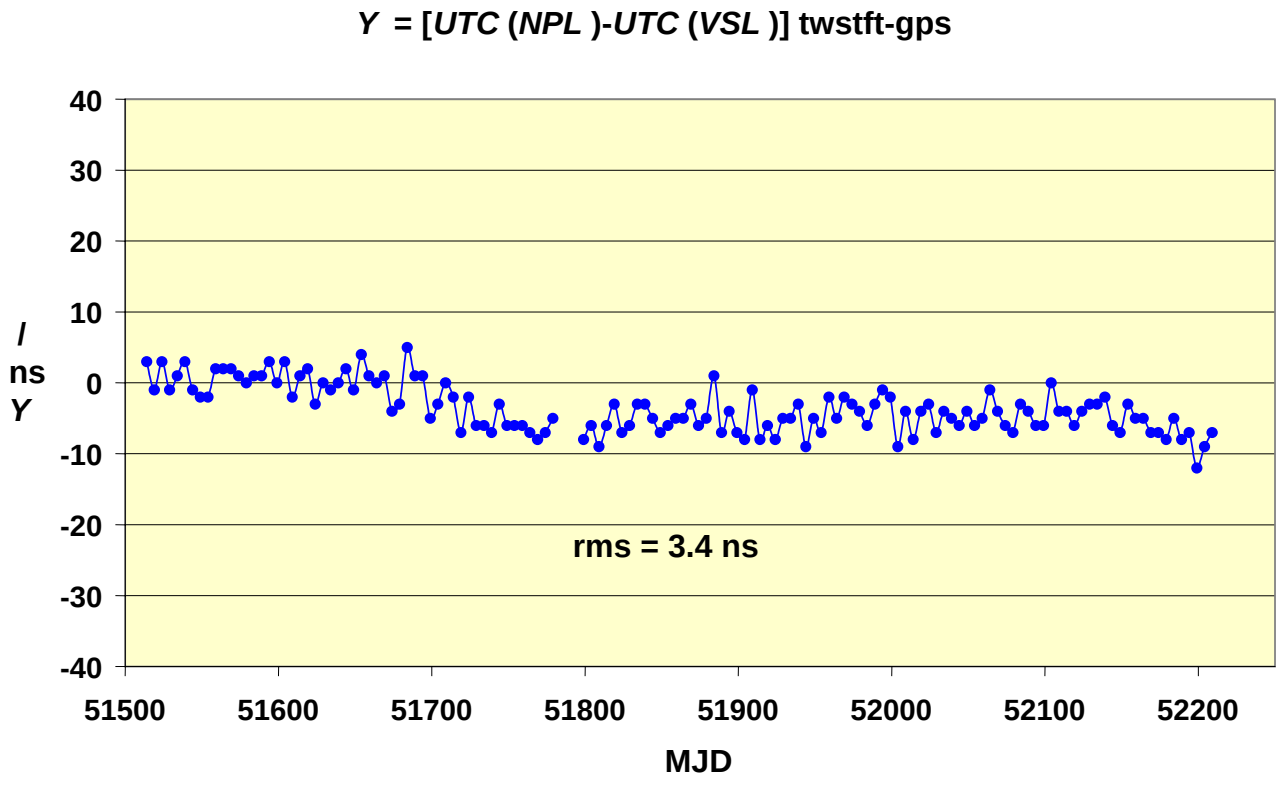


Figure 6. Differences between TWSTFT (NPL station 01) and GPS C/A-code common-view for NPL/VSL link

Note: A new calibration of the NPL/VSL TWSTFT link using *Circular T* was applied on 29 November 1999 (MJD = 51511).

Change of GPS receiver at the NPL at the beginning of September 2001 (about MJD 52154).

Table 7. PTB/OCA link through INTELSAT 307° E

Date 2001 (MJD)	[*UTC(PTB) – OCA clock*] /ns		TWSTFT – GPS
	TWSTFT	GPS	
4 February (51944)	4852	–	–
9 February (51949)	5000	–	–
14 February (51954)	5121	4911	210
19 February (51959)	5244	5036	208
24 February (51964)	5368	5157	211
1 March (51969)	**5497**	–	–
6 March (51974)	5637	5429	208
11 March (51979)	**5721**	5559	162
16 March (51984)	**5824**	5690	134
21 March (51989)	**5927**	5810	117
26 March (51994)	**6029**	5945	84
31 March (51999)	6156	6063	93
5 April (52004)	6258	6191	67
10 April (52009)	6376	6310	66
15 April (52014)	**–3496**	–3558	62
20 April (52019)	–3362	–3431	69
25 April (52024)	–3231	–3306	75
30 April (52029)	–3148	–3222	74
5 May (52034)	–	–3199	–
10 May (52039)	–	–3079	–
15 May (52044)	**–4211**	–4290	79
20 May (52049)	**–4300**	–4372	72
25 May (52054)	–4386	–4462	76
30 May (52059)	–4466	–4542	76
4 June (52064)	**–4542**	–4619	77
9 June (52069)	–4624	–4708	84
14 June (52074)	–4711	–4790	79
19 June (52079)	–4794	–4869	75
24 June (52084)	–4866	–4950	84
29 June (52089)	–4935	–5016	81
4 July (52094)	–5011	–5088	77
9 July (52099)	–5085	–5159	74
14 July (52104)	–5166	–5241	75
19 July (52109)	**–5243**	–5318	75
24 July (52114)	–5314	–5394	80
29 July (52119)	–5385	–5462	77
3 August (52124)	–5458	–5540	82
8 August (52129)	–5540	–5612	72
13 August (52134)	–	–5696	–
18 August (52139)	–5687	–5770	83
23 August (52144)	**–5760**	–5829	69
28 August (52149)	**–5834**	–5900	66
2 September (52154)	**–5908**	–5980	72
7 September (52159)	**–5983**	–6064	81
12 September (52164)	**–6057**	6152	95
17 September (52169)	**–6131**	–6217	86
22 September (52174)	**–6205**	–6298	93
27 September (52179)	3722	3643	79
2 October (52184)	–	3580	–
7 October (52189)	3568	3496	72
12 October (52194)	3491	3417	74
17 October (52199)	3408	3335	73
22 October (52204)	3332	3262	70
27 October (52209)	3261	3189	72

