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Table 9 - Offsets and step adjustments of UTC, until 1976 Dec. 31

Date (at 0h UT)			Offsets	Steps
1961	Jan.	1	-150×10^{-10}	
	Aug.	1	"	+0.050 s
1962	Jan.	1	-130×10^{-10}	
1963	Nov.	1	"	-0.100 s
1964	Jan.	1	-150×10^{-10}	
	April	1	"	-0.100 s
	Sept.	1	"	-0.100 s
1965	Jan.	1	"	-0.100 s
	March	1	"	-0.100 s
	July	1	"	-0.100 s
	Sept.	1	"	-0.100 s
1966	Jan.	1	-300×10^{-10}	
1968	Feb.	1	"	+0.100 s
1972	Jan.	1	0	-0.107 7580 s
	July	1	"	-1 s
1973	Jan.	1	"	-1 s
1974	Jan.	1	"	-1 s
1975	Jan.	1	"	-1 s
1976	Jan.	1	"	-1 s

Table 10 - Relationship between TAI and UTC, until 1976 Dec. 31

Limits of validity (at 0 h UT)	TAI-UTC
1961 Jan. 1 - 1961 Aug. 1	1.422 818 0 s + (MJD - 37 300) × 0.001 296 s
Aug. 1 - 1962 Jan. 1	1.372 818 0 s + "
1962 Jan. 1 - 1963 Nov. 1	1.845 858 0 s + (MJD - 37 665) × 0.001 123 2 s
1963 Nov. 1 - 1964 Jan. 1	1.945 858 0 s + "
1964 Jan. 1 - April 1	3.240 130 0 s + (MJD - 38 761) × 0.001 296 s
April 1 - Sept. 1	3.340 130 0 s + " "
Sept. 1 - 1965 Jan. 1	3.440 130 0 s + " "
1965 Jan. 1 - March 1	3.540 130 0 s + " "
March 1 - July 1	3.640 130 0 s + " "
July 1 - Sept. 1	3.740 130 0 s + " "
Sept. 1 - 1966 Jan. 1	3.840 130 0 s + " "
1966 Jan. 1 - 1968 Feb. 1	4.313 170 0 s + (MJD - 39 126) × 0.002 592 s
1968 Feb. 1 - 1972 Jan. 1	4.213 170 0 s + " "
1972 Jan. 1 - July 1	10.000 000 0 s
July 1 - 1973 Jan. 1	11.000 000 0 s
1973 Jan. 1 - 1974 Jan. 1	12.000 000 0 s
1974 Jan. 1 - 1975 Jan. 1	13.000 000 0 s
1975 Jan. 1 - 1976 Jan. 1	14.000 000 0 s
1976 Jan. 1	15.000 000 0 s

Table 11 - Atomic time, collaborating laboratories

ATC	Australian Telecommunication Commission, Melbourne, Australia
ASMW	Amt für Standardisierung, Messwesen und Warenprüfung, Berlin, Deutsche Demokratische Republik.
BEV	Bundesamt für Eich - und Vermessungswesen, Wien, Österreich.
DHI	Deutsches Hydrographisches Institut, Hamburg, Bundesrepublik Deutschland.
DNM	Division of National Mapping, Canberra, Australia.
F	Commission Nationale de l'Heure, Paris, France.
FOA	Research Institute of National Defence, Stockholm, Sweden.
IEN	Istituto Elettrotecnico Nazionale, Torino, Italia.
IGMA	Instituto Geographico Militar, Buenos-Aires, Argentina
ILOM	International Latitude Observatory, Mizusawa, Japan.
NBS	National Bureau of Standards, Boulder, USA.
NIS	National Institute for Standards, Cairo, Egypt, Arab Rep.
NPL	National Physical Laboratory, Teddington, U.K.
NPRL	National Physical Research Laboratory, Pretoria, South Africa.
NRC	National Research Council of Canada, Ottawa, Canada.
OMH	Országos Mérésügyi Hivatal, Budapest, Hungary.
OMSF	Instituto y Observatorio de Marina, San Fernando, España.
ON	Observatoire de Neuchâtel, Neuchâtel, Suisse.
ONBA	Observatorio Naval, Buenos-Aires, Argentina
ONRJ	Observatorio National, Rio de Janeiro, Brazil.
OP	Observatoire de Paris, Paris, France.
ORB	Observatoire Royal de Belgique, Bruxelles, Belgique.
PTB	Physikalisch-Technische Bundesanstalt, Braunschweig, Bundesrepublik Deutschland.
PTCH	Direction générale des PTT, Berne, Suisse.
RGO	Royal Greenwich Observatory, Herstmonceux, U.K.
RRL	Radio Research Laboratories, Tokyo, Japan.
SU(1)	Laboratoire d'état de l'étalon de temps et de fréquence, URSS.
TAO	Tokyo Astronomical Observatory, Tokyo, Japan.
TCL	Telecommunication Laboratories, Taiwan, China.
TP(2)	Ústav Radiotechniky a Electroniky, Praha, Československo. Astronomický Ústav, Praha, Československo.
USNO	U.S. Naval Observatory, Washington, USA.
VSL	Van Swinden Laboratorium, Den Haag, Nederland.
ZIPE	Zentralinstitut Physik der Erde, Potsdam, Deutsche Demokratische Republik.

(1) Formerly designated by URSS.
(2) Both laboratories cooperate in the derivation of UTC(TP).

Table 12 - Laboratories keeping an independent local atomic time

Laboratory (i)	Equipment in atomic standards	Information on AT(i) - UTC(i): Interval of validity (in MJD at 0h UT)	AT(i) - UTC(i) in s
F (1)	15 commercial Cs stds	year 1975	AT(F) - UTC(OP) is published in Bulletin H by OP
NBS	10 commercial Cs stds 2 lab. primary stds 1 Hydrogen Maser (2)	42 413 - 42 717 42 717 - 42 778	14.045 085 012 $- (59.6 \times 10^{-9})$ (MJD - 42 413) 14.045 066 894 $- (39.6 \times 10^{-9})$ (MJD - 42 717)
NRC	4 commercial Cs stds 2 lab. primary stds (3)	year 1975	14 seconds exactly
ON	4 commercial Cs stds	year 1975	14 seconds exactly
PTB	8 commercial Cs stds 1 lab. primary std (4)	year 1975	published in PTB Time Service Bulletin
RGO	6 commercial Cs stds	42 413 - 42 594 42 594 - 42778	13.999 960 54 $- (30 \times 10^{-9})$ (MJD - 42 413) 13.999 955 11 $- (50 \times 10^{-9})$ (MJD - 42 594) (5)
USNO	25 commercial Cs stds 1 Hydrogen Maser	year 1975	A.1 (USNO, MEAN) - UTC(USNO MC) : provisional values in USNO series 7 ; final values in USNO series 11. (6)

Table 12 · (cont.)

Notes

(1) The standards are located as follows (at the end of 1975)

Centre National d'Etudes Spatiales	2 Cs
Centre National d'Etudes des Télécommunications	4 Cs
Centre d'Etudes et de Recherches Géodynamiques et Astronomiques	2 Cs
Observatoire de Paris	5 Cs
Observatoire de Besançon	1 Cs
Société Nationale Industrielle Aérospatiale (Toulouse)	1 Cs

They are intercompared by the TV method and linked to the foreign laboratories through OP (see Table 13).

(2) The laboratory primary standards control AT(NBS) via an accuracy algorithm. One of the two primary standards usually operates as a contributing member clock. 3 of the commercial standards provide the reference for WWV and WWVB but do not contribute directly to AT(NBS) ; the are available for NBS time scales back-up and are compared to AT(NBS) to within 0.1 μs.

(3) In 1975, the Cs standards were calibrated twice a week against Cs III, one of the two laboratory standards (2.1 m) with a 2 σ precision of about 1×10^{-12} s. The other laboratory standard was used as a clock starting from 1975 May 1. In 1976, different defintions of AT(NRC) and UTC(NRC) were introduced.

(4) AT(PTB) results from a reading of the 8 HP Cs St. considering the comparisons with the primary freq. st. CS1 of PTB. Precautions are taken in order to ensure the best uniformity of the scale. The AT(PTB) second is about 1×10^{-12} shorter than the CS1 second. UTC(PTB) + 1 h = MEZ(PTB) is called the Official Time Scale (in Central European Time) which is desseminated, e.g., by the LF transmitter DCF77.

(5) AT(RGO) is designated by GA2.

(6) AT(USNO) is designated by A.1 (USNO, MEAN).

Table 13 - Equipment and links of the collaborating laboratories

Laboratory (i)	Equipment (1)	Source of UTC(i)	LORAN-C receptions (2)	VLF and LF receptions (3)	Television link with
ASMW	1 Cs	1 Cs			ZIPE, TP
BEV	1 Cs	1 Cs	7970-W 7990-M 7990-X	GBR, OMA50, MSF60, HBG, DCF77	
DHI	2 Cs	1 Cs	7970-W	DCF77	PTB, TP, ZIPE
DNM(4)	3 Cs	all the Cs		NLK, NWC	other lab. in Australia
FOA	3 Cs	mean of 3 Cs	7970-W	GBR, NAA, OMEGA/ND	other lab. in Sweden
IEN	4 Cs	1 Cs	7970-W 7990-M 7990-Z	GBR, NAA, MSF60	other lab. in Italy
IGMA	1 Cs	1 Cs		NAA, NLK, GBR	ONBA
ILOM	3 Cs	Cs	9970-M	NLK	RRL
NBS	see Table 12	7 Cs 2 lab. Cs	9930-Z	NAA, NLK	NRC, USNO
NPL	5 Cs 1 lab. Cs 2 H Masers	1 Cs	7970-W	GBR, MSF60	transmitting station in Rugby
NPRL	1 Cs	1 Cs		GBR, NAA	
NRC	see Table 12	all the Cs	9930-Y		NBS, USNO
OMH	1 Cs	1 Cs			TP
OMSF	3 Cs	all the Cs	7990-Z	NAA	
ON	see Table 12	all the Cs	7970-W 7990-Z		
ONBA	2 Cs	2 Cs		NAA, OMEGA/T	
ONRJ	2 Cs	all the Cs		GBR, NAA	other lab. in Brasil
OP	5 Cs	1 Cs	7970-W 7990-Z		other lab. in France, ORB

Table 13 - (cont.)

