

BUREAU INTERNATIONAL DE L'HEURE

# RAPPORT ANNUEL POUR 1971

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**EXTRACT: PAGES B-21 TO C-13**

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*Adresser toutes les communications à M. le Directeur du Bureau International de l'Heure,  
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Tableau 8. Décalages et sauts de TUC, jusqu'au 31 décembre 1972

Date (à 0h TUC)	Décalage	Saut
1961 janv. 1	$-150 \times 10^{-10}$	
août 1	"	+0,050 s
1962 janv. 1	$-130 \times 10^{-10}$	
1963 nov. 1	"	-0,100 s
1964 janv. 1	$-150 \times 10^{-10}$	
avril 1	"	-0,100 s
sept. 1	"	-0,100 s
1965 janv. 1	"	-0,100 s
mars 1	"	-0,100 s
juil. 1	"	-0,100 s
sept. 1	"	-0,100 s
1966 janv. 1	$-300 \times 10^{-10}$	
1968 fév. 1	"	+0,100 s
1972 janv. 1	0	-0,107 7577 s
juil. 1	"	-1 s

Tableau 9. Relation entre TAI et TUC, jusqu'au 31 décembre 1972

Limites de validité (à 0h TUC)	TAI - TUC (J.J. : numéro du jour julien)
1961 janv. 1 - 1961 août 1	1,422 818 0 s + (J.J.-2437 300,5) × 0,001 296 s
août 1 - 1962 janv. 1	1,372 818 0 s + "
1962 janv. 1 - 1963 nov. 1	1,845 858 0 s + (J.J.-2437 665,5) × 0,001 123 2 s
1963 nov. 1 - 1964 janv. 1	1,945 858 0 s + "
1964 janv. 1 - avril 1	3,240 130 0 s + (J.J.-2438 761,5) × 0,001 296 s
avril 1 - sept. 1	3,340 130 0 s + "
sept. 1 - 1965 janv. 1	3,440 130 0 s + "
1965 janv. 1 - mars 1	3,540 130 0 s + "
mars 1 - juil. 1	3,640 130 0 s + "
juil. 1 - sept. 1	3,740 130 0 s + "
sept. 1 - 1966 janv. 1	3,840 130 0 s + "
1966 janv. 1 - 1968 fév. 1	4,313 170 0 s + (J.J.-2439 126,5) × 0,002 592 s
1968 fév. 1 - 1972 janv. 1	4,213 170 0 s + "
1972 janv. 1 - juil. 1	10,000 000 0 s
juil. 1 -	11,000 000 0 s

Tableau 10. Relation entre TAI et TAS

Limites de validité (à 0h TAS)	TAI-TAS	Limites de validité (à 0h TAS)	TAI-TAS
1967 janv. 1 - 1967 mars 1	+5,354 600 s	1969 nov. 1 - 1970 fév. 1	+7,954 600 s
mars 1 - juin 1	554 600	1970 fév. 1 - avril 1	8,154 600
juin 1 - sept. 1	754 600	avril 1 - juil. 1	354 600
sept. 1 - déc. 1	954 600	juil. 1 - sept. 1	554 600
déc. 1 - 1968 mars 1	6,154 600	sept. 1 - nov. 1	754 600
1968 mars 1 - mai 1	354 600	nov. 1 - 1971 fév. 1	954 600
mai 1 - août 1	554 600	1971 fév. 1 - avril 1	9,154 600
août 1 - nov. 1	754 600	avril 1 - juil. 1	354 600
nov. 1 - 1969 fév. 1	954 600	juil. 1 - sept. 1	554 600
1969 fév. 1 - avril 1	7,154 600	sept. 1 - nov. 1	754 600
avril 1 - juil. 1	354 600	nov. 1 - 1972 janv. 1	954 600
juil. 1 - sept. 1	554 600		
sept. 1 - nov. 1	754 600		

L'échelle TAS a cessé d'exister le 1er janvier 1972.

Tableau II - Comparaison de temps entre laboratoires par transport d'horloge en 1971.

Date 1971	J.J. 2400000,5 +	Comparaisons de temps (unité : 1 microseconde)	Sources
Jan. 24	40975,6	TUC (USNO) - TUC (ONBA) (1) = + 7,9 ± 0,8	USNO, DPV (4) 212
26	977,5	TUC (USNO) - TUC (IGMA) = + 360,0 ± 0,8	IGMA
26	977,6	TUC (USNO) - TUA (NRC) = + 165,1 ± 0,2	USNO, DPV 214
28	979,5	TUC (USNO) - TUC (ONRJ) = + 4,9 ± 0,8	" 212
Fév. 23	41005,2	TUC (USNO) - TUC (TCL) (2) = - 32,3 ± 0,2	" 214
26	008,3	TUC (USNO) - TUC (TAO) = - 158,4 ± 0,2	" "
26	008,3	TUC (USNO) - TUC (RRL) = - 1024,6 ± 0,2	" "
Mars 18	028,3	TUC (USNO) - TUC (ROJ) = - 89,0 ± 0,3	" 219
31	041,0	TUC (USNO) - TUC (APO) (3) = + 34,4 ± 0,3	" "
31	041,2	TUC (USNO) - TUC (MSO) = + 47,0 ± 0,3	" "
Mai 6	077,6	TUC (USNO) - TUA (NRC) = + 164,1 ± 0,2	" 228
16	087,4	TUC (USNO) - TUC (OP) = - 134,9 ± 1,0	" 229
18	089,3	TUC (USNO) - TUC (TCL) (2) = - 44,7 ± 1,0	" "
19	090,2	TUC (USNO) - TUC (RRL) = - 1021,3 ± 1,0	" 234
19	090,3	TUC (USNO) - TUC (TAO) = - 151,3 ± 1,0	" 229
Juin 22	124,5	TUC (OP) - TUC (TP) = + 59,8 ± 0,5	OP, URE
29	131,6	TUC (USNO) - TUC (NBS) = + 3,9 ± 0,2	USNO, DPV 232
Juil. 23	155,8	TUC (USNO) - TUC (APO) (3) = + 29,8 ± 0,3	" 235
23	156,0	TUC (USNO) - TUC (MSO) = + 72,8 ± 0,3	" "
Sept. 16	210,7	TUC (NBS) - TUC (OP) = - 140,5 ± 0,1	NBS
20	214	TUC (USNO) - TUC (IEN) = - 75,8	IEN
23	217,4	TUC (USNO) - TUC (OP) = - 135,5 ± 0,3	USNO, DPV 244
24	218,3	TUC (USNO) - TUC (OP) = - 135,6 ± 0,2	" 243
24	218,3	TUC (NBS) - TUC (OP) = - 140,9 ± 0,1	NBS
25	219,2	TUC (USNO) - TUC (NBS) = + 5,2 ± 0,2	USNO, DPV 243
25	219,3	TUC (USNO) - TUA (PTB) = - 327,2 ± 0,3	" 244
28	222,3	TUC (USNO) - TUC (DHI) = - 151,9 ± 0,3	" "
30	224,3	TUC (USNO) - TUC (RGO) = + 28,0 ± 0,5	" 249
Déc. 10	295,8	TUC (USNO) - TUC (ONBA) (1) = - 67,1 ± 0,5	" 267
Déc. 15	300,7	TUC (USNO) - TUC (NBS) = + 5,7 ± 0,2	" 264

(1) La mesure a été faite par rapport à l'horloge 227 de ONBA. La correction nécessaire, communiquée par ONBA, a été appliquée.

(2) TCL : Telecommunication Laboratories, Taiwan, République de Chine.

(3) APO : Australian Post Office, Research Laboratories, Melbourne, Australie.

(4) DPV : Daily Phase Values, Series 4, published by the USNO.

Tableau 12 - Comparaison avec les temps du BIH au moyen des liaisons radioélectriques permanentes.

Caractères droits : résultats obtenus par LORAN-C et télévision.

*Caractères italiques* : résultats obtenus par V.L.F.

Entre parenthèses : pas de comparaison de temps initiale (origine arbitraire).

Important : consulter les notes, p. B 27 et B 28, ainsi que les explications, p. A 12 à A 17.