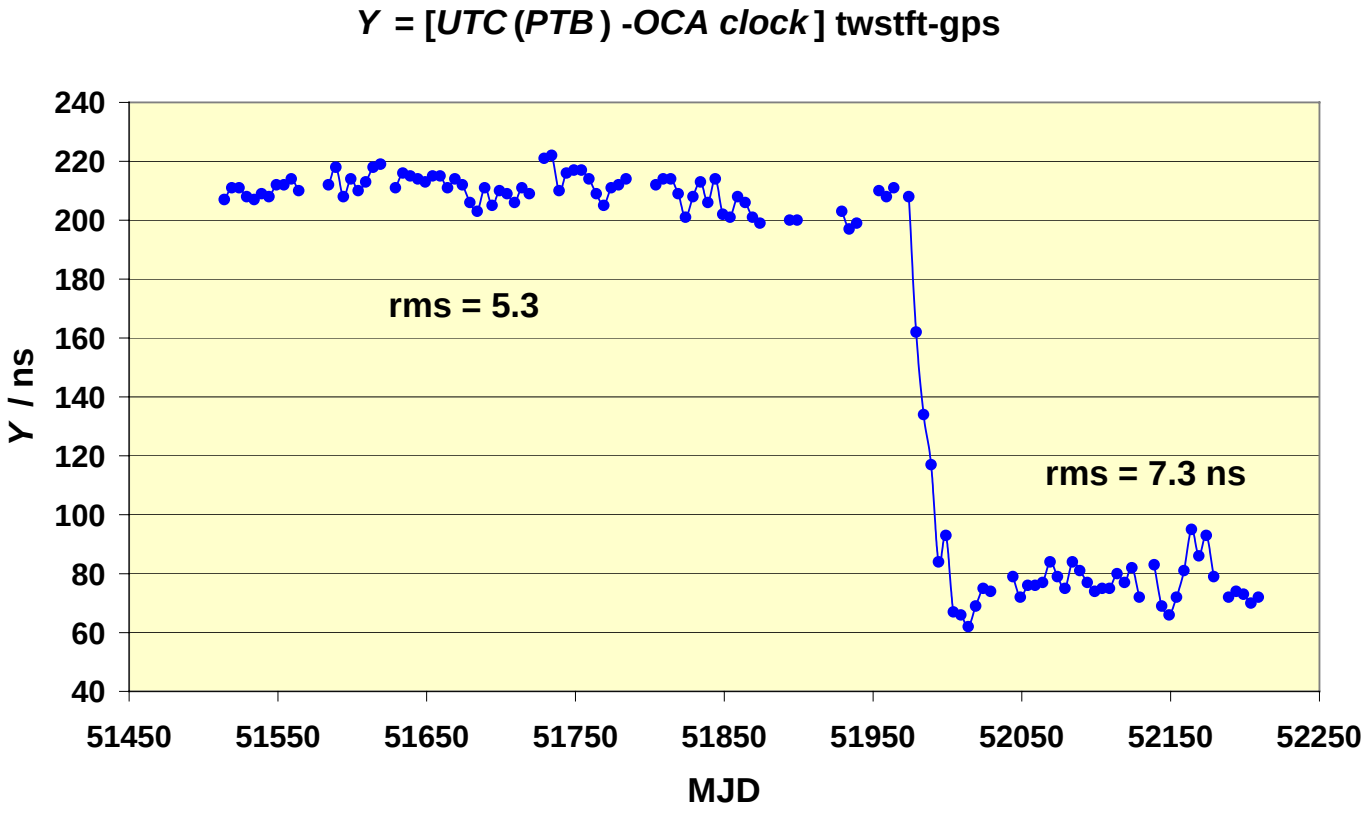


Figure 7. Differences between TWSTFT and GPS C/A-code common-view for PTB/OCA link. TWSTFT is not calibrated.

Note: Several changes in PTB earth station hardware in March 2001 ending on 28 March 2001 (MJD 51996).

Table 8. IEN/PTB link through INTELSAT 307° E

Date 2001 (MJD)	[*UTC(IEN)* – *UTC(PTB)*] /ns		TWSTFT – GPS
	TWSTFT	GPS (*Circular T*)	
4 July (52094)	186	–56	242
9 July (52099)	186	–55	241
14 July (52104)	183	–57	240
19 July (52109)	176	–67	243
24 July (52114)	168	–70	238
29 July (52119)	161	–77	238
3 August (52124)	159	–79	238
8 August (52129)	155	–86	241
13 August (52134)	157	–83	240
18 August (52139)	**154**	–86	240
23 August (52144)	151	–87	238
28 August (52149)	146	–92	238
2 September (52154)	147	–92	239
7 September (52159)	147	–95	242
12 September (52164)	**147**	–94	241
17 September (52169)	**148**	–93	241
22 September (52174)	144	–91	235
27 September (52179)	146	–90	236
2 October (52184)	157	–81	238
7 October (52189)	154	–81	235
12 October (52194)	158	–76	234
17 October (52199)	171	–66	237
22 October (52204)	176	–62	238
27 October (52209)	169	–65	234

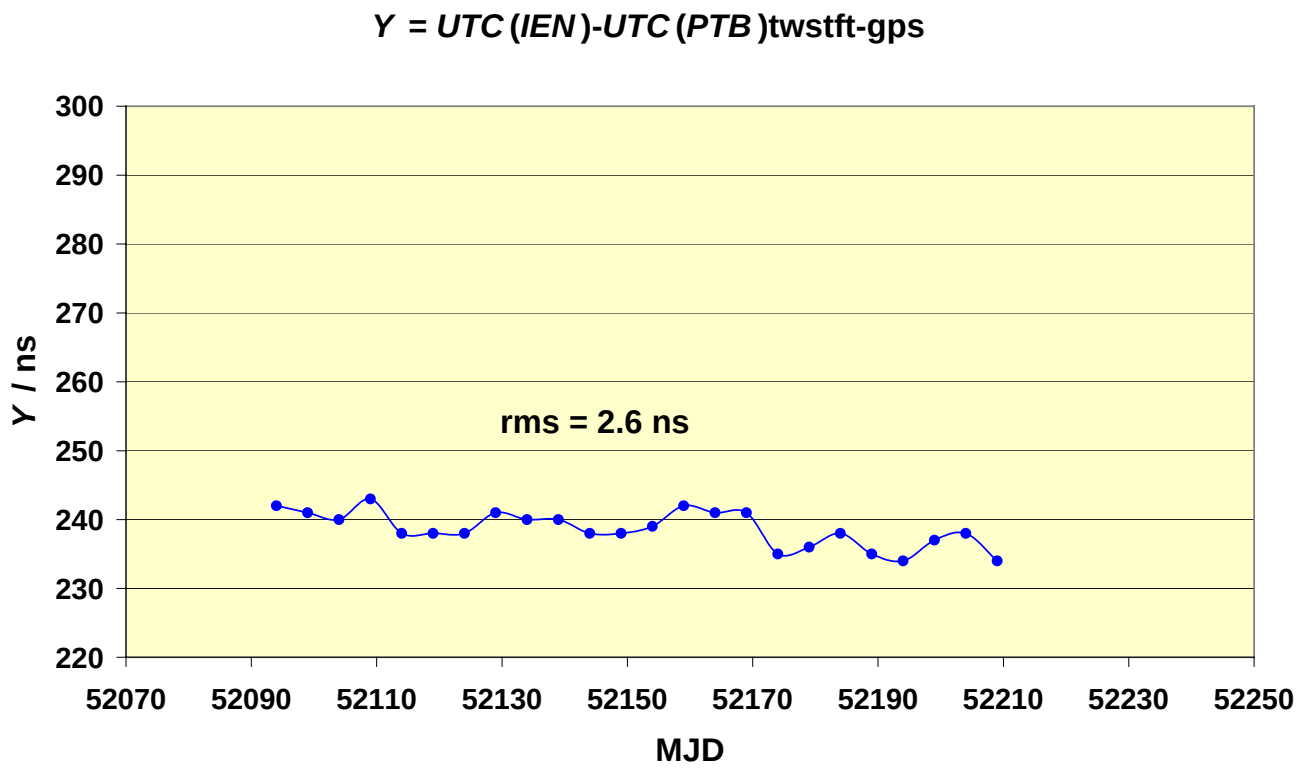


Figure 8. Differences between TWSTFT and GPS C/A-code common-view for IEN/PTB link. TWSTFT is not calibrated.