Laboratory (i)	Equipment (1)	Source of UTC(i)	LORAN - C receptions (2)	VLF and LF receptions (3)	Television link with
ORB	2 Cs	1 Cs	7970-W		OP
PTB	see Table 12		7970-W	GBR, NAA	DHI, TP
PTCH	1 Cs	1 Cs	7970-W	DCF77, HBG	
RGO	see Table 12	selection of the Cs	7970-M 7970-W 7990-Z	GBR, MSF60	
RRL	6 Cs 2 H masers	1 Cs	9970-M	NLK, OMEGA/ND, OMEGA/H	
SU	6 Cs H masers	Cs		GBR, NAA, OMA50, RBU	other lab. in the USSR
TAO	4 Cs	1 Cs	9970-M	NLK, NWC	ILOM, RRL
TCL	3 Cs	all the Cs	9970-M	NDT, NWC	
TP	1 Cs	1 Cs		DCF77, GBR, NAA	DHI, PTB ZIPE, ASMW, OMH
USNO	see Table 12	Cs	(5)	(5)	NRC, NBS
VSL	2 Cs	Cs	7970-W	DCF77	other lab. in Holland
ZIPE	1 Cs	1 Cs	7970-W	DCF77, GBR, NAA, OMA50, HBG, OMEGA/N	ASMW, DHI, TP, Borowiec (Poland)

Table 13 - (cont.)

Notes

(1) Cs designates a commercial Cs Std.

(2) LORAN-C stations :

9930-Y	East Coast chain, Nantucket
9930-Z	" " " Dana
7990-M	Mediterranean chain, Simeri Crichi
7990-X	" " " Lampedusa
7990-Z	" " Estartit
7970-M	Norwegian Sea chain, Ejde
9970-W	" " " Sylt
9970-M	Northwest Pacific chain, Iwo Jima
5970	Southeast Asia

(3) OMEGA stations :

/N	Aldra, Norway
/ND	Lamoure, North Dakota, USA
/T	Trinidad, West Indies
/H	Hawaii

(4) Satellite link via Timation with RGO and combination of Timation and Television links with USNO.

(5) The daily phase values Series 4 of the USNO give the values of UTC(USNO MC) - transmitting station for :

the LORAN-C chains

the LORAN-D West Coast, USA

teh OMEGA stations ND, T, H.

the VLF stations GBR, NAA, NBA, NLK.

TABLE 14 - TIME COMPARISONS BETWEEN LABORATORIES BY CLOCK TRANSPORTATION IN 1975 (FOR ABBREVIATIONS, SEE P. B 42).

UNLESS OTHERWISE STATED, THE TRANSPORTATION WAS CARRIED OUT BY THE FIRST MENTIONED LABORATORY

DATE	MJD	TIME COMPARISONS		ERROR	SOURCE
1975		(UNIT : 1 MICROSECOND)			
JAN 12	42424.1	UTC(USNO) - UTC(TCL) =	61.6	0.4	USNO DPV 418 (1)
JAN 15	42427.3	UTC(USNO) - UTC(OP) =	1.5	0.3	USNO DPV 416
JAN 17	42429.3	UTC(USNO) - UTC(PTB) =	-3.8	0.3	USNO DPV 416
MAR 16	42487.6	UTC(USNO) - UTC(IGMA) =	31.3	0.1	USNO DPV 426
MAR 16	42487.7	UTC(USNO) - UTC(ONBA) =	-1973.8	0.5	USNO DPV 426
MAR 25	42496.5	UTC(USNO) - UTC(ONRJ) =	-77.8	0.1	USNO DPV 426
JUL 17	42610.5	UTC(NBS) - UTC(USNO) =	8.1	0.1	USNO DPV 442
JUL 18	42611.2	UTC(USNO) - UTC(CSIR) =	2.8	0.2	USNO DPV 442 (2)
JUL 31	42624.8	UTC(NBS) - UTC(USNO) =	8.4	0.1	USNO DPV 443
AUG 27	42651.1	UTC(USNO) - UTC(TAO) =	29.5	0.2	USNO DPV 451
AUG 27	42651.1	UTC(USNO) - UTC(RRL) =	-8.9	0.2	USNO DPV 451
AUG 27	42651.7	UTC(USNO) - UTC(NBS) =	-8.4	0.4	USNO DPV 451 (3)
SEP 10	42665.6	UTC(ASMW) - UTC(ON) =	34.9		ASMW LETTER
SEP 27	42682.0	UTC(NBS) - UTC(USNO) =	8.23	0.03	USNO DPV 454
OCT 3	42688.0	UTC(USNO) - UTC(RRL) =	-8.6	0.2	USNO DPV 457 (4)
OCT 3	42688.0	UTC(USNO) - UTC(TAO) =	29.2	0.2	USNO DPV 457 (4)
OCT 3	42688.4	UTC(USNO) - UTC(OMSF) =	-7.5	0.1	USNO DPV 455
OCT 7	42692.6	UTC(USNO) - UTC(ON) =	11.0	0.1	USNO DPV 455
OCT 10	42695.3	UTC(USNO) - UTC(DHI) =	-2.2	0.1	USNO DPV 455
OCT 13	42698.4	UTC(USNO) - UTC(VSL) =	41.3	0.1	USNO DPV 455
OCT 14	42699.4	UTC(USNO) - UTC(ORB) =	26.1	0.1	USNO DPV 455
OCT 16	42701.8	UTC(RGO) - UTC(OP) =	-0.74		RGO LETTER
OCT 17	42702.3	UTC(USNO) - UTC(OP) =	-2.9	0.1	USNO DPV 455
OCT 17	42702.3	UTC(USNO) - UTC(RGO) =	-2.2	0.2	USNO DPV 456
OCT 27	42712.7	UTC(OP) - UTC(SU) =	55.0	0.1	OP LETTER
NOV 6	42722.2	UTC(IEN) - UTC(OP) =	10.5	0.2	IEN LETTER
NOV 8	42724.2	UTC(IEN) - UTC(TP) =	4.2	0.2	IEN LETTER
DEC 1	42747.9	UTC(USNO) - UTC(IGMA) =	74.8	0.1	IGMA LETTER
DEC 1	42747.9	UTC(USNO) - UTC(ONBA) =	-1887.2	0.1	IGMA LETTER
DEC 11	42757.7	UTC(USNO) - UTC(NBS) =	-7.8	0.2	USNO DPV 463
DEC 31	42777.0	UTC(IGMA) - UTC(ONBA) =	-1962.0	0.1	IGMA LETTER

COMPLEMENTARY RESULT FOR THE PREVIOUS YEAR

DATE	MJD	TIME COMPARISONS		ERROR	SOURCE
1974					
SEP 17	42307.5	UTC(ON) - UTC(SU) =	32.1	0.1	ON LETTER (5)

(1) UTC(USNO) IS WRITTEN INSTEAD OF UTC(USNO MC)
DPV:DAILY PHASE VALUES,SERIES 4,PUBLISHED BY USNO

(2) CSIR IS AN ABBREVIATION INSTEAD OF CSIRO : COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION , AUSTRALIA

(3) COMPARISON CARRIED OUT BY U.S. AEROSPACE GUIDANCE AND METROLOGY CENTER

(4) COMPARISON CARRIED OUT BY U.S. COAST GUARD , WASHINGTON RADIO STATION

(5) COMPARISON CARRIED OUT BY 'OSCILLOQUARTZ S.A.' , SWITZERLAND

TABLE 15 - INDEPENDENT ATOMIC TIMES

TA(I) DENOTES THE ATOMIC TIME OF THE LABORATORY I

UNIT IS ONE MICROSECOND

DATE 1975		MJD	TAI - TA(I)						
			F	NBS	NRC	ON	PTB	RGO	USNO
JAN	7	42419	-69.8	-45087.0	2.2	17.1	-363.0	36.0	-34396.2
JAN	17	42429	-70.1	-45086.5	2.5	17.0	-362.9	36.5	-34395.0
JAN	27	42439	-70.5	-45085.9	2.5	17.2	-362.7	37.2	-34395.2
FEB	6	42449	-70.7	-45085.4	2.4	17.2	-362.6	37.8	-34396.0
FEB	16	42459	-71.1	-45084.8	2.4	17.2	-362.5	38.3	-34395.8
FEB	26	42469	-71.4	-45084.3	1.9	17.3	-362.3	38.8	-34395.7
MAR	8	42479	-71.7	-45083.6	2.0	17.3	-362.2	39.4	-34395.6
MAR	18	42489	-72.2	-45082.9	2.0	17.3	-362.1	39.9	-34395.4
MAR	28	42499	-72.6	-45082.3	1.9	17.3	-361.9	40.6	-34395.3
APR	7	42509	-73.0	-45081.7	1.7	17.4	-361.9	40.9	-34395.0
APR	17	42519	-73.2	-45081.3	1.6	17.5	-361.6	41.5	-34395.0
APR	27	42529	-73.7	-45080.4	1.8	17.3	-361.7	41.9	-34394.7
MAY	7	42539	-73.9	-45080.1	1.8	17.2	-361.5	42.5	-34394.7
MAY	17	42549	-74.1	-45079.7	1.5	17.3	-361.2	43.3	-34394.8
MAY	27	42559	-74.5	-45079.0	1.3	17.1	-361.0	43.9	-34394.6
JUN	6	42569	-74.9	-45078.5	1.2	17.0	-360.8	44.3	-34394.5
JUN	16	42579	-75.3	-45077.9	1.1	16.7	-360.6	44.8	-34394.4
JUN	26	42589	-75.7	-45077.4	1.0	16.4	-360.5	45.4	-34394.2
JUL	6	42599	-76.1	-45076.8	0.8	16.2	-360.4	45.9	-34394.0
JUL	16	42609	-76.4	-45076.3	0.5	15.9	-360.3	46.6	-34393.9
JUL	26	42619	-76.8	-45075.8	0.3	15.7	-360.3	47.1	-34393.8
AUG	5	42629	-77.1	-45075.4	0.1	15.5	-360.3	48.0	-34393.6
AUG	15	42639	-77.5	-45074.7	0.0	15.1	-360.2	48.7	-34393.5
AUG	25	42649	-77.9	-45074.2	-0.1	14.8	-360.1	49.5	-34393.4
SEP	4	42659	-78.2	-45073.7	-0.4	14.6	-360.0	50.1	-34393.4
SEP	14	42669	-78.6	-45073.2	-0.4	14.4	-360.0	50.8	-34393.3
SEP	24	42679	-79.0	-45072.6	-0.6	14.3	-359.9	51.3	-34393.2
OCT	4	42689	-79.4	-45071.9	-0.6	14.2	-359.9	51.9	-34393.0
OCT	14	42699	-79.7	-45071.3	-0.7	14.1	-359.6	52.4	-34392.9
OCT	24	42709	-80.2	-45070.6	-0.5	13.9	-359.8	52.6	-34392.4
NOV	3	42719	-80.5	-45070.2	-0.4	13.9	-359.6	53.1	-34392.3
NOV	13	42729	-80.8	-45069.8	-0.6	13.9	-359.5	53.5	-34392.2
NOV	23	42739	-81.1	-45069.3	-0.4	13.8	-359.4	53.9	-34391.9
DEC	3	42749	-81.5	-45068.9	-0.3	13.7	-359.3	54.4	-34391.7
DEC	13	42759	-81.7	-45068.8	-0.2	13.8	-359.2	54.7	-34391.6
DEC	23	42769	-82.2	-45068.6	0.0	13.8	-359.1	55.0	-34391.3