ETABLISSEMENTS		DHI	F	FOA	IEN	IGMA	ILOM
ECHELLES		TUC	TAI	TUC	TUC	TUC	TUC
		-TUC(DHI)	-TA(F)	-TUC(FOA)	-TUC(IEN)	-TUC(IGMA)	-TUC(ILOM)
Dates (0h TU)	J. J						
1971	2400000,5						
	+						
Jan. 8	40959	- 4,6	-48,1	+134,2	+78,5	+498	-234,8
18	969	4,4	48,4	133,0	77,5	500	231,7
28	979	4,2	48,5	131,8	76,6	498	229,8
Fév. 7	989	4,1	48,8	130,3	75,9		227,1
17	999	3,9	49,2	129,0	74,3	( 0)	223,8
27	41009	- 3,7	-49,5	+127,5	+72,9	(+ 1)	-220,5
Mars 9	019	3,6	49,6	126,3	72,0		216,9
19	029	3,4	49,8	125,2	71,1	( 0)	213,3
29	039	3,4	50,1	123,7	70,1	(+ 1)	-
Avril 8	049	3,1	50,1	122,7	69,5	(- 2)	208,2
18	41059	- 2,8	-50,2	+121,6	+69,2	(- 3)	-204,1
28	069	2,8	50,6	120,5	68,7	(- 5)	200,2
Mai 8	079	2,8	50,8	119,3	68,1	(- 7)	196,7
18	089	3,0	50,9	118,0	68,1	(- 7)	193,1
28	099	3,2	51,1	116,8	68,0	(- 9)	190,0
Juin 7	41109	- 3,3	-51,3	+115,5	+67,4	(-12)	-186,4
17	119	3,4	51,5	114,6	67,2	(-13)	183,1
27	129	3,5	51,6	113,7	67,6	(-16)	179,1
Juil. 7	139	4,1	51,9	112,0	67,2	(-18)	174,8
17	149	4,2	52,0	111,0	67,6	(-17)	171,8
27	41159	- 4,5	-52,0	+109,3	+67,7	(-18)	-168,4
Août 6	169	4,7	52,1	108,0	68,0	(-19)	165,1
16	179	5,3	52,5	106,1	-	(-20)	161,0
26	189	5,6	52,6	104,7	68,6	(-21)	157,4
Sept. 5	199	6,0	52,7	103,6	69,8	(-22)	153,4
15	41209	- 6,2	-52,8	+101,9	+69,4	(-22)	-149,0
25	219	6,3	53,0	100,6	69,8	(-23)	144,6
Oct. 5	229	6,9	53,3	98,9	69,7	(-24)	140,0
15	239	7,3	53,4	97,2	70,6	(-23)	135,6
25	249	7,9	53,6	95,4	70,7	(-21)	131,5
Nov. 4	41259	- 8,3	-53,9	+ 93,6	+70,9	(-12)	-
14	269	8,9	54,1	92,1	71,1	(-10)	-
24	279	9,5	54,3	90,6	71,0	(-11)	-
Déc. 4	289	10,2	54,6	88,7	70,7	(-11)	-120,0
14	299	10,5	54,8	87,0	70,5	(-14)	117,9
24	41309	-11,3	-55,2	+ 85,1	+70,6	(-10)	-115,7

Tableau 12 - (suite)

ETABLISSEMENTS		MSO		NBS		NIS	NPL	NRC
ECHELLES		TUC	TAI	TUC	TUC	TUC	TUC	TUC
		-TUC(MSO)	-TA(NBS)	-TUC(NBS)	-TUC(NIS)	-TUC(NPL)	-TUA(NRC)	
Dates (0h TU)		J.J						
1971		2400000,5						
		+						
Jan.	8	40959	+171	-45239,3	+135,0	( 0)	(-54)	+303,9
	18	969	173	238,5	135,5	(- 1)	(-49)	303,7
	28	979	175	237,9	135,7	(+17)	(-48)	304,0
Fév.	7	989	177	237,1	136,2	(+21)	(-46)	304,1
	17	999	179	236,2	136,7	(+24)	(-42)	304,3
	27	41009	+181	-45235,0	+137,6	(+22)	(-35)	+304,3
Mars	9	019	183	234,2	138,0	(+21)	(-31)	304,6
	19	029	185	233,3	138,6	(+21)	(-33)	304,9
	29	039	186	232,5	139,1	(+22)	(-31)	305,1
Avril	8	049	189	231,9	139,3	(+21)	(-35)	305,1
	18	41059	+190	-	-	(+22)	(-34)	+305,0
	28	069	192	-	-	(+21)	(-34)	305,4
Mai	8	079	195	-	-	(+19)	(-34)	305,8
	18	089	196	-45226,5	143,3	(+18)	(-34)	306,4
	28	099	198	225,7	143,8	(+17)	(-32)	306,9
Juin	7	41109	+200	-45224,4	+144,7	(+16)	(-28)	+307,1
	17	119	202	223,2	145,4	(+15)	(-26)	307,1
	27	129	204	222,7	145,3	(+10)	(-24)	307,3
Juil.	7	139	207	221,6	146,0	(+ 4)	(-25)	307,9
	17	149	209	220,9	146,1	( 0)	(-26)	308,2
	27	41159	+212	-45219,9	+146,6		(-25)	+308,0
Août	6	169	215	218,9	147,0		(-24)	308,8
	16	179	220	218,0	147,5		(-24)	309,4
	26	189	223	217,0	147,9		(-22)	310,0
Sept.	5	199	228	215,9	148,5		(-23)	310,1
	15	41209	+235	-45215,1	+148,8		(-23)	+310,4
	25	219	245	214,2	149,1		(-23)	310,8
Oct.	5	229	257	213,1	149,7		(-22)	311,3
	15	239	268	212,3	149,9		(-20)	311,5
	25	249	277	211,3	150,3		(-16)	311,8
Nov.	4	41259	+285	-45210,4	+150,6		(-17)	+312,4
	14	269	292	209,6	150,8		(-13)	313,0
	24	279	299	208,6	151,2		(-12)	313,4
Déc.	4	289	306	207,1	152,1		(-12)	313,8
	14	299	313	206,1	152,5		(-13)	314,3
	24	41309	+321	-45205,2	+152,8		(-14)	+315,2

Tableau 12 - (suite)

ETABLISSEMENTS		ON	OP	PTB		ROJ	RGO	
EHELLES		TUC	TUC	TAI	TUC	TUC	TUC	
		-TUC(ON)	-TUC(OP)	-TA(PTB)	-TUA(PTB)	-TUC(ROJ)	-TUC(RGO)	
Dates (0h TU) J.J								
1971 2400000,5								
Jan.	8	40959	+ 9,8	+ 2,9	-382,0	-185,0	(- 3)	+175,1
	18	969	10,0	3,5	381,8	184,8	+ 45	175,3
	28	979	10,4	3,8	381,6	184,6	48	175,6
Fév.	7	989	10,7	4,1	381,5	184,5	47	175,6
	17	999 X	10,8	4,3	381,2	184,2	48	175,7
	27	41009	+10,9	+ 4,5	-381,1	-184,1	+ 48	+175,8
Mars	9	019	11,1	4,9	380,9	183,9	50	175,8
	19	029	11,2	5,1	380,7	183,7	51	176,0
	29	039	11,1	5,3	380,7	183,7	47	176,0
Avril	8	049	11,1	5,9	380,4	183,4	53	176,5
	18	41059	+11,3	+ 6,4	-380,2	-183,2	+ 51	+176,6
	28	069	11,1	6,7	380,0	183,0	51	176,7
Mai	8	079	11,0	7,0	380,1	183,1	52	176,8
	18	089	11,1	7,3	380,0	183,0	53	176,8
	28	099 X	11,1	7,6	380,0	183,0	54	176,6
Jun	7	41109	+11,4	+ 7,8	-380,0	-183,0	+ 54	+176,4
	17	119	11,7	8,1	379,9	182,9	54	176,2
	27	129	12,1	8,5	379,6	182,6	54	176,3
Juil.	7	139	12,0	8,0	379,7	182,7	52	175,7
	17	149	12,3	8,9	379,4	182,4	51	175,7
	27	41159	+12,8	+ 9,3	-379,4	-182,4	+ 50	+175,5
Août	6	169	13,0	9,6	379,3	182,3	46	175,2
	16	179	13,0	9,5	379,5	182,5	42	174,7
	26	189	13,3	9,8	379,3	182,3	( 0)	174,5
Sept.	5	199 X	13,4	9,9	379,3	182,3	(- 2)	174,5
	15	41209	+13,6	+10,1	-379,0	-182,0	(- 2)	+174,4
	25	219	13,8	10,4	378,8	181,8	(+ 2)	174,2
Oct.	5	229	13,9	10,6	378,9	181,9	(- 2)	173,8
	15	239	14,3	11,0	378,6	181,6	(- 5)	173,9
	25	249	14,5	11,2	378,5	181,5	(- 4)	173,8
Nov.	4	41259	+14,8	+11,4	-378,3	-181,3	(- 5)	+173,6
	14	269	14,8	11,7	378,2	181,2	( 0)	173,3
	24	279	14,9	12,2	378,1	181,1	( 0)	173,1
Déc.	4	289	14,8	12,4	378,1	181,1	(- 6)	172,9
	14	299 X	14,7	12,8	377,9	180,9		172,9
	24	41309	+14,4	+13,1	-377,8	-180,8		+172,9