Table 9. NML/CRL link through INTELSAT 176° E

Date 2001 (MJD)	[*UTC(NML) – UTC(CRL)*] /ns		TWSTFT – GPS
	TWSTFT	GPS (*Circular T*)	
20 April (52019)	93	76	17
25 April (52024)	109	94	15
30 April (52029)	115	97	18
5 May (52034)	**111**	92	19
10 May (52039)	**105**	75	30
15 May (52044)	113	84	29
20 May (52049)	117	99	18
25 May (52054)	**132**	120	12
30 May (52059)	140	112	28
4 June (52064)	140	113	27
9 June (52069)	139	108	31
14 June (52074)	142	114	28
19 June (52079)	123	96	27
24 June (52084)	114	84	30
29 June (52089)	107	77	30
4 July (52094)	95	69	26
9 July (52099)	98	62	36
14 July (52104)	**79**	62	17
19 July (52109)	**64**	30	34
24 July (52114)	**57**	28	29
29 July (52119)	**58**	29	29
3 August (52124)	57	29	28
8 August (52129)	64	41	23
13 August (52134)	52	21	31
18 August (52139)	40	10	30
23 August (52144)	31	–3	34
28 August (52149)	31	8	23
2 September (52154)	26	1	25
7 September (52159)	18	–6	24
12 September (52164)	14	–7	21
17 September (52169)	21	2	19
22 September (52174)	15	–5	20
27 September (52179)	21	–4	25
2 October (52184)	18	4	14
7 October (52189)	**30**	5	25
12 October (52194)	34	6	28
17 October (52199)	28	1	27
22 October (52204)	26	–3	29
27 October (52209)	27	–5	32

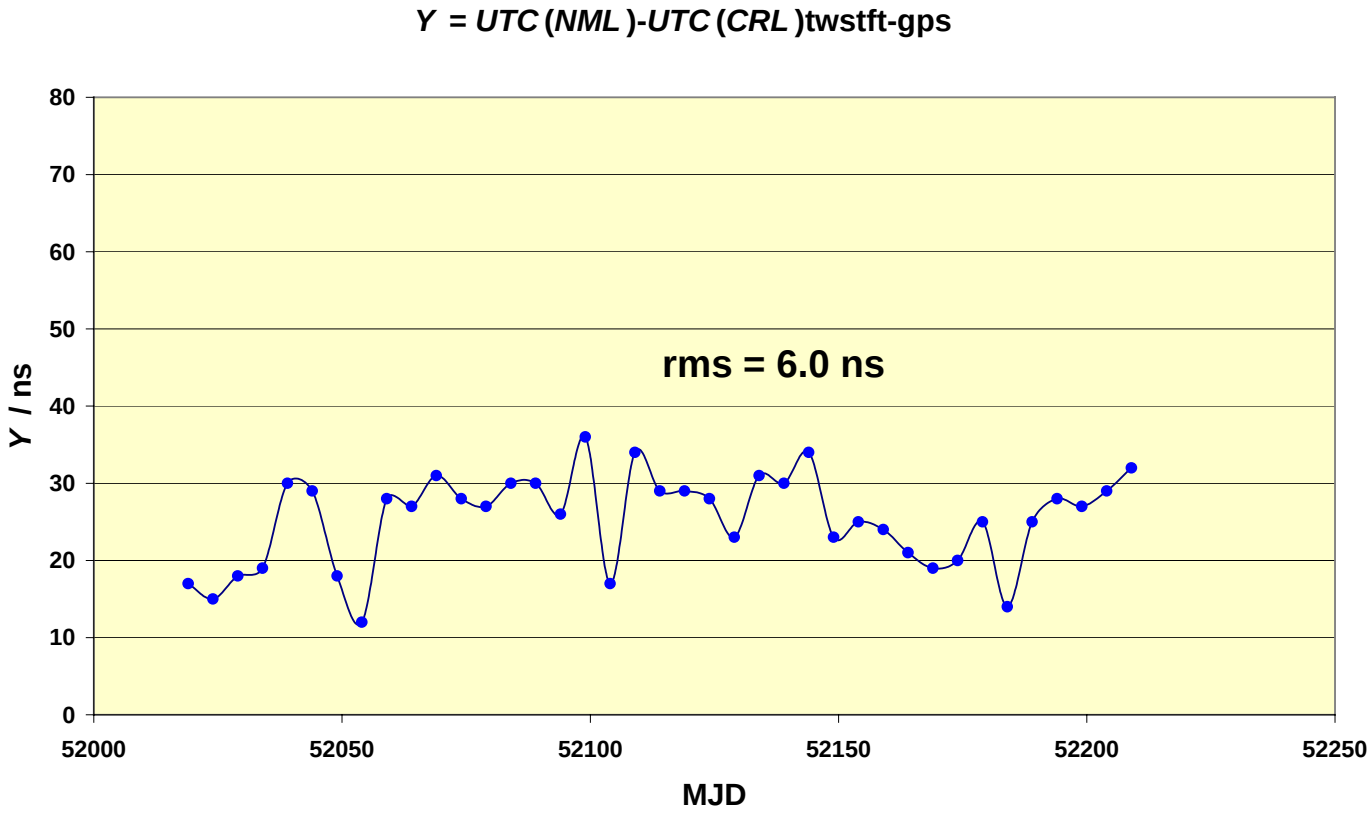


Figure 9. Differences between TWSTFT and GPS C/A-code common-view for NML/CRL link. TWSTFT is not calibrated.

Table 10. CSAO/CRL link through JCSAT-1B at 150° E

Date 2001 (MJD)	[*UTC(CSAO) – UTC(CRL)*] /ns		TWSTFT – GPS
	TWSTFT	GPS (*Circular T*)	
20 April (52019)	–57	–85	28
25 April (52024)	–60	–77	17
30 April (52029)	–50	–72	22
5 May (52034)	**–41**	–66	25
10 May (52039)	–43	–72	29
15 May (52044)	–44	–65	21
20 May (52049)	–29	–43	14
25 May (52054)	–25	–42	17
30 May (52059)	–14	–43	29
4 June (52064)	–8	–34	26
9 June (52069)	–4	–25	21
14 June (52074)	–2	–20	18
19 June (52079)	6	–16	22
24 June (52084)	13	–5	18
29 June (52089)	20	–3	23
4 July (52094)	20	–5	25
9 July (52099)	24	–1	25
14 July (52104)	31	8	23
19 July (52109)	**42**	21	21
24 July (52114)	**52**	29	23
29 July (52119)	**51**	29	22
3 August (52124)	40	23	17
8 August (52129)	43	29	14
13 August (52134)	42	18	24
18 August (52139)	38	16	22
23 August (52144)	**38**	7	31
28 August (52149)	49	22	27
2 September (52154)	49	18	31
7 September (52159)	46	28	18
12 September (52164)	42	26	16
17 September (52169)	48	32	16
22 September (52174)	55	32	23
27 September (52179)	48	24	24
2 October (52184)	49	31	18
7 October (52189)	42	24	18
12 October (52194)	33	11	22
17 October (52199)	26	0	26
22 October (52204)	26	0	26
27 October (52209)	34	11	23