TABLE 16 - PRIMARY STANDARDS USED AS CLOCKS

UNIT IS ONE MICROSECOND

DATE 1975	MJD	TAI-LAB.STD. NBS 4	NRC CSV
MAY 7	42539		2.5
MAY 17	42549		3.1
MAY 27	42559		4.0
JUN 6	42569		4.8
JUN 16	42579		5.6
JUN 26	42589		6.5
JUL 6	42599		7.4
JUL 16	42609	-172.2	8.3
JUL 26	42619	-153.1	9.1
AUG 5	42629	-134.0	9.9
AUG 15	42639	-114.7	10.7
AUG 25	42649	-95.6	11.5
SEP 4	42659	-76.5	12.2
SEP 14	42669	-57.5	13.0
SEP 24	42679	-38.3	13.6
OCT 4	42689	-18.9	14.4
OCT 14	42699	0.4	14.8
OCT 24	42709	19.7	15.7
NOV 3	42719	38.8	16.6
NOV 13	42729	57.7	17.2
NOV 23	42739		18.3
DEC 3	42749		19.0
DEC 13	42759		20.0
DEC 23	42769		20.9

TABLE 17 - COORDINATED UNIVERSAL TIME

UTC(I) DENOTES THE APPROXIMATION TO UTC KEPT BY THE LABORATORY I

UNIT IS ONE MICROSECOND

DATE 1975	MJD	UTC - UTC(I) ASMW (1)	DHI	DNM (2)	FOA (3)	IEN	ILOM	NBS
JAN 7	42419	-10.8	2.6	-8.6	-23.3	-11.5	-33.7	-2.3
JAN 17	42429	-11.2	2.7	-11.4	-23.9	-12.1	-34.1	-2.4
JAN 27	42439	-11.4	2.9	-12.0	-24.4	-12.6	-34.4	-2.4
FEB 6	42449	-11.7	3.0		-25.0	-12.7	-34.9	-2.6
FEB 16	42459	-11.3	3.1		-25.6	-12.8	-35.1	-2.5
FEB 26	42469	-10.3	3.3		-26.2	-13.0	-35.4	-2.6
MAR 8	42479	-10.7	3.4		-27.1	-13.6	-35.5	-2.6
MAR 18	42489	-11.4	3.5		-27.8	-13.8	-35.5	-2.4
MAR 28	42499	-12.1	4.1		-28.6	-13.9	-35.8	-2.4
APR 7	42509	-12.9	4.8		-29.1	-13.7	-36.2	-2.4
APR 17	42519	-13.5	5.5		-29.9	-13.5	-36.7	-2.6
APR 27	42529	-14.1	5.5	0.0*	-30.7	-13.6	-37.0	-2.4
MAY 7	42539	-14.7	5.6	3.2	-32.0	-14.0	-37.8	-2.6
MAY 17	42549	-15.0	5.8	5.7	-33.1	-13.1	-38.1	-2.8
MAY 27	42559	-15.6	5.9	6.1	-34.2	-13.6	-38.0	-2.7
JUN 6	42569	-16.0	5.6	9.8	-35.5	-14.2	-37.9	-2.8
JUN 16	42579	-16.9	5.3	13.6	-36.9	-14.1	-37.8	-2.8
JUN 26	42589	-17.2	5.2	15.6	-38.3	-14.0	-37.9	-2.8
JUL 6	42599	-17.8	5.0	17.3	-39.7	-13.9	-38.4	-2.9
JUL 16	42609	-18.5	4.8	18.9	-40.6	-13.8	-39.3	-3.0
JUL 26	42619	-18.9	4.8	20.1	-41.3	-13.5	-39.6	-3.1
AUG 5	42629	-19.2	4.8	24.2	-42.2	-12.9	-39.8	-3.2
AUG 15	42639	-19.6	4.4	23.4	-43.1	-12.6	-39.6	-3.1
AUG 25	42649	-19.9	4.2	27.1	-44.4	-12.0	-39.8	-3.3
SEP 4	42659	-19.6	3.9	26.1	-45.7	-11.2	-40.0	-3.4
SEP 14	42669	-19.1	3.5	27.5	-47.1	-11.1	-39.5	-3.4
SEP 24	42679	-19.8	3.2	30.6	-48.3	-10.6	-39.5	-3.4
OCT 4	42689	-18.5	2.7	31.4	-49.7	-10.1	-39.7	-3.4
OCT 14	42699	-18.4	2.3	32.6	-50.8	-10.3	-39.8	-3.3
OCT 24	42709	-18.2	1.7	34.1	-52.5	-10.3	-39.9	-3.2
NOV 3	42719	-18.2	1.3	35.8	-54.2	-9.9	-40.1	-3.4
NOV 13	42729	-18.0	1.0		-56.2	-9.3	-40.4	-3.4
NOV 23	42739	-18.1	0.5		-58.0	-9.1	-40.5	-3.2
DEC 3	42749	-18.1	0.1	0.0*	-60.1	-8.7	-41.3	-3.3
DEC 13	42759	-18.3	-0.1	2.4	-61.9	-8.2	-41.8	-3.5
DEC 23	42769	-18.1	-0.2	2.3	-63.8	-8.0	-42.5	-3.7

TABLE 17 - (CONT.)

UNIT IS ONE MICROSECOND

DATE 1975	MJD	UTC - UTC(I) NPL	NRC	OMH	OMSF	ON	OP	ORB
JAN 7	42419	-41.0	2.2		7.6	17.1	5.0	-3.8
JAN 17	42429	-41.2	2.5		6.7	17.0	4.8	-2.4
JAN 27	42439	-41.3	2.5		5.5	17.2	4.7	-1.3
FEB 6	42449	-41.3	2.4		4.2	17.2	4.7	0.3
FEB 16	42459	-41.4	2.4		2.7	17.2	4.7	1.3
FEB 26	42469	-41.4	1.9		1.6	17.3	4.6	2.5
MAR 8	42479	-41.5	2.0		0.0	17.3	4.5	3.6
MAR 18	42489	-41.6	2.0		-1.5	17.3	4.3	4.7
MAR 28	42499	-41.5	1.9		-2.7	17.3	4.2	5.8
APR 7	42509	-41.7	1.7		-3.0	17.4	4.0	6.9
APR 17	42519	-41.9	1.6		-2.8	17.5	4.0	8.2
APR 27	42529	-42.3	1.8		-2.9	17.3	3.7	9.7
MAY 7	42539	-42.2	1.8		-2.8	17.2	3.6	10.8
MAY 17	42549	-42.2	1.5		-2.4	17.3	3.7	12.5
MAY 27	42559	-42.3	1.3		-2.2	17.1	3.5	13.7
JUN 6	42569	-42.4	1.2		-2.1	17.0	3.4	15.2
JUN 16	42579	-42.4	1.1		-1.9	16.7	3.2	16.5
JUN 26	42589	-42.5	1.0		-1.8	16.4	3.1	17.4
JUL 6	42599	-42.6	0.8		-1.7	16.2	2.9	19.0
JUL 16	42609	-42.6	0.5		-1.6	15.9	2.9	20.3
JUL 26	42619	-42.5	0.3		-1.5	15.7	2.8	21.3
AUG 5	42629	-42.5	0.1		-1.3	15.5	2.8	22.2
AUG 15	42639	-42.7	0.0		-1.3	15.1	2.7	23.4
AUG 25	42649	-42.8	-0.1		-1.2	14.8	2.6	24.6
SEP 4	42659	-42.9	-0.4	-851.6	-1.1	14.6	2.3	26.1
SEP 14	42669	-43.1	-0.4	-851.0	-1.6	14.4	2.0	27.3
SEP 24	42679	-43.3	-0.6	-850.0	-2.1	14.3	1.8	28.1
OCT 4	42689	-43.4	-0.6	-849.9	-2.3	14.2	1.6	29.2
OCT 14	42699	-43.4	-0.7	-848.6	-3.2	14.1	1.4	30.8
OCT 24	42709	-43.5	-0.5	-848.3	-4.0	13.9	1.0	31.9
NOV 3	42719	-43.4	-0.4	-848.5	-3.9	13.9	0.9	32.2
NOV 13	42729	-43.4	-0.6	-848.0	-3.8	13.9	0.8	33.7
NOV 23	42739	-43.6	-0.4	-847.3	-3.7	13.8	0.6	33.9
DEC 3	42749	-43.4	-0.3	-847.5	-3.7	13.7	0.4	34.9
DEC 13	42759	-43.3	-0.2	-846.8	-3.6	13.8	0.2	36.4
DEC 23	42769	-43.4	0.0	-847.5	-3.4	13.8	-0.1	37.5

TABLE 17 - (CONT.)