Tableau 12 - (suite)

ETABLISSEMENTS		RRL	TAO	TP	URSS	USNO		
ECHELLES		TUC	TUC	TUC	TUC	TAI	TUC	
		-TUC(RRL)	-TUC(TAO)	-TUC(TP)	-TUC(URSS)	-TA(USNO) [Mean(USNO)]	-TUC(USNO) [MC(USNO)]	
Dates (0h TU)	J. J							
1971	2400000,5							
	+							
Jan.	8	40959	-889,5	-26,7	+79	(+49)	-34405,4	+137,6
	18	969	888,0	24,6	76	( 56)	405,1	137,8
	28	979	888,4	24,2	75	( 68)	404,7	138,4
Fév.	7	989	887,8	23,0	76	(-85)	404,4	138,6
	17	999 <sub>X</sub>	886,5	21,3	77	( 77)	404,0	138,8
	27	41009	-885,2	-19,7	+75	(+61)	-34403,7	+138,8
Mars	9	019	884,1	18,3	76	( 63)	403,4	139,2
	19	029	882,9	16,8	76	( 61)	403,2	139,8
	29	039	-	-	74	( 64)	402,8	139,9
Avril	8	049	882,0	14,7	74	( 36)	402,5	140,3
	18	41059	-880,6	-12,7	+72	(+36)	-34402,3	+140,6
	28	069	880,0	11,5	72	( 28)	402,0	140,9
Mai	8	079	879,7	10,7	73	( 22)	401,9	141,1
	18	089	879,2	9,7	71	( 5)	401,6	141,3
	28	099 <sub>X</sub>	878,9	8,9	70	( 18)	401,5	141,5
Juin	7	41109	-878,8	- 8,2	+70	(+ 9)	-34401,2	+141,9
	17	119	878,3	7,3	68	( 13)	400,9	142,3
	27	129	877,0	6,6	67	( 11)	400,8	142,7
Juil.	7	139	877,1	5,5	67	( 2)	400,4	143,4
	17	149	876,8	5,2	66	(-11)	400,2	143,6
	27	41159	-876,6	+ 4,7	+65	(-26)	-34400,2	+143,9
Août	6	169	876,5	4,4	64	( 36)	400,0	144,1
	16	179	875,9	3,7	63	( 47)	399,7	144,8
	26	189	875,8	3,5	62	( 55)	399,8	145,0
Sept.	5	199 <sub>X</sub>	875,8	3,3	61	( 58)	399,6	145,1
	15	41209	-875,4	- 2,7	+59	(-59)	-34399,6	+145,4
	25	219	874,8	1,9	58	( 48)	399,4	145,6
Oct.	5	229	874,2	1,1	57	( 35)	399,2	146,0
	15	239	873,7	0,7	56	( 39)	399,3	146,2
	25	249	873,2	0,1	55	( 39)	399,2	146,6
Nov.	4	41259	-873,5	- 0,4	+55	(-28)	-34399,1	+146,9
	14	269	-	-	54	( 27)	399,0	147,2
	24	279	874,0	1,3	53	( 14)	398,8	147,7
Déc.	4	289	874,1	1,5	52	( 1)	398,7	148,0
	14	299 <sub>X</sub>	874,0	1,6	51	(+13)	398,6	148,5
	24	41309	-873,9	- 0,9	+50	(+18)	-34398,4	+148,9

## Notes sur le tableau 12

IEN Origine donnée par un transport d'horloge à Genève (centre Hewlett-Packard) le 20 septembre 1971.

~~A la suite de la communication des temps de réception des signaux de LORAN-C (Méditerranéan Sea Chain) à partir du 2 mars 1970, les valeurs TUC-TUC(IEN) depuis cette date deviennent :~~

J.J	TUC	J.J	TUC	J.J	TUC
2400000,5	-TUC(IEN)	2400000,5	-TUC(IEN)	2400000,5	-TUC(IEN)
+		+		+	
40649	+108,5	40759	-	40869	+89,5
659	107,5	769	+102,1	879	88,3
669	106,4	779	96,6	889	87,0
679	105,3	789	95,2	899	86,2
689	108,8	799	94,8	909	83,5
699	107,5	809	94,2	919	82,4
709	107,1	819	93,8	929	81,5
719	105,2	829	93,5	939	80,3
729	103,8	839	92,4	949	79,1
739	103,2	849	91,7		
749	101,7	859	90,7		

IGMA Origine fixée par un transport d'horloge le 26 janvier 1971.  
Les valeurs TUC-TUC(IGMA) pour 1970 sont :

J.J	TUC	J.J	TUC	J.J	TUC
2400000,5	-TUC(IGMA)	2400000,5	-TUC(IGMA)	2400000,5	-TUC(IGMA)
+		+		+	
40689	+544	40779	+521	40869	+505
699	541	789	518	879	505
709	538	799	513	889	504
719	535	809	511	899	504
729	536	819	509	909	506
739	533	829	509	919	501
749	530	839	510	929	500
759	528	849	507	939	499
769	525	859	508	949	498

ILOM Les valeurs provisoires à partir du 19 novembre 1970, publiées dans le Rapport Annuel pour 1970 sont confirmées et doivent être prises comme définitives. Ceci s'applique aussi à RRL et TAO.

MSO 1° - A la suite d'une erreur d'impression dans le Rapport Annuel pour 1970, les valeurs de TUC-TUC(MSO) doivent recevoir le signe +, au lieu de -, des dates 40589 à 40619 et 40859 à 40949.  
2° - Les valeurs publiées pour 1971 ont été obtenues à partir des valeurs de TUC(USNO)-TUC(MSO) envoyées au BIH par MSO.



RG0 On obtient TAI-TA(RGO) [TA(RGO)  $\equiv$  GA2] par la relation suivante :

$$\text{TAI-TA(RGO)} = \text{TUC-TUC(RGO)} - 175,0 \mu\text{s}$$

RRL Voir ILOM

TA0 Voir ILOM

TP Origine fixée par un transport d'horloge le 22 juin 1971.

Les valeurs TUC-TUC(TP) du Rapport Annuel pour 1970 sont améliorées comme suit :

J. J	TUC	J. J	TUC	J. J	TUC
2400000,5	-TUC(TP)	2400000,5	-TUC(TP)	2400000,5	-TUC(TP)
+		+		+	
40689	+116	40779	+98	40869	+88
699	114	789	97	879	86
709	113	799	96	889	85
719	110	809	96	899	81
729	107	819	93	909	81
739	105	829	92	919	80
749	104	839	92	929	79
759	103	849	90	939	79
769	101	859	88	949	77

URSS Une nouvelle origine arbitraire a été choisie le 9 décembre 1970, par suite de données manquantes pour le mois de novembre 1970.