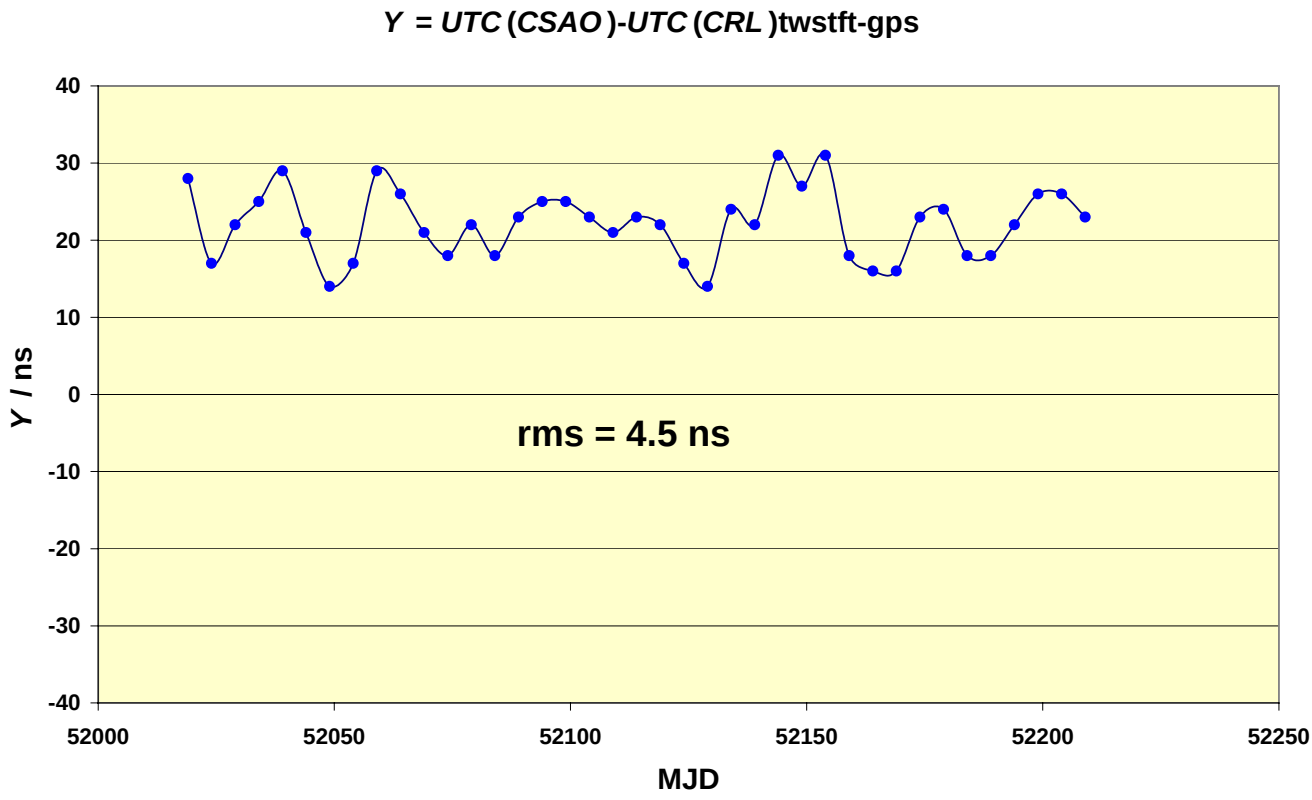


Figure 10. Differences between TWSTFT and GPS C/A-code common-view for CSAO/CRL link. TWSTFT is not calibrated.

Table 11. NMIJ/CRL link through JCSAT-1B at 150° E

Date 2001 (MJD)	[*UTC(NMIJ) – UTC(CRL)*] /ns		TWSTFT – GPS
	TWSTFT	GPS (*Circular T*)	
20 April (52019)	180	86	94
25 April (52024)	180	84	96
30 April (52029)	191	97	94
5 May (52034)	**190**	89	101
10 May (52039)	181	86	95
15 May (52044)	176	82	94
20 May (52049)	180	91	89
25 May (52054)	178	85	93
30 May (52059)	172	77	95
4 June (52064)	160	66	94
9 June (52069)	157	67	90
14 June (52074)	158	67	91
19 June (52079)	160	64	96
24 June (52084)	160	60	100
29 June (52089)	167	74	93
4 July (52094)	164	69	95
9 July (52099)	164	69	95
14 July (52104)	165	72	93
19 July (52109)	**162**	72	90
24 July (52114)	**165**	76	89
29 July (52119)	**167**	73	94
3 August (52124)	**170**	66	104
8 August (52129)	**172**	67	105
13 August (52134)	**175**	54	121
18 August (52139)	**177**	57	120
23 August (52144)	**180**	57	123
28 August (52149)	**182**	71	111
2 September (52154)	**185**	78	107
7 September (52159)	**187**	85	102
12 September (52164)	**190**	97	93
17 September (52169)	**192**	102	90
22 September (52174)	**195**	105	90
27 September (52179)	**197**	98	99
2 October (52184)	207	109	98
7 October (52189)	208	110	98
12 October (52194)	209	109	100
17 October (52199)	204	112	92
22 October (52204)	208	105	103
27 October (52209)	**206**	106	100

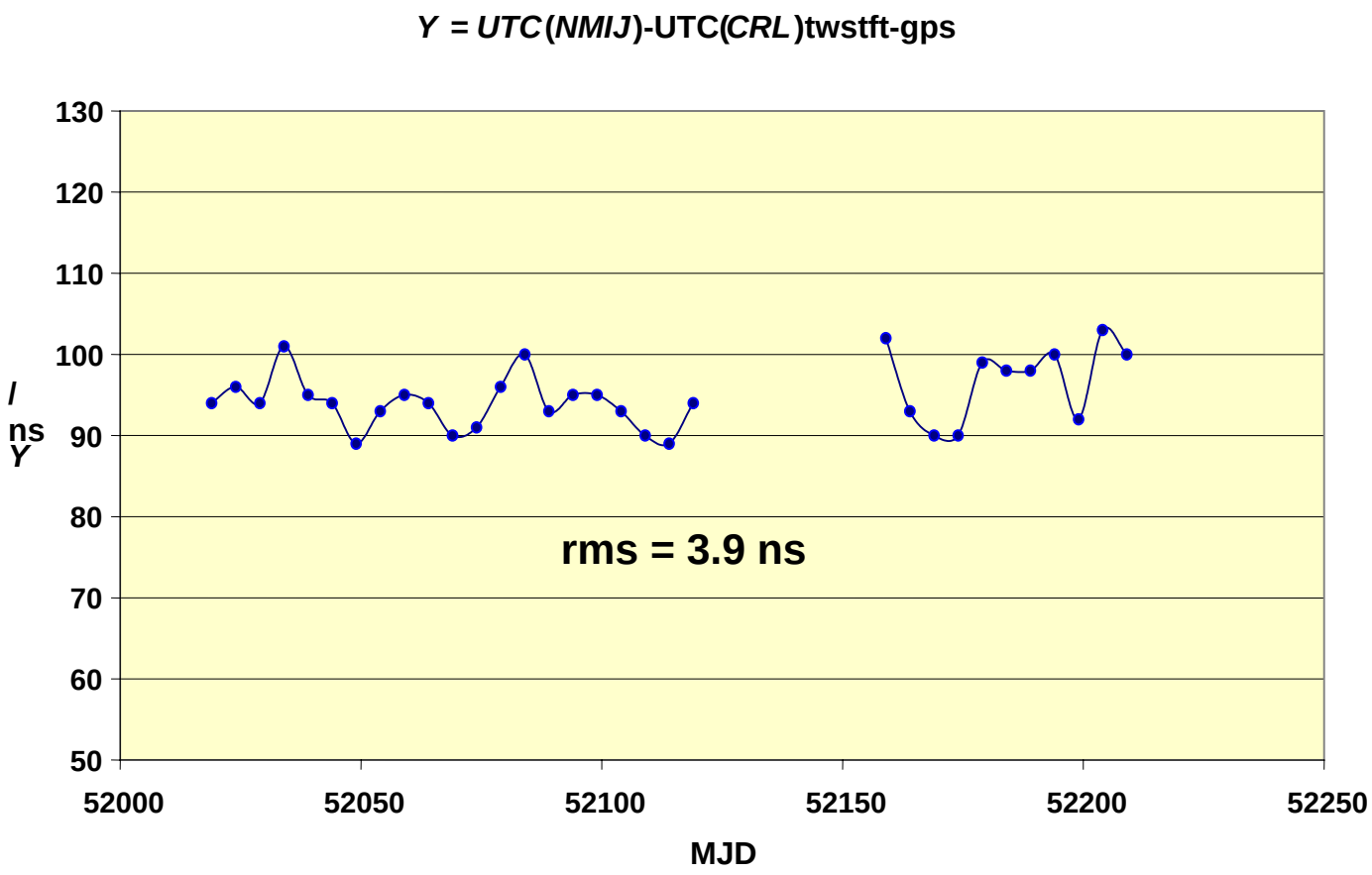


Figure 11. Differences between TWSTFT and GPS C/A-code common-view for NMIJ/CRL link. TWSTFT is not calibrated.