UNIT IS ONE MICROSECOND

DATE 1975	MJD	UTC - UTC(I) PTB	PTCH (4)	RGO	RRL	TAO (5)	TCL	TP
JAN 7	42419	-0.6	1.5	-3.6	0.3	18.7	62.8	-1.3
JAN 17	42429	-0.4	3.6	-3.4	0.5	17.4	63.1	-1.6
JAN 27	42439	-0.0	6.5	-3.0	0.4	15.1	63.0	-1.5
FEB 6	42449	0.2	9.2	-2.8	0.2	12.6	63.0	-1.7
FEB 16	42459	0.4	12.0	-2.6	0.2	10.3	63.8	-2.0
FEB 26	42469	0.6	13.2	-2.3	0.1	8.1	64.4	-2.1
MAR 8	42479	0.7	10.4	-2.1	0.3	6.1	65.7	-2.2
MAR 18	42489	0.7	10.6	-1.8	0.5	34.3	67.4	-2.3
MAR 28	42499	0.9	11.5	-1.4	0.4	34.3	67.1	-2.2
APR 7	42509	0.9	13.3	-1.4	0.4	34.3	66.9	-2.9
APR 17	42519	1.2	15.5	-1.1	0.6	34.3	67.5	-2.5
APR 27	42529	0.9	16.4	-1.1	0.9	34.4	68.4	-2.8
MAY 7	42539	1.1	16.2	-0.7	0.1	33.8	69.2	-3.2
MAY 17	42549	1.2	15.6	-0.2	-0.9	33.7	70.0	-3.2
MAY 27	42559	1.3	15.1	0.1	-1.6	34.0	71.9	-3.7
JUN 6	42569	1.4	14.0	0.2	-2.4	34.0	73.1	-3.5
JUN 16	42579	1.5	14.7	0.4	-3.4	34.1	73.9	-3.7
JUN 26	42589	1.5	16.0	0.7	-4.4	34.1	74.9	-3.8
JUL 6	42599	1.4	17.8	0.8	-5.1	33.8	75.2	-3.8
JUL 16	42609	1.4	19.1	1.0	-5.7	33.1	73.4	-3.7
JUL 26	42619	1.2	20.4	1.0	-5.8	32.9	73.5	-3.8
AUG 5	42629	1.1	20.7	1.4	-6.0	32.7	73.9	-4.0
AUG 15	42639	1.0	21.0	1.6	-5.9	32.8	74.6	-4.1
AUG 25	42649	0.9	21.8	1.9	-6.3	32.3	74.8	-4.2
SEP 4	42659	0.8	21.9	2.0	-6.5	32.0	74.4	-4.2
SEP 14	42669	0.7	20.3	2.1	-5.9	32.5	75.5	-4.6
SEP 24	42679	0.6	18.4	2.2	-5.9	32.4	75.7	-4.4
OCT 4	42689	0.5	17.3	2.2	-6.0	32.2	75.9	-4.6
OCT 14	42699	0.5	18.8	2.3	-5.9	32.2	75.9	-4.6
OCT 24	42709	0.2	19.9	2.0	-5.6	32.5	76.5	-5.0
NOV 3	42719	0.2	19.2	2.0	-5.6	32.5	76.8	-5.2
NOV 13	42729	0.2	18.2	1.9	-5.6	32.6	77.0	-5.3
NOV 23	42739	0.1	17.3	1.8	-5.4	32.9	77.1	-5.8
DEC 3	42749	0.2	16.6	1.8	-5.5	32.8	77.0	-6.3
DEC 13	42759	0.3	16.3	1.6	-5.5	32.8	77.3	-6.6
DEC 23	42769	0.3	16.2	1.4	-5.4	32.9	77.0	-7.1

TABLE 17 - (CONT.)

UNIT IS ONE MICROSECOND

DATE 1975		MJD	UTC - UTC(I)		
			USNO	VSL (6)	ZIPE
JAN	7	42419	3.3	-4.1	-1.1
JAN	17	42429	3.5	-2.7	-1.6
JAN	27	42439	3.6	-1.1	-1.8
FEB	6	42449	3.7	0.5	-2.1
FEB	16	42459	3.8	2.2	-1.1
FEB	26	42469	3.9	4.0	-0.7
MAR	8	42479	4.1	5.5	-1.8
MAR	18	42489	4.3	6.9	-2.3
MAR	28	42499	4.3	8.7	-2.9
APR	7	42509	4.5	10.7	-3.7
APR	17	42519	4.5	12.9	-4.1
APR	27	42529	4.8	14.7	-5.0
MAY	7	42539	4.8	16.4	-5.5
MAY	17	42549	4.8	18.0	-5.9
MAY	27	42559	5.1	19.5	-6.4
JUN	6	42559	5.2	21.0	-6.8
JUN	16	42579	5.3	22.6	-7.6
JUN	26	42589	5.5	24.3	-8.1
JUL	6	42599	5.5	26.3	-8.6
JUL	16	42509	5.3	28.5	-9.3
JUL	26	42619	5.4	30.4	-9.6
AUG	5	42629	5.3	32.1	-10.0
AUG	15	42639	5.3	33.6	-10.4
AUG	25	42649	5.2	35.3	-10.8
SEP	4	42559	4.9	37.3	-10.4
SEP	14	42569	4.9	39.6	-9.9
SEP	24	42579	4.8	41.7	-9.7
OCT	4	42689	4.7	43.6	-9.4
OCT	14	42599	4.6	45.5	-9.2
OCT	24	42709	4.8	46.8	-9.1
NOV	3	42719	4.8	48.3	-9.0
NOV	13	42729	4.8	49.8	-8.8
NOV	23	42739	4.9	51.1	-8.8
DEC	3	42749	4.7	52.5	-8.9
DEC	13	42759	4.8	54.0	-9.1
DEC	23	42769	4.8	55.4	-9.1

NOTES

(1) Values published in circulars D were corrected by - 1 µs, taking into account the clock transportation result.

(2) The symbol* denotes arbitrary origins.

(3) Values published in all the previous Annual Reports should be corrected by - 55.9 µs due to a wrong origin adopted by the BIH.

(4) The origin of UTC-UTC(PTCH) is not known ; UTC-UTC(PTCH) = 0 was arbitrarily fixed on 1972 Nov. 18.

(5) Change of master clock on MJD = 42 481. The UTC(TAO) time step was - 28.7 µs.

(6) A UTC(VSL) time step of + 75 µs was applied on MJD = 42 413 by VSL.

TABLE 18 - UNIVERSAL TIME COORDINATED ,FROM VLF MEASUREMENTS.

UTC(I) DENOTES THE APPROXIMATION TO UTC KEPT BY THE LABORATORY I

UNIT IS ONE MICROSECOND

DATE 1975	MJD	UTC - UTC(I) IGMA (1)	NPRL	SU (2)
JAN 7	42419	21	166	57
JAN 17	42429	17	157	57
JAN 27	42439	19	162	55
FEB 6	42449	23	162	55
FEB 16	42459	26	159	52
FEB 26	42469	31	163	52
MAR 8	42479	38	160	51
MAR 18	42489	43	157	53
MAR 28	42499	53	155	50
APR 7	42509	62	152	52
APR 17	42519	66	149	53
APR 27	42529	67	147	53
MAY 7	42539	67	144	55
MAY 17	42549	68	142	55
MAY 27	42559	69	139	54
JUN 6	42569	70	136	56
JUN 16	42579	71	132	56
JUN 26	42589	73	130	57
JUL 6	42599	73	125	57
JUL 16	42609	73	121	58
JUL 26	42619	73	117	58
AUG 5	42629	72	127	58
AUG 15	42639	72	130	59
AUG 25	42649	73	126	58
SEP 4	42659	73	123	58
SEP 14	42669	74	127	57
SEP 24	42679	74	127	58
OCT 4	42689	73	126	56
OCT 14	42699	73	124	56
OCT 24	42709	74	124	55
NOV 3	42719	71	122	57
NOV 13	42729	71	120	55
NOV 23	42739	73	117	54
DEC 3	42749	73	116	54
DEC 13	42759	75	116	55
DEC 23	42769	74	114	52

(1) IGMA Origin given by the clock transportations on 1975 March 16 and December 1.

(2) SU Origin given by a clock transportation on 1975 October 27.

Table 19 — Comparisons between the clock transportations and the BIH results

The table gives the differences between the clock transportations results and those derived from the data of Table 14 (before rounding-off) for some pairs of laboratories.

Time comparisons		Date	MJD	Difference in μs clock tr.-BIH
UTC(USNO) –	UTC(DHI)	1975 Oct. 10	42695.3	0.0
	UTC(NBS)	1975 Jul. 17	42610.6	+ 0.2
		Jul. 31	42624.8	+ 0.1
		Aug. 27	42651.7	0.0
		Sep. 27	42682.0	- 0.06
		Dec. 11	42757.7	+ 0.5
	UTC(OMSF)	1975 Oct. 3	42688.4	- 0.5
	UTC(ON)	1975 Oct. 7	42692.6	+ 1.5
	UTC(OP)	1975 Jan. 15	42427.3	+ 0.2
		Oct. 17	42702.3	+ 0.5
	UTC(ORB)	1975 Oct. 14	42699.4	- 0.1
	UTC(PTB)	1975 Jan. 17	42429.3	+ 0.2
	UTC(RGO)	1975 Oct. 17	42702.3	+ 0.3
	UTC(RRL)	1975 Aug. 27	42651.1	+ 2.6
		Oct. 3	42668.0	+ 2.1
	UTC(TAO)	1975 Aug. 27	42651.1	+ 2.4
		Oct. 3	42688.0	+ 1.7
	UTC(TCL)	1975 Jan. 12	42424.1	+ 2.0
	UTC(VSL)	1975 Oct. 13	42698.4	+ 0.5
UTC(IEN) –	UTC(OP)	1975 Nov. 6	42722.2	- 0.1
	UTC(TP)	1975 Nov. 8	42724.2	- 0.2
UTC(OP) –	UTC(ON)	1975 Oct. 7	42692.6	+ 1.1
	UTC(ORB)	1975 Oct. 14	42699.4	- 0.5
	UTC(PTB)	1975 Jan. 17	42429.3	- 0.1
	UTC(RGO)	1975 Oct. 16	42701.8	- 0.17
	UTC(TP)	1975 Nov. 6	42722.2	- 0.1
	UTC(VSL)	1975 Oct. 13	42698.4	0.0
UTC(RRL) –	UTC(TAO)	1975 Aug. 27	42651.1	- 0.2
		Oct. 3	42688.0	- 0.4