Les valeurs TUC-TUC(URSS) pour décembre 1970 sont :

J. J	TUC
2400000,5	-TUC(URSS)
+	
40929	( 0)
939	(+ 20)
949	(+ 43)

Tableau 13 - Comparaison entre les transports d'horloge et les liaisons horaires radioélectriques

Le tableau donne les différences entre les résultats des transports d'horloge et ceux obtenus par LORAN-C ou V.L.F. pour quelques couples de laboratoires. Les valeurs font suite à celles publiées dans le tableau 15 du Rapport Annuel pour 1970. Les transports d'horloge utilisés pour fixer une origine sont notés par une astérisque (\*).

Comparaisons de temps	Date	J. J 2400000,5 +	Différence ( $\mu$ s)
TUC (USNO) - TUC (DHI)	28 sept. 1971	41222,3	+ 0,4
TUC (MSO)	31 mars 1971	41041,2	0
	23 juil. 1971	41156,0	+ 5
TUC (NBS)	29 juin 1971	41131,6	+ 1,3
	25 sept. 1971	41219,2	+ 1,6
	15 déc. 1971	41300,7	+ 1,7
TUA (NRC)	26 janv. 1971	40977,6	- 0,5
	6 mai 1971	41077,6	- 0,6
TUC (OP)	16 mai 1971	41087,4	- 0,8
	23 sept. 1971	41217,4	- 0,3
	24 sept. 1971	41218,3	- 0,4
TUA (PTB)	25 sept. 1971	41219,3	+ 0,2
TUC (RGO)	30 sept. 1971	41224,3	- 0,2
TUC (ROJ)	18 mars 1971	41028,3	0 *
TUC (RRL)	26 fév. 1971	41008,3	- 0,5
	19 mai 1971	41090,2	- 0,8
TUC (TAO)	26 fév. 1971	41008,3	+ 0,3
	19 mai 1971	41090,3	- 0,3
TUC (OP) - TUC (DHI)	28 sept. 1971	41222,3	+ 0,6
TUA (PTB)	25 sept. 1971	41219,3	+ 0,6
TUC (RGO)	30 sept. 1971	41224,3	+ 0,2
TUA (PTB) - TUC (DHI)	28 sept. 1971	41222,3	+ 0,1
TUC (RGO) - TUC (DHI)	28 sept. 1971	41222,3	+ 0,5
TUA (PTB)	25 sept. 1971	41219,3	+ 0,4
TUC (RRL) - TUC (TAO)	26 fév. 1971	41008,3	+ 0,8
	19 mai 1971	41090,2	+ 0,4

Tableau 14 - Comparaison avec les temps du BIH

Mesures occasionnelles pour des échelles de temps

1) qui ne sont pas liées de façon permanente au BIH par les méthodes radioélectriques,

2) qui ne possèdent pas d'étalons atomiques.

LABORATOIRE i	DESIGNATION DE L'ECHELLE DE TEMPS	DATE	TUC-TUC(i) ( $\mu$ s)	REMARQUES, SOURCES
PMG Research Lab. (Australian Post Office) Melbourne, Australia	TUC (APO)	31 mars 1971	+174,3	Transport d'horloge par l'USNO
		23 juil. 1971	+173,6	
Telecommunication Lab. Taiwan	TUC (TCL)	23 fév. 1971	+106,5	"
		18 mai 1971	+ 96,7	
Zentralinstitut Physik der Erde, Potsdam R.D. Allemande	TUC (ZIPE)	8 jan. 1971	- 3	Valeurs obtenues à l'aide des liaisons par télévision
		6 fév.	- 1	
		8 mars	- 21	
		7 avril	- 27	
		7 mai	- 30	
		6 juin	- 30	
		6 juil.	- 33	
		5 août	- 31	
		4 sept.	- 32	
		4 oct.	- 33	
3 nov.	- 33			
3 déc.	- 33			

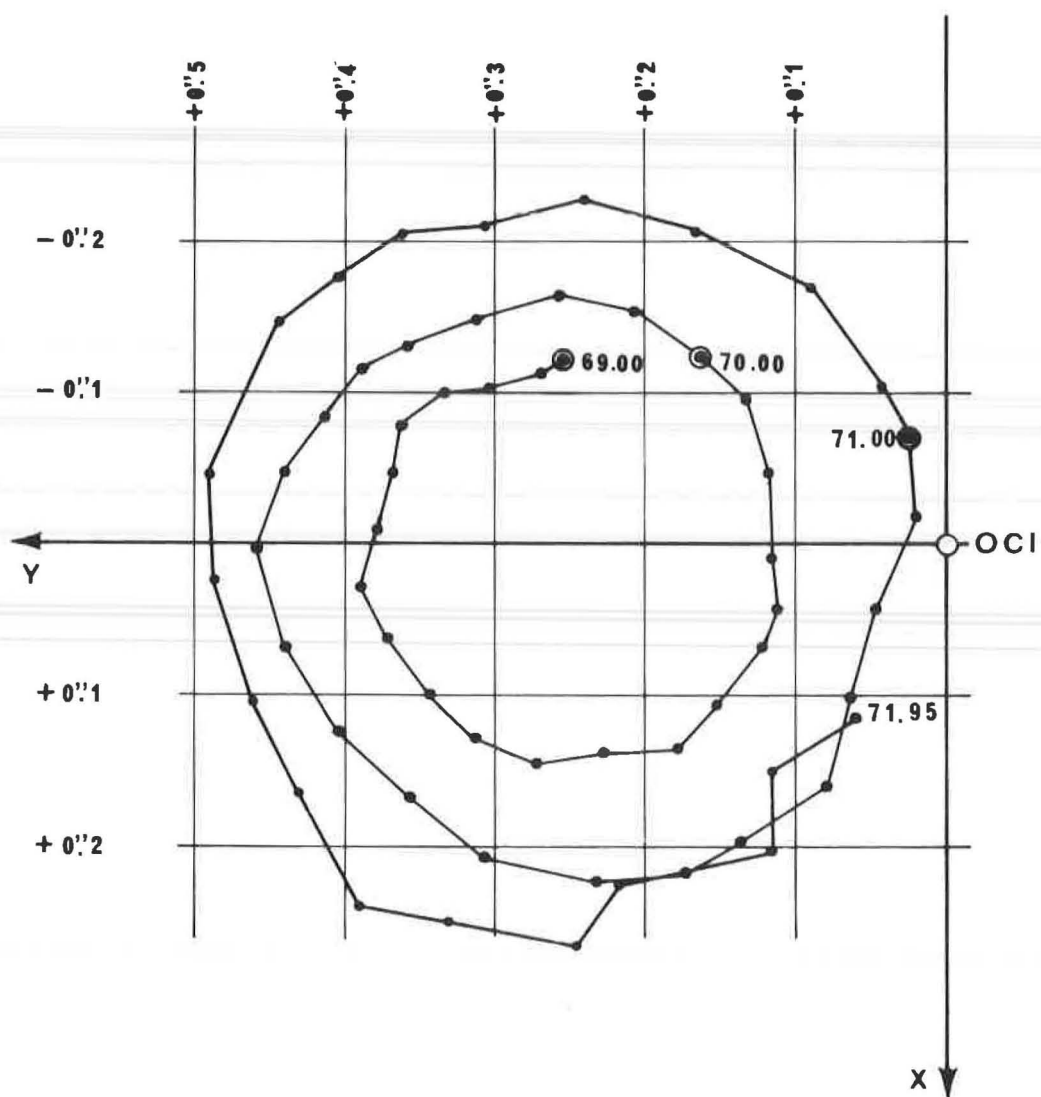


Fig. 1 - Trajectoire du pôle de 1969,00 à 1971,95 (valeurs du tableau 5)