Table 12. TL/CRL link through JCSAT-1B at 150° E

Date 2001 (MJD)	[*UTC(TL) – UTC(CRL)*] /ns		TWSTFT – GPS
	TWSTFT	GPS (*Circular T*)	
20 April (52019)	95	43	52
25 April (52024)	81	25	56
30 April (52029)	76	16	60
5 May (52034)	**61**	5	56
10 May (52039)	45	–8	53
15 May (52044)	20	–37	57
20 May (52049)	14	–38	52
25 May (52054)	4	–46	50
30 May (52059)	20	–39	59
4 June (52064)	9	–48	57
9 June (52069)	**2**	–46	48
14 June (52074)	1	–55	56
19 June (52079)	**9**	–50	59
24 June (52084)	**14**	–48	62
29 June (52089)	18	–42	60
4 July (52094)	14	–47	61
9 July (52099)	17	–49	66
14 July (52104)	18	–43	61
19 July (52109)	**22**	–39	61
24 July (52114)	**32**	–30	62
29 July (52119)	**24**	–28	52
3 August (52124)	18	–38	56
8 August (52129)	21	–28	49
13 August (52134)	12	–51	63
18 August (52139)	17	–41	58
23 August (52144)	19	–52	71
28 August (52149)	21	–41	62
2 September (52154)	26	–37	63
7 September (52159)	23	–31	54
12 September (52164)	26	–38	64
17 September (52169)	**28**	–25	53
22 September (52174)	32	–21	53
27 September (52179)	36	–30	66
2 October (52184)	31	–23	54
7 October (52189)	68	15	53
12 October (52194)	**74**	8	66
17 October (52199)	**72**	30	42
22 October (52204)	80	11	69
27 October (52209)	83	23	60

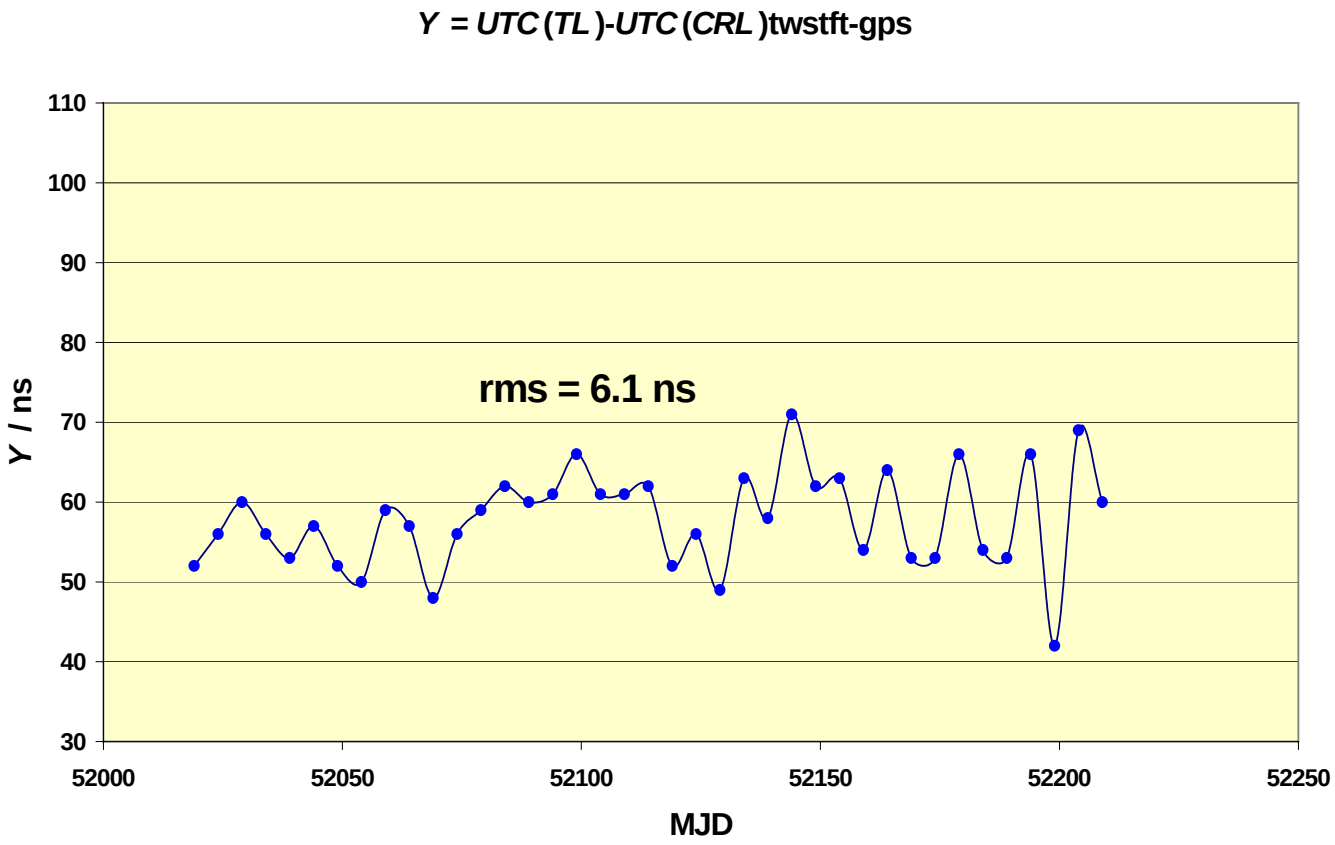


Figure 12. Differences between TWSTFT and GPS C/A-code common-view for TL/CRL link. TWSTFT is not calibrated.