TABLE 20 - INTERNATIONAL ATOMIC TIME , BI-MONTHLY RATES OF TAI-CLOCK FOR 1975

THE RATES ARE AVERAGED OVER INTERVALS OF TWO MONTHS ENDING AT THE GIVEN DATES

UNIT IS NS/DAY , 0.0 DENOTES THAT THE CLOCK WAS NOT USED

LAB.	CLOCK	42469	42529	42589	42649	42709	42769
F	12 133	0.0	0.0	-227.78	-250.86	-243.16	-253.97
F	12 158	126.28	105.30	108.95	113.57	117.34	115.76
F	12 195	0.0	-219.98	-203.73	-222.86	-204.51	0.0
F	12 206	0.0	6.91	14.75	76.85	0.0	0.0
F	12 207	7.68	19.69	-100.11	-161.61	0.0	0.0
F	12 231	0.0	0.0	0.0	0.0	41.21	60.01
F	12 347	159.69	151.20	150.07	141.14	149.32	143.58
F	12 439	-77.60	-76.53	-78.02	-100.19	-91.19	-84.27
F	12 475	153.67	156.78	196.65	0.0	0.0	193.14
F	12 560	0.0	0.0	0.0	0.0	0.0	121.78
F	12 594	64.00	58.12	62.54	0.0	0.0	0.0
F	14 134	0.0	0.0	0.0	0.0	0.0	22.64
F	14 753	193.84	199.11	200.18	192.20	172.51	177.12
F	14 873	0.0	41.21	43.29	45.61	32.04	35.78
F	22 120	0.0	0.0	0.0	0.0	0.0	-22.48
FOA	11 55	278.79	290.53	242.40	186.17	197.55	370.67
FOA	11 200	-314.30	-379.56	-446.78	-299.96	-408.35	-311.20
FOA	14 900	-123.44	-130.44	-169.08	-175.18	-184.75	-192.04
IEN	12 303	-36.69	79.50	153.56	0.0	0.0	0.0
IEN	12 469	-33.80	-6.91	-7.90	34.01	18.68	-41.11
IEN	12 609	0.0	0.0	61.81	56.17	79.81	147.82
IEN	14 893	0.0	0.0	0.0	0.0	47.89	39.20
NBS	11 121	-195.91	-214.63	0.0	0.0	0.0	0.0
NBS	11 137	-20.77	-27.35	0.0	0.0	-206.50	-242.64
NBS	11 167	-31.67	-10.44	-1.01	44.59	125.20	227.59
NBS	11 169	-104.80	-25.92	-143.25	0.0	0.0	0.0
NBS	12 323	-107.92	-107.21	-227.29	0.0	0.0	0.0
NBS	14 324	383.82	393.53	388.16	393.00	400.44	374.15
NBS	12 352	127.18	123.96	102.04	93.22	125.70	117.53
NBS	14 601	25.87	33.12	24.49	18.11	17.00	-16.67
NBS	25 67	0.0	0.0	0.0	0.0	507.44	481.11
NBS	91 4	0.0	0.0	0.0	0.0	1925.52	0.0
NPL	11 334	-56.75	-58.73	0.0	0.0	0.0	0.0
NPL	12 316	-132.61	-144.17	-154.74	-106.14	-129.49	-115.26
NPL	12 418	-9.19	-13.40	-4.61	-3.58	-11.93	1.80

TABLE 20 - (CONT.)

LAB.	CLOCK	42469	42529	42589	42649	42709	42769
NPL	12 832	6.44	-13.50	-19.25	4.66	-44.90	-56.98
NRC	11 217	72.02	94.62	88.14	112.43	0.0	0.0
NRC	12 122	-236.28	-262.50	-277.47	-292.09	-294.84	-288.16
NRC	12 267	33.89	32.83	38.93	39.23	35.94	47.33
NRC	14 911	0.0	0.0	0.0	-24.17	-30.87	-12.77
NRC	90 5	0.0	0.0	0.0	82.22	68.65	86.61
OMSF	14 896	56.63	322.34	594.97	372.44	81.33	567.83
OMSF	13 16	0.0	0.0	0.0	0.0	0.0	-14.28
OMSF	13 17	223.15	0.0	0.0	0.0	0.0	0.0
ON	11 173	11.80	4.78	-1.48	-4.77	2.52	26.41
ON	12 285	31.17	33.67	17.47	5.99	21.12	30.30
ON	13 14	-56.09	-83.25	-102.81	-158.72	-139.92	-129.65
ON	14 863	-296.31	-34.01	-52.14	-48.26	-66.32	-78.89
ORB	12 804	123.22	117.24	132.53	115.92	119.07	93.58
PTB	12 320	245.49	233.72	252.02	228.32	228.27	228.34
PTB	12 389	124.73	116.84	120.27	101.12	108.08	108.79
PTB	12 394	-58.48	0.0	0.0	0.0	-225.11	-226.35
PTB	12 395	-91.49	-96.38	-98.94	-110.20	-100.70	-88.11
PTB	12 462	-155.99	-135.92	-111.07	-129.04	0.0	0.0
PTB	14 867	0.0	-82.42	-73.04	-77.92	-76.89	-78.34
PTB	24 103	0.0	0.0	0.0	33.95	24.62	-9.13
PTCH	13 23	245.02	79.73	-19.70	89.96	-51.45	-66.47
RGO	11 123	0.0	0.0	-5.26	-20.94	-28.46	-28.49
RGO	11 199	187.81	191.39	209.53	228.74	240.84	240.84
RGO	12 202	-86.85	-93.33	0.0	0.0	0.0	0.0
RGO	12 348	-36.55	-44.77	-42.95	-42.57	-36.38	-40.73
RGO	12 484	428.12	428.53	433.41	452.82	429.87	402.70
RGO	14 868	0.0	-84.64	-70.24	-52.36	-67.66	-85.67
TP	12 335	-16.05	-12.94	-14.68	-7.07	-11.59	-35.94
USNO	11 276	-502.96	0.0	0.0	0.0	0.0	0.0
USNO	12 346	308.56	301.13	294.48	311.25	325.80	307.71
USNO	12 444	-127.42	-132.96	-83.94	-43.64	0.0	0.0
USNO	12 532	35.23	35.73	14.99	12.06	24.65	28.66
USNO	12 546	-297.20	-292.17	-348.59	-358.41	-330.78	-307.42
USNO	12 549	-51.56	-46.93	-60.86	-56.05	-57.09	-50.96

TABLE 20 - (CONT.)

LAB.	CLOCK	42469	42529	42589	42649	42709	42769
USNO	12 573	0.0	0.0	0.0	0.0	-149.41	-121.17
USNO	12 583	0.0	0.0	0.0	-378.70	-388.03	-449.64
USNO	12 591	48.62	44.22	33.31	31.05	31.26	32.20
USNO	12 592	315.13	303.36	287.82	298.66	284.34	262.26
USNO	14 571	140.12	148.65	139.12	138.51	132.51	141.36
USNO	14 651	47.90	47.38	43.37	64.21	0.0	0.0
USNO	14 653	10.51	22.37	0.0	0.0	0.0	0.0
USNO	14 654	-94.61	-80.10	-73.48	-65.82	-60.47	-51.32
USNO	14 656	-9.65	9.94	42.03	43.71	51.82	56.69
USNO	14 660	-13.25	-13.30	-2.94	18.65	6.03	-4.04
USNO	14 778	0.0	0.0	0.0	74.38	86.07	94.13
USNO	14 783	-39.80	-24.26	-8.74	18.28	37.45	60.16
USNO	14 834	38.16	34.04	33.45	40.79	41.72	37.51
USNO	14 837	7.57	22.60	37.44	61.40	0.0	0.0
USNO	22 100	0.0	0.0	0.0	-141.06	0.0	0.0
USNO	22 109	0.0	0.0	0.0	170.23	0.0	0.0
USNO	22 114	0.0	0.0	0.0	174.35	173.08	150.50
USNO	24 91	0.0	0.0	0.0	135.51	0.0	0.0
USNO	24 94	0.0	0.0	0.0	-220.61	-218.81	-192.33
USNO	24 104	0.0	0.0	0.0	-33.66	-34.96	-31.52
USNO	24 118	0.0	0.0	0.0	-16.29	-15.79	23.12
VSL	12 503	158.80	182.12	157.45	183.29	196.31	142.51
VSL	22 34	0.0	0.0	-142.13	-135.46	-159.61	-138.58
ZIPE	12 979	9.66	-48.44	-51.92	-43.56	28.76	-1.47

NOTE - THE CLOCKS ARE DESIGNATED BY THEIR MODEL (2 DIGITS) AND SERIAL NO. THE CODES FOR THE MODELS ARE

11	HEWLETT-PACKARD 5060A	
12 AND 22	HEWLETT PACKARD 5061A	(22 109 EQUIVALENT TO 12 1109)
13	EBAUCHES OSCILLATOM. B 5000	
14 AND 24	HEWLETT-PACKARD 5061A OPT.4	(24 104 EQUIVALENT TO 14 1104)
25	HEWLETT-PACKARD 5062C	(ADD 1000 TO THE SERIAL NO.)
90	LABORATORY CESIUM STANDARD NRC CS V	
91	LABORATORY CESIUM STANDARD NBS 4	

TABLE 21 - INTERNATIONAL ATOMIC TIME , WEIGHTS OF THE CLOCKS FOR 1975

THE WEIGHTS ARE GIVEN FOR INTERVALS OF TWO MONTHS ENDING AT THE GIVEN DATES

*** DENOTES THAT THE CLOCK WAS NOT USED

LAB.	CLOCK	42469	42529	42589	42649	42709	42769
F	12 133	***	***	0	22	52	61
F	12 158	8	18	30	44	55	100
F	12 195	***	0	46	64	80	***
F	12 206	***	0	100	0	***	***
F	12 207	9	17	0	0	***	***
F	12 231	***	***	***	***	0	33
F	12 347	100	98	100	65	100	100
F	12 439	100	100	100	71	99	100
F	12 475	100	100	16	***	***	0
F	12 560	***	***	***	***	***	0
F	12 594	92	100	100	***	***	***
F	14 134	***	***	***	***	***	0
F	14 753	41	60	82	99	70	75
F	14 873	***	0	100	100	90	100
F	22 120	***	***	***	***	***	0
FOA	11 55	0	3	3	4	5	0
FOA	11 200	0	0	0	0	0	0
FOA	14 900	49	64	22	13	10	12
IEN	12 303	3	0	0	***	***	***
IEN	12 469	9	12	27	17	16	2
IEN	12 609	***	***	0	100	47	0
IEN	14 893	***	***	***	***	0	100
NBS	11 121	12	10	***	***	***	***
NBS	11 137	10	24	***	***	0	10
NBS	11 167	100	77	53	12	0	0
NBS	11 169	31	0	0	***	***	***
NBS	12 323	16	23	0	***	***	***
NBS	14 324	95	94	100	100	100	67
NBS	12 352	21	44	34	29	38	50
NBS	14 601	100	100	100	100	100	33
NBS	25 67	***	***	***	***	0	19
NBS	91 4	***	***	***	***	0	***
NPL	11 334	30	21	***	***	***	***
NPL	12 316	42	27	22	24	30	30
NPL	12 418	96	100	98	100	100	89

TABLE 21 - (CONT.)