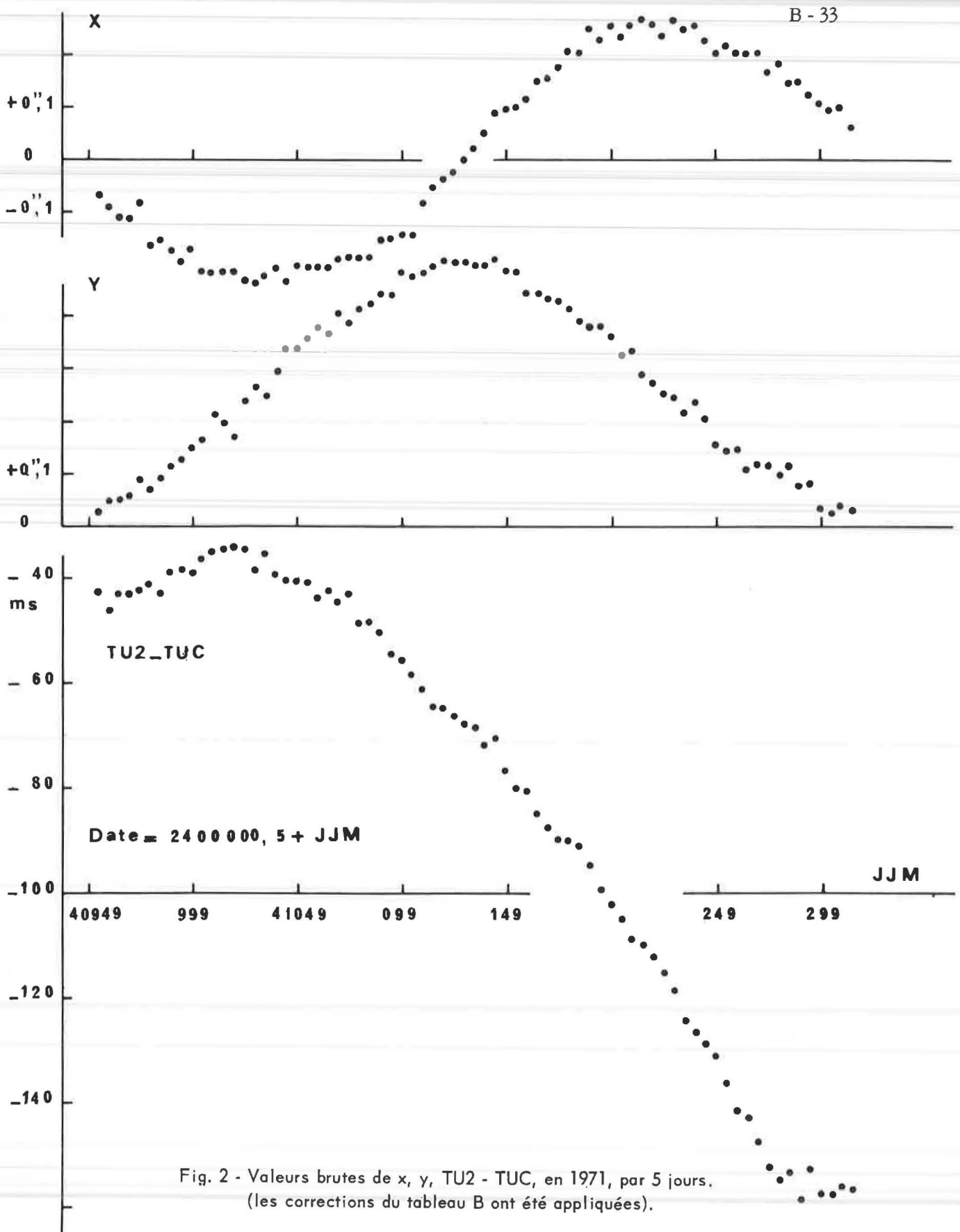


Fig. 2 - Valeurs brutes de  $x$ ,  $y$ , TU2 - TUC, en 1971, par 5 jours.  
(les corrections du tableau B ont été appliquées).

## PART C

## TIME SIGNALS

(1)

In the following tables, characteristics of the main time signal emissions are shown. They are established with all informations received until March 1972. The addresses of the authorities responsible for the emissions are given next pages.

The carriers of the following time signals are standard frequencies.

Station	Accuracy of the carrier's frequency in $10^{-10}$
CHU	0.2
DCF77	0.2
FFH	2
GBR	0.2
HBG	0.02
IAM	0.5
IBF	0.5
JJY	0.5
LOL1	0.2
MSF (60 kHz)	0.2
MSF (h.f.)	1
NBA (V.L.F.)	0.5
NSS (V.L.F.)	0.5
OMA (all frequencies)	0.05
VNG	1
WWV	0.1
WWVB	0.1
WWVH	0.5
ZUO	0.5

(1) - Afin de permettre la réutilisation partielle des tableaux du Rapport pour 1970, la langue anglaise a été conservée pour la partie C.

## CODE FOR THE TRANSMISSION OF DUTI

Most of the time signals disseminate the difference UTI-UTC in integral multiples of 0.1 s. This correction is called DUTI.

### CCIR code

A positive value of DUTI is indicated by emphasizing a number (n) of consecutive seconds markers following the minute marker from seconds markers one to seconds marker (n) inclusive ; (n) being an integer from 1 to 7 inclusive.

$$DUTI = (n \times 0.1) \text{ s}$$

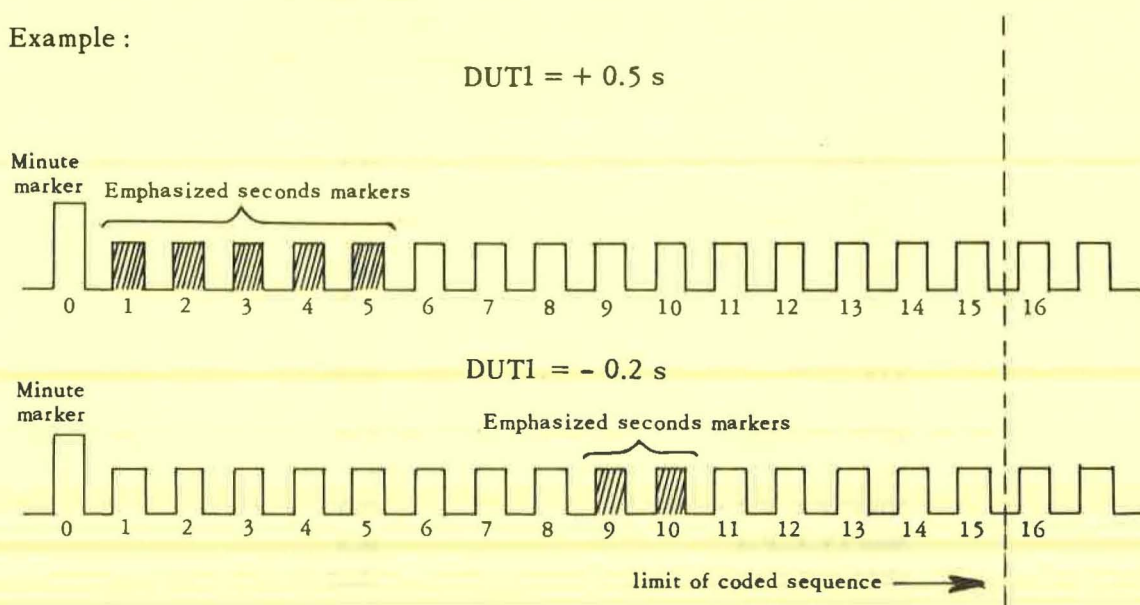
A negative value of DUTI is indicated by emphasizing a number (m) of consecutive seconds markers following the minute marker from seconds marker nine to seconds marker (8 + m) inclusive ; (m) being an integer from 1 to 7 inclusive.

$$DUTI = - (m \times 0.1) \text{ s}$$

A zero value of DUTI is indicated by the absence of emphasized seconds markers.

The appropriate seconds markers are emphasized by lengthening, doubling, splitting, or tone modulation of the normal seconds markers, as stated in following pages.

Example :



### Other transmissions of DUTI :

by voice announcement or in Morse code.

Reference : CCIR Report 517, Geneva (1971).