Section II

Frequency stability of some TWSTFT and GPS CV links
reported in Section I

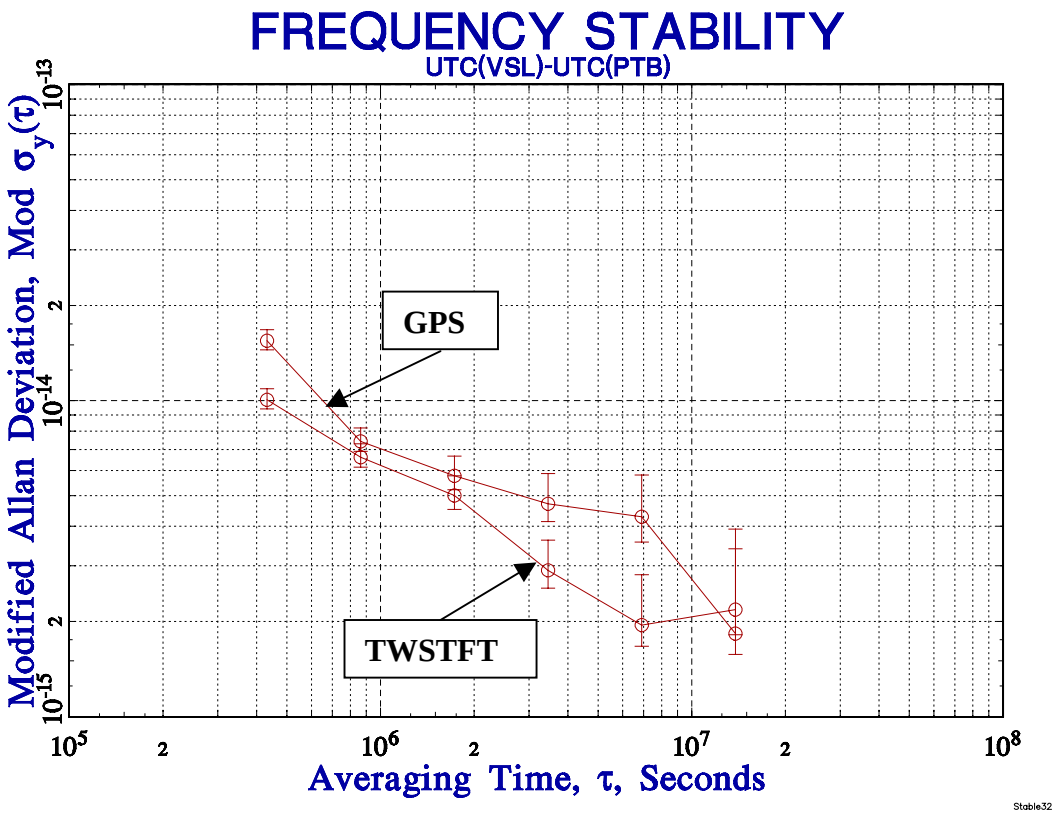


Figure 1. Frequency stability of [*UTC(VSL) – UTC(PTB)*] by GPS CV and by TWSTFT for the MJD period 51269 - 52209.

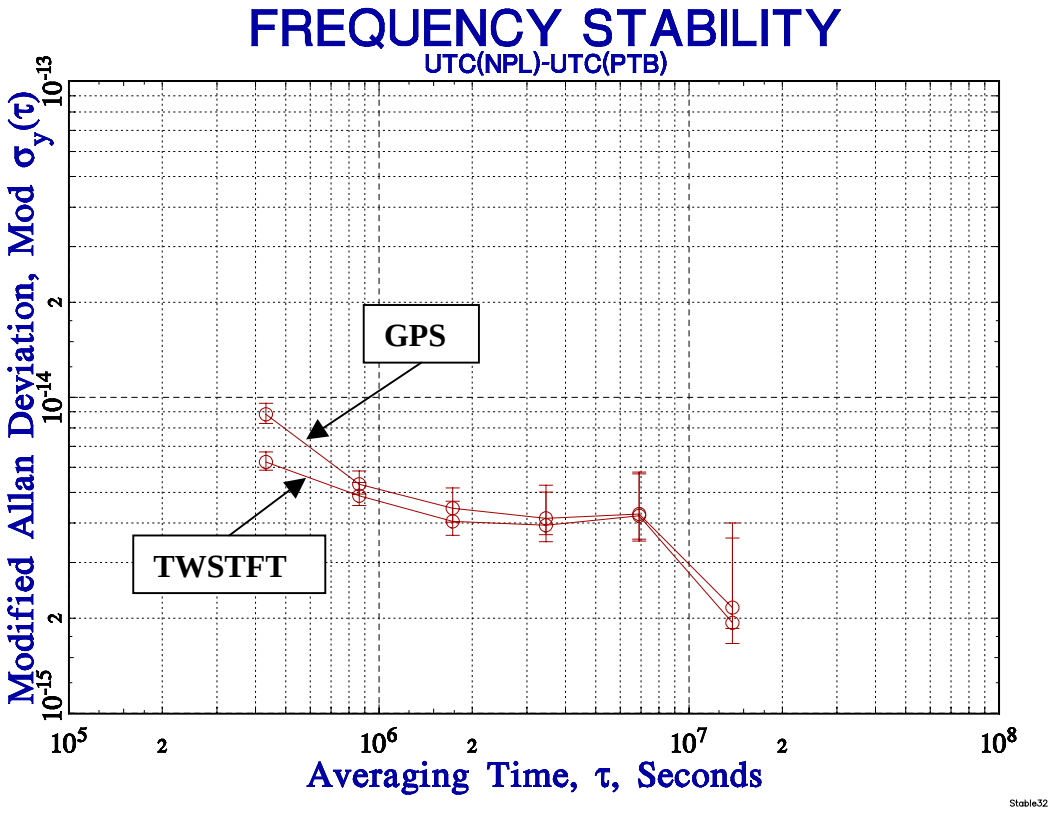


Figure 2. Frequency stability of [*UTC(NPL) – UTC(PTB)*] by GPS CV and by TWSTFT for the MJD period 51269 - 52209.

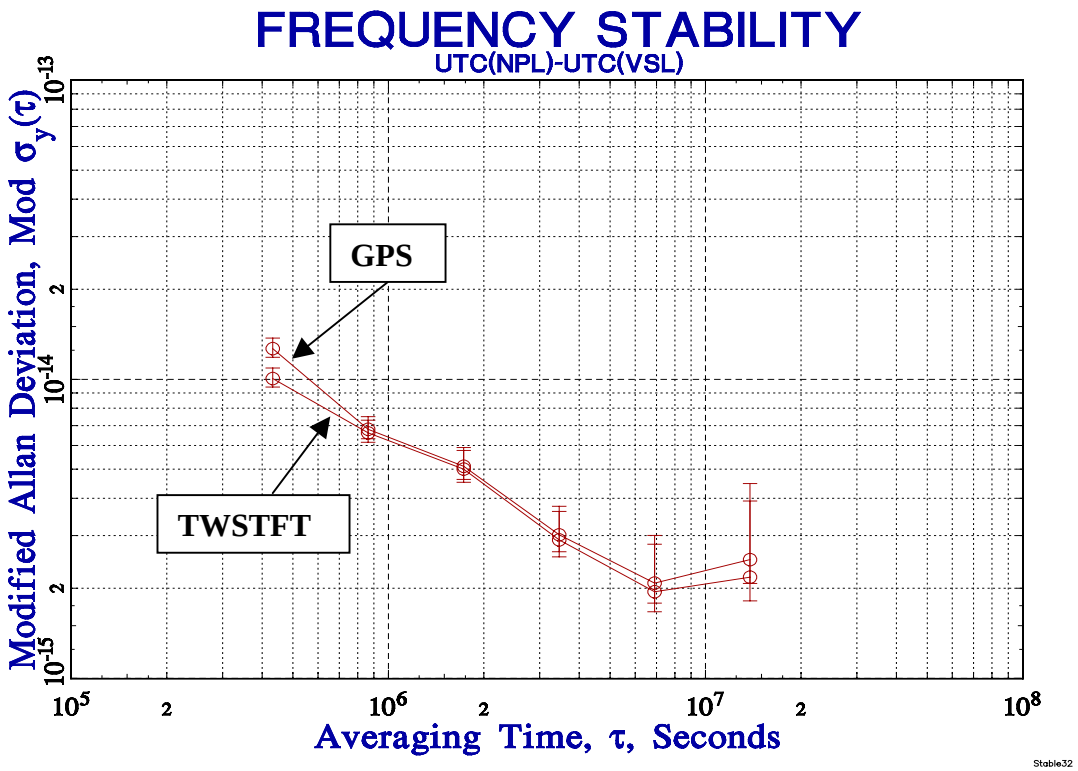


Figure 3. Frequency stability of [*UTC(NPL) – UTC(VSL)*] by GPS CV and by TWSTFT. for the MJD period 51269 - 52209.