LAB.	CLOCK	42469	42529	42589	42649	42709	42769
NPL	12 832	99	65	53	56	21	15
NRC	11 217	95	53	45	29	***	***
NRC	12 122	31	12	11	9	10	20
NRC	12 267	92	100	100	100	100	93
NRC	14 911	***	***	***	0	100	81
NRC	90 5	***	***	***	0	68	79
OMSF	14 896	57	0	0	0	0	0
OMSF	13 16	***	***	***	***	***	0
OMSF	13 17	0	***	***	***	***	***
ON	11 173	2	5	12	10	29	69
ON	12 285	100	100	85	89	88	87
ON	13 14	9	16	32	6	6	7
ON	14 863	0	0	1	1	1	1
ORB	12 804	95	100	86	82	100	62
PTB	12 320	100	92	80	68	100	96
PTB	12 389	100	99	100	77	100	100
PTB	12 394	40	***	***	***	0	100
PTB	12 395	100	100	100	92	98	91
PTB	12 462	100	47	18	20	***	***
PTB	14 867	***	0	97	100	100	100
PTB	24 103	***	***	***	0	99	15
PTCH	13 23	0	0	0	0	0	1
RGO	11 123	***	***	0	47	52	69
RGO	11 199	0	6	5	5	6	17
RGO	12 202	100	100	***	***	***	***
RGO	12 348	45	53	56	100	100	100
RGO	12 484	38	56	46	25	33	40
RGO	14 868	***	0	58	29	46	49
TP	12 335	51	66	79	100	100	71
USNO	11 276	12	***	***	***	***	***
USNO	12 346	59	30	25	28	42	83
USNO	12 444	54	100	21	8	***	***
USNO	12 532	51	100	77	54	61	98
USNO	12 546	31	62	8	13	13	13
USNO	12 549	100	100	90	100	100	100

TABLE 21 - (CONT.)

LAB.	CLOCK	42469	42529	42589	42649	42709	42769
USNO	12 573	***	***	***	***	0	15
USNO	12 583	***	***	***	0	99	0
USNO	12 591	89	81	92	62	60	100
USNO	12 592	54	79	83	79	56	30
USNO	14 571	100	100	98	100	100	98
USNO	14 651	18	18	23	45	***	***
USNO	14 653	26	25	***	***	***	***
USNO	14 654	21	29	32	38	42	41
USNO	14 656	0	1	1	1	3	14
USNO	14 660	29	79	95	71	64	66
USNO	14 778	***	***	***	0	93	69
USNO	14 783	100	88	59	19	10	7
USNO	14 834	100	100	100	100	100	100
USNO	14 837	100	54	28	16	***	***
USNO	22 100	***	***	***	0	***	***
USNO	22 109	***	***	***	0	***	***
USNO	22 114	***	***	***	0	100	42
USNO	24 91	***	***	***	0	***	***
USNO	24 94	***	***	***	0	100	28
USNO	24 104	***	***	***	0	100	100
USNO	24 118	***	***	***	0	100	14
VSL	12 503	6	22	21	34	39	14
VSL	22 34	***	***	0	100	46	68
ZIPE	12 979	0	2	6	10	0	8

NOTE - THE CLOCKS ARE DESIGNATED BY THEIR MODEL (2 DIGITS) AND SERIAL NO. THE CODES FOR THE MODELS ARE

11	HEWLETT-PACKARD 5060A	
12 AND 22	HEWLETT PACKARD 5061A	(22 109 EQUIVALENT TO 12 1109)
13	EBAUCHES OSCILLATOM. B 5000	
14 AND 24	HEWLETT-PACKARD 5061A OPT.4	(24 104 EQUIVALENT TO 14 1104)
25	HEWLETT-PACKARD 5062C	(ADD 1000 TO THE SERIAL NO.)
90	LABORATORY CESIUM STANDARD NRC CS V	
91	LABORATORY CESIUM STANDARD NBS 4	

TABLE 22 - DATA FROM PRIMARY STANDARDS

NO GRAVITATIONAL FREQUENCY CORRECTION IS APPLIED UNLESS OTHERWISE STATED

LAB.	STANDARD	CALIBRATION INTERVAL MJD	NORMALIZED FREQ. DIF. OF TA(I) - STD. IN 10**-13	SIGMA1 IN 10**-13	SIGMA2 IN 10**-13
NBS	NBS 3	40358 - 40362	0.0	5.0	
NRC	NRC CS3	40221 - 40587	(1)	(2)	(2)
NRC	NRC CS3	40587 - 40709			
NRC	NRC CS3	40709 - 40952			
NRC	NRC CS3	40952 - 41072			
NRC	NRC CS3	41072 - 41139			
PTB	PTB CS1	40494 - 40644	16.0	1.0	1.8
PTB	PTB CS1	40749 - 40809	15.1	1.9	1.8
PTB	PTB CS1	40889 - 40949	13.3	1.9	1.8
PTB	PTB CS1	41449 - 41509	10.8	0.6	1.8
PTB	PTB CS1	41744 - 41774	9.4	1.5	1.8
PTB	PTB CS1	42254 - 42297	9.1	1.5	1.8
PTB	PTB CS1	42383 - 42407	10.3	1.5	1.8
PTB	PTB CS1	42448 - 42465	10.0	1.6	1.8
PTB	PTB CS1	42610 - 42622	8.5	1.0	1.8
PTB	PTB CS1	42654 - 42665	11.0	1.5	1.8
PTB	PTB CS1	42761 - 42792	9.9	1.5	1.8
NBS	NBS 5	41709 - 41713	0.1	3.0	3.5
NBS	NBS 5	41724 - 41728	-1.2	2.1	2.5
NBS	NBS 5	41759 - 41763	-1.4	5.0	2.5
NBS	NBS 5	41775 - 41779	0.2	2.5	2.5
NBS	NBS 5	41962 - 41966	-2.6	2.0	2.0
NBS	NBS 4	41924 - 41928	-6.2	5.0	2.5
NBS	NBS 4	42047 - 42051	-1.2	2.8	0.5
NBS	NBS 4	42084 - 42088	-0.1	2.8	0.5
NBS	NBS 4	42128 - 42132	-2.7	2.8	0.5
NBS	NBS 4	42170 - 42174	-1.7	2.8	2.5
NBS	NBS 4	42209 - 42213	-1.8	2.8	0.5
NBS	NBS 4	42239 - 42243	-0.2	2.8	0.5
NBS	NBS 4	42274 - 42278	-2.3	2.8	0.5
NBS	NBS 4	42317 - 42321	0.4	2.8	0.5
NBS	NBS 4	42352 - 42356	0.0	2.8	0.5
NBS	NBS 4	42394 - 42398	-1.0	2.8	0.5
NBS	NBS 4	42429 - 42433	-1.4	2.8	0.5
NBS	NBS 5	42048 - 42052	-2.7	2.0	0.5
NRC	NRC CSV	42539 - 42549	(1)		0.5
NRC	NRC CSV	42649 - 42709			0.5
NRC	NRC CSV	42709 - 42769			0.5
NRC	NRC CSV	42769 - 42829			0.5

(1) THE RESULTS ARE DIRECTLY REFERRED TO TAI , SEE TABLE 23.

(2) THE UNCERTAINTY OF THE CALIBRATION RESULTS IS 15*10**-13.

TABLE 23 - DATA USED FOR EVALUATING THE DURATION OF THE TAI SECOND .

GRAVITATIONAL FREQUENCY CORRECTIONS ARE APPLIED . THE FREQUENCIES ARE EXPRESSED AT SEA LEVEL .