AUTHORITIES RESPONSIBLE FOR THE TIME SIGNAL EMISSIONS

Signal	Authority
CHU	National Research Council, Time and Frequency Section Physics Division (M-36) <b>Ottawa K1A 0S1, Ontario, Canada,</b> Attn : Dr. C.C. Costain
DAM, DAN, DAO	Deutsches Hydrographisches Institut <b>2 Hamburg 4, Federal Republic of Germany.</b>
DCF77	Physikalisch-Technische Bundesanstalt, Laboratorium 1.22 <b>33 Braunschweig</b> Bundesallee 100, Federal Republic of Germany.
DGI, DIZ	Central Earth Physics Institute Time Service <b>DDR 15 Potsdam</b> Telegraphenberg A 17
FFH	Centre National d'Etudes des Télécommunications Groupement Etudes spatiales et Transmissions Département Dispositifs et Ensembles fonctionnels 38, rue du Général Leclerc, <b>92 - Issy-les-Moulineaux, France.</b>
FTA91, FTH42 FTK77, FTN87	Observatoire de Paris, Service de l'Heure, 61, avenue de l'Observatoire, <b>Paris 14ème, France.</b>
GBR MSF	National Physical Laboratory, Electrical Science Division <b>Teddington, Middlesex, United Kingdom.</b>
HBG	Service horaire HBG Observatoire Cantonal, <b>CH - 2000 - Neuchâtel, Suisse.</b>
IAM	Istituto Superiore Poste e Telecomunicazioni Viale di Trastevere, 189 <b>00100 - Roma, Italy</b>
IBF	Istituto Elettrotecnico Nazionale Galileo Ferraris Corso Massimo d'Azeglio, 42 <b>10125 - Torino, Italy</b>
JJY, JG2AE, JG2AS	Frequency Standard Division The Radio Research Laboratories Ministry of Posts and Telecommunications <b>Midori-cho, Koganei, Tokyo 184, Japan.</b>



Signal	Authority
LOL	Director Observatorio Naval Av. Costanera Sur, 2099 Buenos Aires, Republica Argentina.
LQB9, LQC20	Servicio internacional de la Hora Gral. Savio 865 Villa Maipú San Martin, Pcia. de Buenos Aires Republica Argentina.
NBA, NDT, NPG, NPM, NPN, NSS, NWC	Superintendent U.S. Naval Observatory Washington, D.C. 20390 U.S.A.
OLB5, OMA	1° - Time information : Astronomický Ústav ČSAV, Budečska 6, Praha 2, Vinohrady, Czechoslovakia. 2° - Standard frequency information. Ústav radiotechniky a elektroniky ČSAV, Lumumbova 1, Praha 8, Kobylišy, Czechoslovakia.
PPE, PPR	Serviço da Hora Observatorio Nacional Rua General Bruce, 586 2000-Rio de Janeiro. GB.ZC.-08, Brasil.
RAT, RCH, RES RID, RIM, RKM, RWM	Comité d'Etat des Normes Conseil des Ministres de l'URSS Moscou, USSR, Leninski prosp., 9.
VNG	Enginer-in-Charge Time and Frequency Standards Section A.P.O. Research Laboratories 59 Little Collins Street Melbourne, VIC. 3000, Australia
WWV, WWVH WWVB	Frequency-Time Broadcast Services Section Time and Frequency Division National Bureau of Standards Boulder, Colorado 80302, U.S.A.
ZUO	National Physical Research Laboratory P.O. Box 395 Pretoria South Africa

## Time - Signals emitted in the UTC system (since 1972, Jan. 1)

C - 5

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
CHU	Ottawa Canada +45° 18' +75° 45'	3330 7335 14670	continuous	Second pulses of 300 cycles of a 1 kHz modulation. Minute pulses are 0.5 s long. A bilingual (Fr.-Eng.) announcement of time is made each minute. <b>DUT1 : CCIR code by split pulses</b>
DAM	Elmshorn Germany, F.R. +53° 46' - 9° 40'	8638.5 <b>16980.4</b> 4625 8638.5 6475.5 12763.5	11 h 55 m to 12 h 6 m 23 h 55 m to 24 h 6 m from 21 Sept. to 20 March 23 h 55 m to 24 h 6 m from 21 March to 20 Sept.	New international system, then second pulses from minutes 0.5 to 6.0 (minute pulses prolonged). A1 type. <b>DUT1 : CCIR code by doubling, after minute pulses 1 to 5.</b>
DAN	Osterloog Germany, F.R. +53° 38' - 7° 12'	2614	11 h 55 m to 12 h 6 m 23 h 55 m to 24 h 6 m	As DAM (see above)
DAO	Kiel Germany, F.R. +54° 26' -10° 8'	2775	11 h 55 m to 12 h 6 m 23 h 55 m to 24 h 6 m	As DAM (see above)
DCF77	Mainflingen Germany, F.R. +50° 1' - 9° 0'	77.5	continuous, except second Tuesday of every month from 4 h to 8 h	The second marks are reduction to 1/4 of the carrier's amplitude of 0.1 s duration ; the reference point is the beginning of the pulse modulation. The second 59 marker is omitted <b>DUT1 : CCIR code by lengthening to 0.2 s</b>
DGI	Oranienburg Germ.Dem.Rep. +52° 48' -13° 24'	185	5 h 59 m 30 s to 6 h 00 m 11 h 59 m 30 s to 12 h 00 m 17 h 59 m 30 s to 18 h 00 m	A2 type second pulses of 0.1 s duration for seconds 30-40, 45, 50, 58, 59, 60.
DIZ	Nauen Germ.Dem.Rep. +52° 39' -12° 55'	4525	continuous except from 8 h 15 m to 9 h 45 m	A1 type second pulses of 0.1s duration. Minute pulses prolonged to 0.5 s. Hour pulses marked by prolonged pulses for seconds 58, 59, 60. <b>DUT1 : CCIR code by double pulse</b>
FFH	Chevannes France +48° 32' - 2° 27'	2500	continuous from 8 h to 16 h 25 except Saturday and Sunday.	Second pulses of 5 cycles of 1 kHz modulation. Minute pulses prolonged to 0.5 s. <b>DTU1 : CCIR code by lengthening to 0.1 s.</b>
FTA91	Saint-André-de-Corcy France +45° 55' - 4° 55'	91.15	at 8 h, 9 h, 9 h 30 m, 13 h, 20 h, 21 h, 22 h 30 m.	A1 type second pulses during the 5 minutes preceding the indicated times. Minute pulses are prolonged. <b>DTU1 : in Morse code</b>
FTH42 FTK77 FTN87	Pontoise France +49° 4' - 2° 7'	7428 10775 13873	at 9 h and 21 h at 8 h and 20 h at 9 h 30 m, 13 h, 22 h 30 m	A1 type second pulses during the 5 minutes preceding the indicated times. Minute pulses are prolonged. <b>DUT1 : in Morse code.</b>
GBR	Rugby United Kingdom +52° 22' + 1° 11'	16	at 3 h, 9 h, 15 h, 21 h	A1 type second pulses during the 5 minutes preceding the indicated times. <b>DUT1 : CCIR code by double pulse</b>

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
HBG	Prangins Switzerland +46° 24' - 6° 15'	75	continuous	Interruption of the carrier at the beginning of each second, during 100 ms. The minutes are identified by a double pulse, the hours by a triple pulse. No transmission of DUT1
IAM	Rome Italy +41° 52' - 12° 27'	5000	from 7 h 30 m to 8 h 30 m and from 13 h 0 m to 14 h 0 m 10 m every 15 m exc. Sun. Advanced by 1 hour in summer.	Second pulses of 5 cycles of 1 kHz modulation. Minute pulses of 20 cycles (Announcements and 1 kHz modulation, 5 m before the emission of time signals).
IBF	Torino Italy +45° 2' - 7° 42'	5000	During 15 m preceding 7 h, 9 h, 10 h, 11 h, 12 h, 13 h, 14 h, 15 h, 16 h, 17 h, 18 h. Advanced by 1 hour in summer.	Second pulses of 5 cycles of 1 kHz modulation. These pulses are repeated 7 times at the minute. Voice announcements at the beginning and end of each emission. DUT1 : CCIR code by double pulse.
JG2AE	Koganei Japan +35° 42' - 139° 31'	8000	from 20 h 59 m to 10 h 59 m, interruptions between minutes 25 and 34	Second pulses of 1600 Hz modulation. Minute pulses are preceded by a 600 Hz modulation. DUT1 : CCIR code by lengthening
JG2AS	Chiba Japan +35° 38' - 140° 4'	40	from 7 h to 8 h, except Sunday, interrup- tions during communi- cations	A1 type second pulses of 0.5 sec. duration. Second 59 is omitted. No DUT1 code.
JJY	Koganei Japan +35° 42' - 139° 31'	2500 5000 10000 15000	continuous, except inter- ruptions between minutes 25 and 34.	Second pulses of 8 cycles of 1600 Hz modulation. Minute pulses are preceded by a 600 Hz modulation. DUT1 : CCIR code by lengthening
LOL1	Buenos-Aires Argentina -34° 37' + 58° 21'	5000 10000 15000	11 h to 12 h, 14 h to 15 h, 17 h to 18 h, 20 h to 21 h 23 h to 24 h	Second pulses of 5 cycles of 1000 Hz modulation. Second 59 is omitted. Announcement of hours and minutes every 5 minutes, followed by 3 m of 1000 Hz and 440 Hz modulation. DUT1 : CCIR code by lengthening
LOL2 LOL3	Buenos-Aires Argentina -34° 37' +58° 21'	8030 17180	1 h, 13 h, 21 h	A1 second pulses during the 5 minutes preceding the indicated times. Minute pulses are prolonged. DUT1 : CCIR code by lengthening
LQB9 LQC20	Planta Gral Pacheco - 34° 26' +58° 37'	8167.5 17551.5	22 h 5 m, 23 h 50 m 10 h 5 m, 11 h 50 m	A1 second pulses during the 5 minutes preceding the indicated times. Second 59 is omitted, second 60 is prolonged. After the emission, OK is transmitted if the emission is correct, NV if not correct. DUT1 : CCIR code by omission of second markers
MSF	Rugby United Kingdom +52° 22' + 1° 11'	60	continuous except for an interruption for main- tenance from 10 h 0 m to 14 h 0 m on the first Tuesday in each month	Interruptions of the carrier of 100 ms for the second pulses, of 500 ms for the minute pulses. The signal is given by the beginning of the interruption. DUT1 : CCIR code by double pulse