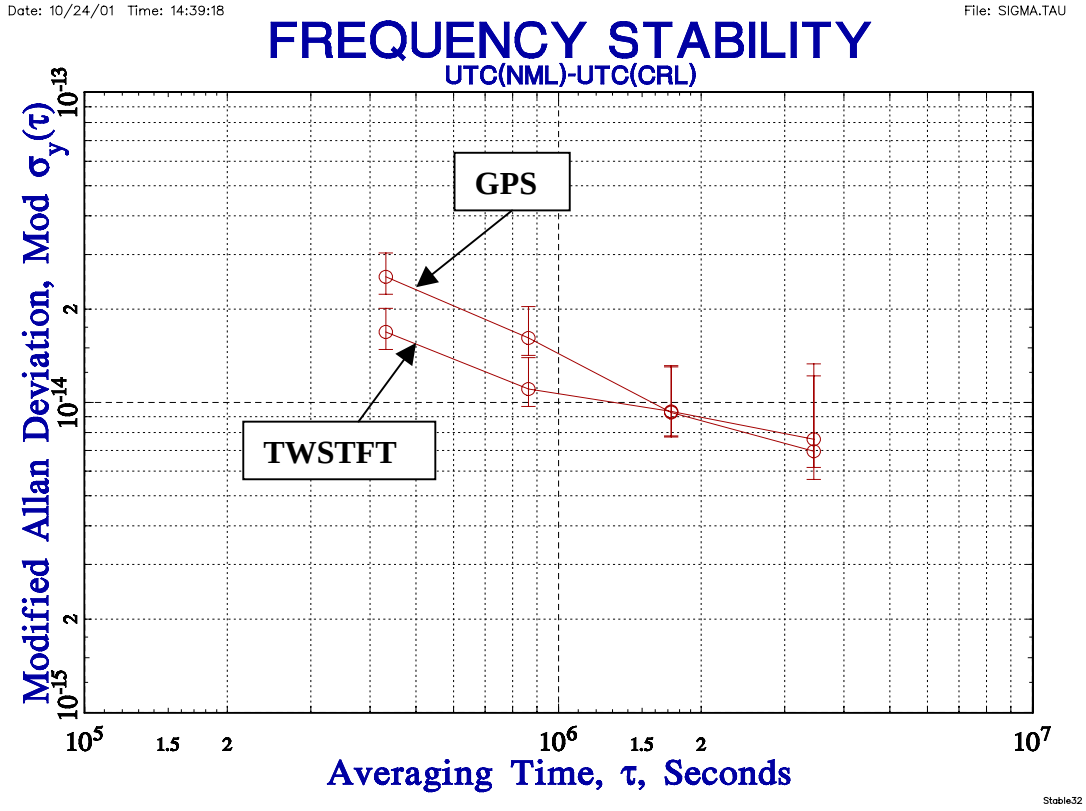


Figure 4. Frequency stability of [*UTC(NML) – UTC(CRL)*] by GPS CV and by TWSTFT. for the MJD period 52019 - 52209.

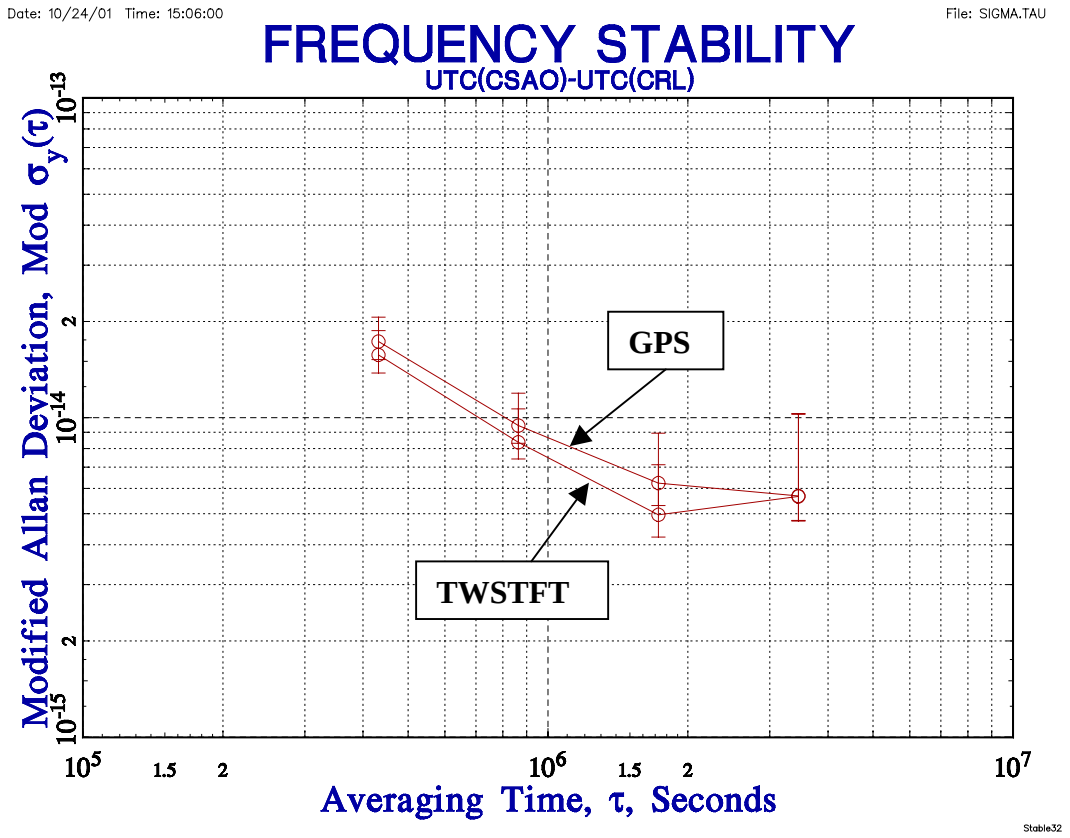


Figure 5. Frequency stability of [*UTC(CSAO) – UTC(CRL)*] by GPS CV and by TWSTFT. for the MJD period 52019 - 52209.

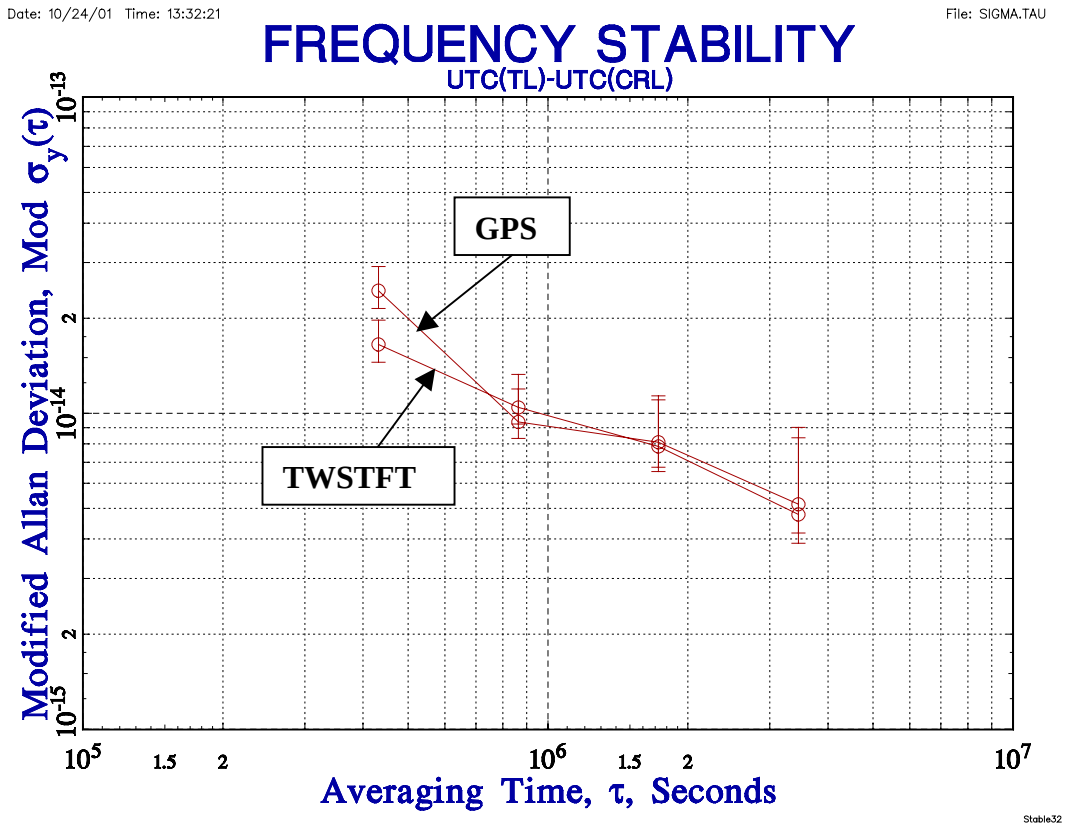


Figure 6. Frequency stability of [*UTC(TL) – UTC(CRL)*] by GPS CV and by TWSTFT. for the MJD period 52019 - 52209.