LAB.	STANDARD	CALIBRATION INTERVAL MJD	NORMALIZED FREQ. DIF. OF TAI-STAND. IN 10**-13	RANDOM UNCERTAINTY IN 10**-13	SYSTEMATIC UNCERTAINTY IN 10**-13
NBS	NBS 3	40330 - 40390	11.8	5.2	2.5
NRC	NRC CS3	40221 - 40587	3.2	13.3	7.0
NRC	NRC CS3	40587 - 40709	5.4	13.3	7.0
NRC	NRC CS3	40709 - 40952	9.9	13.3	7.0
NRC	NRC CS3	40952 - 41072	1.4	13.3	7.0
NRC	NRC CS3	41072 - 41139	4.1	13.3	7.0
PTB	PTB CS1	40494 - 40644	16.6	1.0	1.8
PTB	PTB CS1	40749 - 40809	14.9	1.9	1.8
PTB	PTB CS1	40889 - 40949	13.9	2.0	1.8
PTB	PTB CS1	41449 - 41509	12.8	0.7	1.8
PTB	PTB CS1	41729 - 41789	11.7	1.2	1.8
PTB	PTB CS1	42249 - 42309	8.5	1.6	1.8
PTB	PTB CS1	42365 - 42425	11.2	1.7	1.8
PTB	PTB CS1	42429 - 42489	11.6	1.8	1.8
PTB	PTB CS1	42585 - 42645	9.2	1.4	1.8
PTB	PTB CS1	42629 - 42689	11.8	1.8	1.8
PTB	PTB CS1	42749 - 42809	11.1	1.6	1.8
NBS	NBS 5	41681 - 41741	12.8	2.3	2.7
NBS	NBS 5	41696 - 41756	11.2	2.5	2.7
NBS	NBS 5	41731 - 41791	11.2	5.2	2.7
NBS	NBS 5	41747 - 41807	12.5	2.8	2.7
NBS	NBS 5	41934 - 41994	8.7	2.4	2.7
NBS	NBS 4	41896 - 41956	4.3	5.2	2.5
NBS	NBS 4	42019 - 42079	11.1	3.1	0.5
NBS	NBS 4	42056 - 42116	11.7	3.1	0.5
NBS	NBS 4	42100 - 42160	10.1	3.1	0.5
NBS	NBS 4	42142 - 42202	10.6	3.1	0.5
NBS	NBS 4	42181 - 42241	7.8	3.1	0.5
NBS	NBS 4	42211 - 42271	9.8	3.1	0.5
NBS	NBS 4	42246 - 42306	7.0	3.1	0.5
NBS	NBS 4	42289 - 42349	9.4	3.1	0.5
NBS	NBS 4	42324 - 42384	9.2	3.1	0.5
NBS	NBS 4	42366 - 42426	8.6	3.1	0.5
NBS	NBS 4	42401 - 42461	8.1	3.1	0.5
NBS	NBS 5	42020 - 42080	9.6	2.4	0.5
NRC	NRC CSV	42539 - 42649	10.3	3.0	0.5
NRC	NRC CSV	42649 - 42709	7.9	3.0	0.5
NRC	NRC CSV	42709 - 42769	10.0	3.0	0.5
NRC	NRC CSV	42769 - 42829	9.5	3.0	0.5

PART C

TIME SIGNALS (1975/1976)

The time signal emissions, unless otherwise stated, follow the UTC system, in accordance with the Recommendation 460-1 of the International Radio Consultative Committee (CCIR), reproduced thereafter.

The information on time signals is based on inquiries made in February 1976.

CCIR RECOMMENDATION 460-1

STANDARD-FREQUENCY AND TIME-SIGNAL EMISSIONS

(Question 1/7)

(1970 – 1974)

The C.C.I.R.,

CONSIDERING

(a) that the Administrative Radio Conference, Geneva, 1959, allocated the frequencies 20 kHz ± 0·05 kHz, 2·5 MHz ± 5 kHz (2·5 MHz ± 2 kHz in Region 1), 5 MHz ± 5 kHz, 10 MHz ± 5 kHz, 15 MHz ± 10 kHz, 20 MHz ± 10 kHz and 25 MHz ± 10 kHz to the standard-frequency and time-signal service, requesting the C.C.I.R. to study the question of establishing and operating a world-wide standard-frequency and time-signal service;

(b) that additional standard frequencies and time signals are emitted in other frequency bands;

(c) the provisions of Article 44, Section IV, of the Radio Regulations;

(d) the continuing need for close cooperation between Study Group 7 and the Inter-Governmental Maritime Consultative Organization (I.M.C.O.), the International Civil Aviation Organization (I.C.A.O.), the General Conference of Weights and Measures (C.G.P.M.), the Bureau International de l'Heure (B.I.H.) and the concerned Unions of the International Council of Scientific Unions (I.C.S.U.);

(e) the desirability of maintaining world-wide coordination of standard-frequency and time-signal emissions;

(f) the need to disseminate standard frequencies and time signals in conformity with the second as defined by the 13th General Conference of Weights and Measures (1967);

(g) the continuing need to make Universal Time (UT) immediately available to an accuracy of one-tenth of a second;

UNANIMOUSLY RECOMMENDS

1. that all standard-frequency and time-signal emissions conform as closely as possible to Coordinated Universal Time (UTC) (see Annex I); that the time signals should not deviate from UTC by more than one millisecond; that the standard frequencies should not deviate by more than 1 part in 10^{10}, and that the time signals emitted from each transmitting station should bear a known relation to the phase of the carrier;

2. that all standard-frequency and time-signal emissions should contain information on the difference between UT1 and UTC (see Annexes I and II);

3. that this document be transmitted by the Director, C.C.I.R., to all Administrations Members of the I.T.U., to I.M.C.O., I.C.A.O., the C.G.P.M., the B.I.H., the International Union of Geodesy and Geophysics (I.U.G.G.), the International Union of Radio Science (U.R.S.I.) and the International Astronomical Union (I.A.U.);

4. that the standard-frequency and time-signal emissions should conform to RECOMMENDS 1 and 2 above as from 1 January 1975.

ANNEX I

TIME SCALES

A. Universal Time (UT)

In applications in which an imprecision of a few hundredths of a second cannot be tolerated, it is necessary to specify the form of UT which should be used:

UT0 is the mean solar time of the prime meridian obtained from direct astronomical observation;

UT1 is UT0 corrected for the effects of small movements of the Earth relative to the axis of rotation (polar variation);

UT2 is UT1 corrected for the effects of a small seasonal fluctuation in the rate of rotation of the Earth;

UT1 is used in this document, since it corresponds directly with the angular position of the Earth around its axis of diurnal rotation. GMT may be regarded as the general equivalent of UT.

B. International Atomic Time (TAI)

The international reference scale of atomic time (TAI), based on the second (SI), as realized at sea level, is formed by the Bureau International de l'Heure (B.I.H.) on the basis of clock data supplied by cooperating establishments. It is in the form of a continuous scale, e.g. in days, hours, minutes and seconds from the origin 1 January 1958 (adopted by the C.G.P.M. 1971).

C. Coordinated Universal Time (UTC)

UTC is the time-scale maintained by the B.I.H. which forms the basis of a coordinated dissemination of standard frequencies and time signals. It corresponds exactly in rate with TAI but differs from it by an integral number of seconds.

The UTC scale is adjusted by the insertion or deletion of seconds (positive or negative leap-seconds) to ensure approximate agreement with UT1.

D. DUT1

The value of the predicted difference UT1-UTC, as disseminated with the time signals is denoted DUT1; thus DUT1 $\approx$ UT1 $-$ UTC. DUT1 may be regarded as a correction to be added to UTC to obtain a better approximation to UT1.

The values of DUT1 are given by the B.I.H. in integral multiples of 0·1 s.

The following operational rules apply:

1. Tolerances

1.1 The magnitude of DUT1 should not exceed 0·8 s.

1.2 The departure of UTC from UT1 should not exceed ± 0·9 s.*

1.3 The deviation of (UTC plus DUT1) from UT1 should not exceed ± 0·1 s.

2. Leap-seconds

2.1 A positive or negative leap-second should be the last second of a UTC month, but first preference should be given to the end of December and June, and second preference to the end of March and September.

2.2 A positive leap-second begins at $23^h\ 59^m\ 60^s$ and ends at $0^h\ 0^m\ 0^s$ of the first day of the following month. In the case of a negative leap-second, $23^h\ 59^m\ 58^s$ will be followed one second later by $0^h\ 0^m\ 0^s$ of the first day of the following month (see Annex III).

2.3 The B.I.H. should decide upon and announce the introduction of a leap-second, such an announcement to be made at least eight weeks in advance.

3. Value of DUT1

3.1 The B.I.H. is requested to decide upon the value of DUT1 and its date of introduction and to circulate this information one month in advance.**

3.2 Administrations and organizations should use the B.I.H. value of DUT1 for standard-frequency and time-signal emissions, and are requested to circulate the information as widely as possible in periodicals, bulletins, etc.

3.3 Where DUT1 is disseminated by code, the code should be in accordance with the following principles (except § 3.5 below):

— the magnitude of DUT1 is specified by the number of emphasized second markers and the sign of DUT1 is specified by the position of the emphasized second markers with respect to the minute marker. The absence of emphasized markers indicates DUT1 = 0;

— the coded information should be emitted after each identified minute.

Full details of the code are given in Annex II.

3.4 Alternatively, DUT1 may be given by voice or in Morse code.

3.5 DUT1 information primarily designed for, and used with, automatic decoding equipment may follow a different code but should be emitted after each identified minute.

3.6 In addition, UT1 — UTC may be given to the same or higher precision by other means, for example, in Morse code or voice, by messages associated with maritime bulletins, weather forecasts, etc.; announcements of forthcoming leap-seconds may also be made by these methods.

3.7 The B.I.H. is requested to continue to publish, in arrears, definitive values of the differences UT1 — UTC, UT2 — UTC.

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* The difference between the maximum value of DUT1 and the maximum departure of UTC from UT1 represents the allowable deviation of (UTC+DUT1) from UT1 and is a safeguard for the B.I.H. against unpredictable changes in the rate of rotation of the Earth.

** In exceptional cases of sudden change in the rate of rotation of the Earth, the B.I.H. may issue a correction not later than two weeks in advance of the date of its introduction.

ANNEX II

CODE FOR THE TRANSMISSION OF DUT1

A positive value of DUT1 will be indicated by emphasizing a number (n) of consecutive second markers following the minute marker from second marker one to second marker (n) inclusive; (n) being an integer from 1 to 8 inclusive.

$$\text{DUT1} = (n \times 0{\cdot}1)\ \text{s}$$

A negative value of DUT1 will be indicated by emphasizing a number (m) of consecutive second markers following the minute marker from second marker nine to second marker ($8 + m$) inclusive, (m) being an integer from 1 to 8 inclusive.

$$\text{DUT1} = -(m \times 0{\cdot}1)\ \text{s}$$

A zero value of DUT1 will be indicated by the absence of emphasized second markers.

The appropriate second markers may be emphasized, for example, by lengthening, doubling, splitting or tone modulation of the normal second markers.