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
MSF	Rugby United Kingdom +52° 22' + 1° 11'	2500 5000 10000	between minutes 0 and 5, 10 and 15, 20 and 25, 30 and 35, 40 and 45, 50 and 55	Second pulses of 5 cycles of 1 kHz modulation. Minute pulses are prolonged. DUT1 : CCIR code by double pulse
NBA	Balboa USA + 9° 3' +79° 39'	24  147.85 5448.5 11080 17697.5	Every even hour except 24 h and during Monday maintenance (1200 to 1800) 5 h, 11 h, 17 h, 23 h	CW second pulses during the 5 minutes preceding the indicated times on the American Code time format. DUT1 : by Morse Code, each minute between seconds 56 and 59
NDT	Yosami Japan +34° 58' - 137° 1'	17.4	to be determined	To be determined
NPG	San Francisco USA +38° 6' +122° 16'	3268 6428.5 9277.5 12966	6 h, 12 h, 18 h, 24 h	CW second pulses during 5 minutes pre- ceding the indicated times on the Ame- rican Code time format DUT1 : by Morse Code, each minute between seconds 56 and 59
NPM	Honolulu USA +21° 25' +158° 9'	131.05 4525 9050 13655 16457.5 20575 22593	6 h, 12 h, 18 h, 24 h	CW second pulses during 5 minutes preceding the indicated times on the American Code time format DUT1 : by Morse Code, each minute between seconds 56 and 59
NPN	Guam USA +13° 27' -144° 43'	4955 8150 13380 21760	6 h, 12 h, 18 h, 24 h	CW second pulses during 5 minutes preceding the indicated times on the American Code time format DUT1 : by Morse Code, each minute between seconds 56 and 59
NSS	Annapolis USA +38° 59' +76° 27'	21.4  88 5870 8090 12135 16180 20225 25590	Every hour except during Wednesday maintenance (1300 to 1900)  5 h, 11 h, 17 h, 23 h (on Tuesday 17 h the frequency 185 kHz replaces 88 kHz)  17 h, 23 h	CW second pulses during 5 minutes preceding the indicated times on the American Code time format. Experimental FSK second pulses may be transmitted on 21.4 kHz DUT1 : by Morse Code, each minute between seconds 56 and 59

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
NWC (1) See p. C12	Exmouth Australia - 21° 49' - 114° 9'	22.3	Kepted from 28 to 30 minutes after every other even hour beginning 0 h UT	FSK second pulses during the indicated times on the American Code time format. DUT1 : by Morse Code, between seconds 56 and 58.
OLB5	Podebrady Czechoslovakia + 50° 9' - 15° 8'	3170	continuous except from 5 h to 11 h on the first Wednesday of every month	A1 type, second pulses No transmission of DUT1
OMA	Liblice Czechoslovakia + 50° 4' - 14° 53'	50	continuous except from 5 h to 11 h on the first Wednesday of every month	Interruption of the carrier of 100 ms at the beginning of every second, of 500 ms at the beginning of every minute. The precise time is given by the beginning of the interruption.
		2500	between minutes 5 and 15 25 and 30, 35 and 40, 50 and 60 of every hour except from 5 h to 11 h on the first Wednesday of every month	Pulses of 5 cycles of 1 kHz modulation (prolonged for the minutes). The first pulse of the 5th minute is prolonged to 500 cycles. No transmission of DUT1.
PPE	Rio de Janeiro Brasil - 22° 54' + 43° 13'	8721	0 h 30 m, 11 h 30 m, 13 h 30 m, 19 h 30 m, 20 h 30 m, 23 h 30 m	Second ticks, of A1 type, during the five minutes preceding the indicated hours. The minute ticks are longer DUT1 : CCIR Code by double pulse.
PPR	Rio de Janeiro Brasil - 22° 59' + 43° 11'	435 8634 13105 17194.4	01 h 30 m, 14 h 30 m, 21 h 30 m	Second ticks, of A1 type, during the five minutes preceding the indicated hours. The minute ticks are longer
RAT (2)	Moscow USSR + 55° 19' - 38° 41'	5000	between minutes 30 and 35, 41 and 45, 50 and 60 every day and night	Second pulses. The pulses at the beginning of the minute are prolonged. Rythmic signals between minutes 1 and 6, at 0 h, 2 h and 4 h...
RCH (2)	Tashkent USSR + 41° 19' - 69° 15'	2500	between minutes 15 and 20, 25 and 30, 35 and 40, 45 and 50. 1) from 0 h to 4 h and from 11 h to 24 h from 1 January to 31 March and from 1 Sept. to 31 December 2) from 0 h to 2 h and from 16 h to 24 h from 1 April to 31 August	Second pulses. The pulses at the beginning of the minute are prolonged,
		5000	between minutes 15 and 20, 25 and 30, 35 and 40, 45 and 50 1) from 5 h 30 m to 10 h 30 m, from 1 January to 31 March and from 1 Sept. to 31 December 2) from 2 h 30 m to 15 h 30 m from 1 April to 31 August	

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
RBU (2)	Moscow USSR + 55° 19' - 38° 41'	66 $\frac{2}{3}$	between minutes 0 and 5 of every hour except for 23 h.	A I. type. Second pulses. The pulses at the beginning of the mi- nute are prolonged.
RID (2)	Irkutsk USSR + 52° 46' - 103° 39'	5004	between minutes 15 and 20, 25 and 30, 51 and 60 1) from 0 h to 1 h 30 m and 11 h 40 m to 24 h from 1 January to 31 March and from 1 Sept. to 31 December 2) from 0 h to 1 h and from 18 h to 24 h from 1 April to 31 August	Second pulses. The pulses at the beginning of the minute are prolonged. Rythmic signals. Between minutes 1 and 6 at 0 h, 2 h, 4 h...
		10004	between minutes 15 and 20, 25 and 30, 51 and 60 1) from 1 h 40 m to 11 h 10 m from 1 January to 31 March and from 1 Sept. to 31 December 2) from 1 h 40 m to 17 h from 1 April to 31 August	Second pulses. Are also transmitted between minutes 5 and 10 at 1 h, 3 h, 5 h...
RIM (2)	Tashkent USSR + 41° 19' - 69° 15'	5000	between minutes 15 and 20, 25 and 30, 35 and 40, 45 and 50 1) from 0 h to 4 h and from 14 h to 24 h from 1 Ja- nuary to 31 March and from 1 Sept. to 31 Dec. 2) from 0 h to 2 h and from 16 h to 24 h from 1 April to 31 August.	Second pulses. The pulses at the beginning of the minute are prolonged.
		10000	between minutes 15 and 20 25 and 30, 35 and 40, 45 and 50 1) from 5 h 30 m to 9 h 30 m and from 10 h to 13 h 30 m from 1 January to 31 March and from 1 Sept. to 31 December 2) from 2 h 30 m to 15 h 30 m from 1 April to 31 August	
RKM (2)	Irkutsk USSR + 52° 46' - 103° 39'	10004	between minutes 15 and 20, 25 and 30, 51 and 60 1) from 0 h to 1 h 10 m and from 11 h 40 m to 24 h from 1 January to 31 March and from 1 Sept. to 31 December 2) from 0 h to 1 h 10 m and from 18 h to 24 h from 1 April to 31 August	Second pulses Pulses at the beginning of the minute are prolonged. Rythmic signals between minutes 1 and 6 at 0 h, 2 h, 4 h..  Second pulses are also transmitted between minutes 5 and 10 at 1 h, 3 h, 5 h..