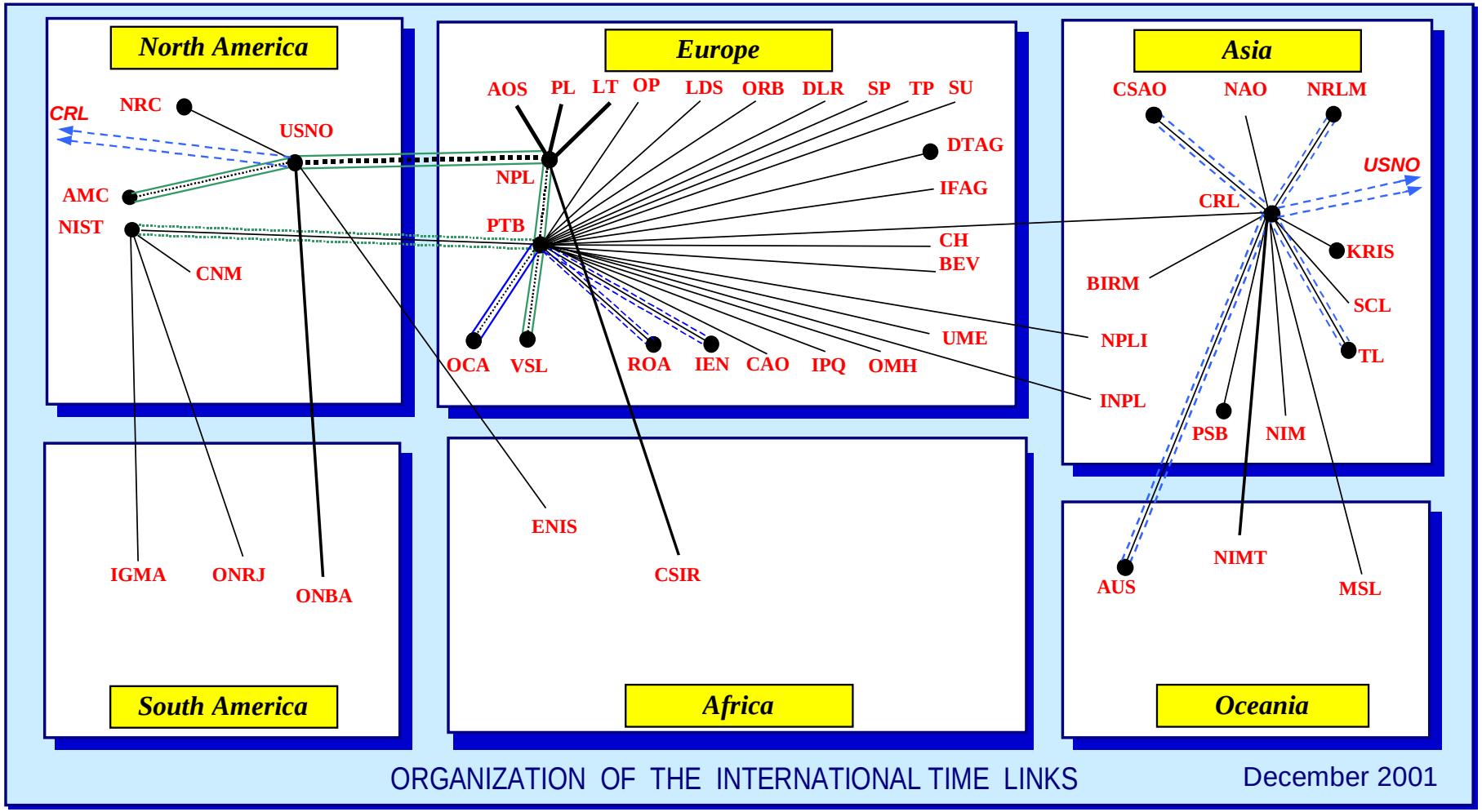
Section III: Description of equipment providing data for this report.

Lab.	GPS CV	TWSTFT (through INTELSAT 307° E)
NIST	Receiver type: NBS/TTR5 Receiver serial no: 010 Internal delay: 53.0 ns Reference name: UTC(NIST) Reference type: ensemble of 4 Cs + 5 H-masers	Modem type: University of Stuttgart/MITREX 2500 Modem serial no: Antenna: 3.7 m – steerable Degree of automation: 85 % Reference name: UTC(NIST) Reference type: ensemble of 4 Cs + 5 H-masers
OCA	Receiver type: AOA/TTR5 Receiver serial No: Internal delay: Reference name: OCA clock Reference type: 1 Cs	Modem type: University of Stuttgart/MITREX 2500 Modem serial no: Antenna: 1.8 m – VSAT Andrew Degree of automation: Reference name: OCA clock Reference type: 1 Cs
NPL *	Receiver type: AOA/TTR5A Receiver serial No: 276 Internal delay: 68.5 ns Reference name: UTC(NPL) Reference type: 1 H-maser	Modem type: TimeTech/SATRE (carrier-phase option) Modem serial no: 038 Antenna: 2.4 m – VSAT Degree of automation: Reference name: UTC(NPL) Reference type: 1 H-maser
PTB	Receiver type: Rockwell Collins/TTR5 Receiver serial No: Internal delay: 77 ns Reference name: UTC(PTB) Reference type: 1 Lab. Cs	Modem type: TimeTech/SATRE (carrier-phase option) Modem serial no: 037 Antenna: 1.8 m – VSAT Degree of automation: Reference name: UTC(PTB) Reference type: 1 Lab. Cs
USNO *	Receiver type: AOA/TTR6 Receiver serial no: 440 Internal delay: Reference name: UTC(USNO MC) Reference type: 1 H-maser + freq. syntent.	Modem type: University of Stuttgart/MITREX 2500 Modem serial no: 85006 From 4 May 2001: TimeTech/SATRE Antenna: 4.6 m – steerable Degree of automation: Reference name: UTC(USNO MC) Reference type: 1 H-maser + freq. syntent.
VSL	Receiver type: VSL/TTR5 Receiver serial no: VSL01 Internal delay: 63.9 ns Reference name: UTC(VSL) Reference type: 1 Cs + micro-phase-stepper	Modem type: Univerity of Stuttgart/MITREX 2500 Modem serial no: 85008 Antenna: 3 m – steerable Degree of automation: Reference name: UTC(VSL) Reference type: 1 Cs + micro-phase-stepper

Notes

* The NPL and USNO are also equipped with TWSTFT back-up stations.

Section IV: Summary of the international time links.



TWSTFT
TWSTFT back-up link
TWSTFT link in preparation
OCA/PTB link not used for computation of TAI
Laboratory equipped with TWSTFT

GPS CV single-channel
GPS CV single-channel back-up link
GPS CV multi-channel
GPS CV multi-channel back-up link

BIPM