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
RKM (2)	Irkutsk USSR + 52° 46' - 103° 39'	15004	between minutes 15 and 20, 25 and 30, 51 and 60. 1) from 1 h 40 m to 11 h 10 m from 1 January to 31 March and from 1 Sept. to 31 December 2) from 1 h 40 m to 17 h from 1 April to 31 August	
RTA (2)	Novosibirsk USSR + 55° 04' - 82° 58'	4996	between minutes 5 and 10, 15 and 20, 25 and 29, 35 and 39. from 0 h to 1 h 30 m and from 18 h to 24 h from 1 January to 31 March and from 1 Sept. to 31 Dec.	Second pulses. Pulses at the beginning of the minute are prolonged.
		9996	between minutes 5 and 10, 15 and 20, 35 and 39 1) from 3 h to 5 h and from 14 h to 17 h 30 m from 1 January to 31 March and from 1 Sept. to 31 December 2) from 0 h to 2 h and from 16 h to 24 h from 1 April to 1 August	
		14996	between minutes 5 and 10, 15 and 20, 25 and 29, 35 and 39 1) from 5 h 30 m to 13 h 30 m from 1 January to 31 March and from 1 Sept. to 31 December 2) from 3 h to 15 h 30 m from 1 April to 31 Aug.	
RWM (2)	Moscow USSR + 55° 19' - 38° 41'	10000	between minutes 30 and 35, 41 and 45, 50 and 60 1) from 0 h to 4 h 20 m from 13 h 50 m to 24 h from 1 January to 31 March and from 1 Sept. to 31 Dec. 2) from 0 h to 2 h 20 m from 13 h 50 m to 24 h from 1 April to 31 August.	Second pulses. Pulses at the beginning of the minute are prolonged.  Rythmic signals between minutes 1 and 6 at 1 h, 3 h, 5 h...
		15000	between minutes 30 and 35, 41 and 45, 50 and 60 1) from 4 h 50 m to 13 h 20 m from 1 January to 31 March and from 1 Sept. to 31 December 2) from 2 h 50 m to 15 h 20 m from 1 April to 31 Aug.	
RTZ (2)	Irkutsk USSR + 52° 18' - 104° 18'	50	between minutes 0 and 5 of every hour except for 20 h	A I type. Second pulses. Pulses at the beginning of the minute are prolonged

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
VNG	Lyndhurst Australia 38° 3' -145° 16'	4500 7500 12000	9 h 45 m to 21 h 30 m continuous except 22 h 30 m to 22 h 45 m 21 h 45 m to 9 h 30 m	Seconds markers of 50 cycles of 1 kHz modulation ; 5 cycles only for seconds markers 55 to 58 ; seconds marker 59 is omitted ; 500 cycles for minute markers. During the 5th, 10th, 15th, etc., minutes, 5 cycles for seconds markers 50 to 58. Identification by voice announcement during 15th, 30th, 45th and 60th minutes. DUT1 : CCIR code by 45 cycles of 900Hz modulation immediately following the normal seconds markers.
WWV	Fort-Collins USA + 40° 41' +105° 2'	2500 5000 10000 15000 20000 25000	continuous	Pulses of 5 cycles of 1 kHz modulation. 59th and 29th second pulse omitted. Hour is identified by 0.8 second long, 1500 Hz tone. Beginning of each minute identified by 0.8 second long, 1000 Hz tone. DUT1 : CCIR code by double pulse. Additional informations on UT correction
WWVB	Fort Collins USA + 40° 40' +105° 3'	60	continuous	Second pulses given by reduction of the amplitude of the carrier. Coded announcement of the date and time and of the correction to obtain UT1. No CCIR code.
WWVH	Kauai USA + 21° 59' +159° 46'	2500 5000 10000 15000 20000	continuous	Pulses of 6 cycles of 1200 Hz modulation. 59th and 29th seconds pulse omitted. Hour identified by 0.8 second long 1500 Hz tone. Beginning of each minute identified by 0.8 second long, 1200 Hz tone. DUT1 : CCIR code by double pulse. Additional informations on UT1 corrections.
ZUO	Olifantsfontein South Africa -25° 58' -28° 14'	5000	continuous	Pulses of 5 cycles of 1 kHz modulation. Second 0 is prolonged. DUT1 : CCIR code by lengthening



### Notes on the characteristics of time signals

(1) NWC - Time control of the transmissions from NWC Harold E. Holt, Australia will begin on an experimental basis in January 1971.

Carrier frequencies of 22300 cycles and 22350 cycles will be phase stabilized.

50 baud frequency shift keying will be employed with bit lengths of 20 ms.

Transition between frequencies will require approximately 2 ms.

The time of the half way point of the transition will be maintained within  $\pm 10 \mu\text{sec}$  of the station clock.

This point will also be identical with the phase coincident point between the two carriers.

The zero crossing of the positive slope of the 22300 cycle carrier will be controlled in time to  $\pm$  one  $\mu\text{s}$  of the station clock.

Time signals will be broadcast in the American Code beginning 2 minutes before and ending one second after certain half hours.

The one second pulses for the American Code will consist of 300 ms of 20 ms reversals followed by 700 ms of steady signal of the 22350 cycle carrier (SPACE).

The beginning of the second will occur at the half transition point at the start of the reversals (22350  $\rightarrow$  22300).

(2) The radiostations of the USSR emit UT1 information in accordance with the CCIR code Furthermore they give an additional information dUT1 specifying more precisely the difference UT1-UTC down to multiples of 0.02 s, the total value of the correction being DUT1+dUT1. Positive values of dUT1 are transmitted by the marking of p second markers within the range between the 20th and 25th second so that  $dUT1 = +0.02 \text{ s} \times p$ . Negative values of DUT1 are transmitted by the marking of q second markers within the range between the 35th and the 40th second, so that  $dUT1 = -0.02 \text{ s} \times q$ .

## TIME OF EMISSION OF THE TIME-SIGNALS IN 1971

Unless otherwise stated, the values of UTC-signal (or SAT-signal) are valid for the whole year 1971. The asterisk (\*) denotes that the error is less than 0.0001 s.

1° - UTC system

Signal	UTC-Signal (unit : 0.0001 s)	Remarks
CHU	- 1* or 0*	-1* until 1971 Nov.12, 0* since 1971 Nov.19, -2 to -9 from Nov.13 to Nov.19.
DAM,DAN,DAO	0*	
DGI	+ 3	
DIZ	0* or -1*	-1* from 1971 April 1. to 1971 April 20, from 1971 Nov.23 to 1971 Nov.30 0* otherwise
FFH	+ 1	
FTA91	- 6	
FTH42,FTK77,FTN87	0*	
HBG	0*	
IAM	- 1	
IBF	+2	
JJY	- 9 then 0	- 9 until 1971 Oct. 31, 0 since 1971 Nov. 1
LOL (all emissions)	- 4	
LQB9	+5	
LQC20	+1	
MSF,GBR	+2*	
NSS(o.c.)	+2	
OLB 5	+9*	
OMA	+1*	
PPE	+1	
RWM	+752	
VNG	+2*	
WWV,WWVH	+1*	
ZUO	+3	

2° - SAT system

Signal	SAT-Signal (unit : 0.0001 . s)
DCF 77	0*
WWVB	+1*