Examples:

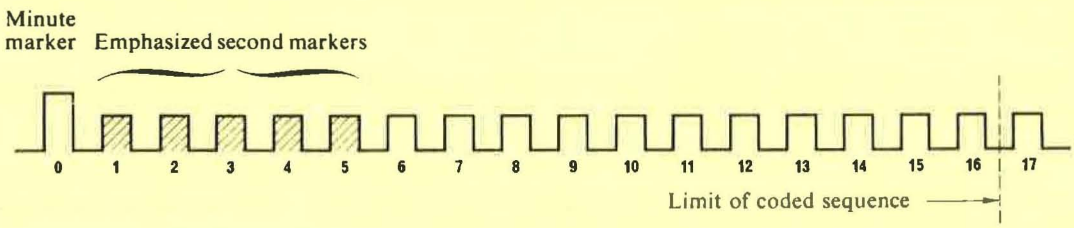

FIGURE 1

DUT1 = +0·5 s

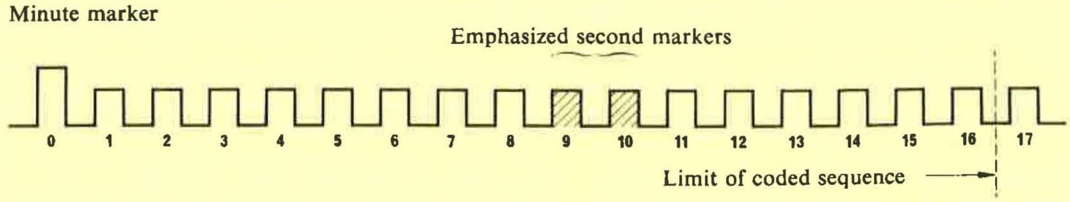

FIGURE 2

DUT1 = −0·2 s

ANNEX III

DATING OF EVENTS IN THE VICINITY OF A LEAP-SECOND

The dating of events in the vicinity of a leap-second shall be effected in the manner indicated in the following figures:

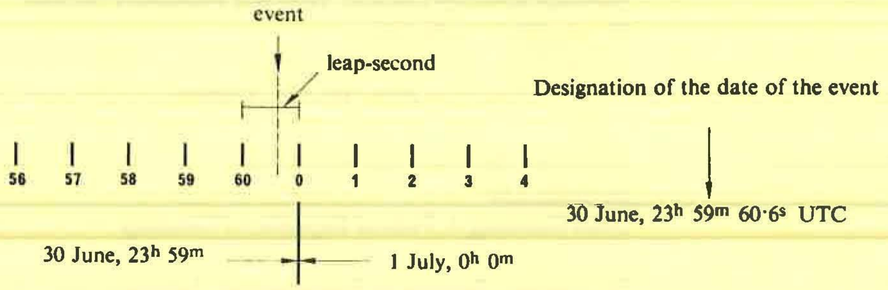

FIGURE 3

Positive leap-second

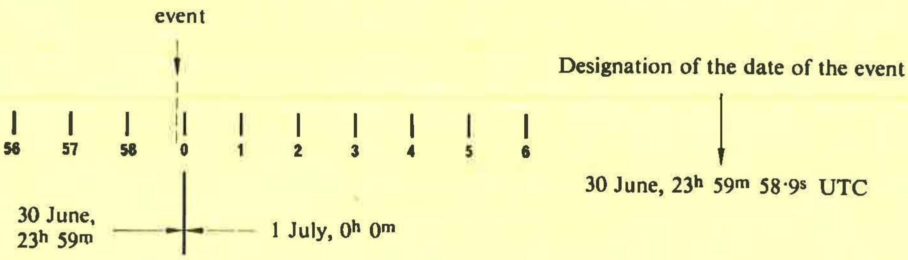

FIGURE 4

Negative leap-second

AUTHORITIES RESPONSIBLE FOR THE TIME SIGNAL EMISSIONS

Signal	Authority
BPV, XSG	Zi-Ka-Wei Section Shanghaï Observatory Academia Sinica Shanghaï, China
CHU	National Research Council, Time and Frequency Section Physics Division (M-36) Ottawa K1A OS 1, Ontario, Canada Attn : Dr. C.C. Costain
DAM, DAN, DAO	Deutsches Hydrographisches Institut Postfach 220 2000 Hamburg 4, Federal Republic of Germany
DCF77	Physikalisch-Technische Bundesanstalt, Laboratorium 1.22 33 Braunschweig Bundesallee 100, Federal Republic of Germany
DGI, DIZ	Amt für Standardisierung, Messwesen und Warenprüfung Fachabteilung Elektrizität Arbeitsgebiet Zeit une Frequenznormale Wallstrasse 16 DDR 1026 Berlin
FFH	Centre National d'Études des Télécommunications Groupement Études spatiales et Transmissions Département: Dispositifs et Ensembles fonctionnels 38, rue du Général Leclerc 92131 Issy-les-Moulineaux, France
FTA91, FTH42 FTK77, FTN87	Laboratoire Primaire du Temps et des Fréquences Observatoire de Paris 61, avenue de l'Observatoire, 75014 Paris, France
GBR, MSF	1/ Time information : Royal Greenwich Observatory Herstmonceux Castle Hailsham, East Sussex BN27, 1RP, United Kingdom 2/ Standard Frequency information : National Physical Laboratory Electrical Science Division Teddington, Middlesex TW11 OLW, United Kingdom
HBG	Service horaire HBG Observatoire Cantonal CH - 2000 Neuchâtel, Suisse
IAM	Istituto Superiore Poste e Telecomunicazioni Viale di Trastevere, 189 00100 - Roma, Italy

Signal	Authority
IBF	Istituto Elettrotecnico Nazionale Galileo Ferraris Corso Massimo d'Azeglio, 42 00125 - Torino, Italy
JJY, JG2AS	Frequency Standard Division The Radio Research Laboratories Ministry of Posts and Telecommunications Midori-cho, Koganei, Tokyo 184, Japan
LOL	Director Observatorio Naval Av. Costanera Sur, 2099 Buenos-Aires, Republica Argentina
LQB9, LQC20	Instituto Geográfico Militar (IGMA) Servicio internacional de la Hora Sección Conservación de la Hora Calle 38 Gral Savio 865 1650 Villa Maipú, San Martin Pcia de Buenos-Aires Republica Argentina
NBA, NDT, NPG, NSS, NWC	Superintendant U. S. Naval Observatory Washington, D.C. 20390 U. S. A.
OLB5, OMA	1/ Time information : Astronomický Ústav ČSAV, Budečská 6, 120 23 Praha 2, Vinohrady, Czechoslovakia. 2/ Standard frequency information ; Ústav radiotechniky a elektroniky ČSAV, Lumumbova 1, 180 88 Praha 8, Kobylisy, Czechoslovakia.
PPE, PPR	Serviço da Hora Observatorio Nacional Rua General Bruce, 586 2000 Rio de Janeiro. GB. ZC.-08, Brasil
RBU, RCH RID, RIM, RTA, RTZ, RWM	Comité d'État des Normes Conseil des Ministres de l'URSS Moscou 117049, URSS, Leninski prosp., 9
VNG	Time and Frequency Standards Section Australian Telecommunications Commission, Research Laboratories 59 Little Collins Street Melbourne, Vic. 3000, Australia
WWV, WWVH WWVB	Time and Frequency Services Section Time and Frequency Division National Bureau of Standards Boulder, Colorado 80302, U. S. A.
YVTO	Direccion de Hidrografia y Navegacion Observatori Cagigal Apartado Postal N° 6745 Caracas, Venezuela
ZUO	National Physical Research Laboratory P.O. Box 395 Pretoria South Africa

Time - Signals emitted in the UTC system

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of time signals
BPV	Shanghaï China + 31°12' -121°26'	5000 10000 15000	16h to 1h continuous 1h to 16h	1/ From 1m 0s to 9m 59s and from 31m 0s to 39m 59s of every hour, second pulses of 10 cycles of 1 kHz mod. ; minute marker of 9 pulses. 2/ From 15m 0s to 24m 59s and from 45m 0s to 54m 59s, 1 kHz modulation ; second markers by interruptions of 50ms of the modulation. Minute markers by 8 of 10ms pulses and a 150ms pulse
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 DUT1 : CCIR code by split pulses
DAM	Elmshorn Germany, F.R. + 53° 46' - 9° 40'	8638.5 } 16980.4 } 4265 } 8638.5 } 6475.5 } 12763.5 }	11h 55m to 12h 06m 23h 55m ot 24h 06m from 21 Oct. to 20 April 23h 55m to 24h 06m from 21 April to 20 Oct.	New international system, then second pulses from minutes 0.5 to 6.0 (minute pulses prolonged). A1 Type DUT1 : CCIR code by doubling, after minute pulses 1 to 5
DAN	Osterloog Germany, F.R. + 53° 38' - 7° 12'	2614	11h 55m to 12h 06m 23h 55m to 24h 06m	As DAM (see above)
DAO	Kiel Germany, F.R. + 54° 26' - 10° 8'	2775	11h 55m to 12h 06m 23h 55m to 24h 06m	As DAM (see above)
DCF77	Mainflingen Germany, F.R. + 50° 1' - 9° 0'	77.5	continuous	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. Time code in BCD (year, month, day, hour, minute, day of the week) by lengthening second marks from marks N° 20 to N° 58 every minute. DUT1 : CCIR code by lenthening to 0.2 s.
DGI	Oranienburg Germ. Dem. Rep. + 52° 48' - 13° 24'	185	5h 59m 30s to 6h 00m 11h 59m 30s to 12h 00m 17h 59m 30s to 18h 00m	A2 type second pulses of 0.1 s duration for seconds 30-40, 45-50, 55-60. The last pulse is prolonged.
DIZ (1) see p. C-13	Nauen Germ. Dem. Rep. + 52° 39' - 12° 55'	4525	continuous except from 8h 15m to 9h 45m for maintenance if necessary	A1 type second pulses of 0.1 s duration. Minute pulses prolonged to 0.5 s. DUT1 : CCIR code by double pulse.
FFH	Ste Assise France 48° 33' 2° 34'	2500	continuous from 8h to 16h 25	Second pulses of 5 cycles of 1 kHz modulation. Minute pulses prolonged to 0.5 s. DUT1 : CCIR code by lengthening to 0.1 s.
FTA91	Saint-André-de-Corcy France + 45° 55' - 4° 55'	91.15	at 8h, 9h, 9h 30m, 13h, 20h, 21 h, 22h 30m	A1 type second pulses during the 5 minutes preceding the indicated times. Minute pulses are prolonged. DUT1 : in Morse code.
FTH42 FTK77 FTN87	Pontoise France + 49° 4' - 2° 7'	7428 10775 13873	at 9h and 21h at 8h and 20h at 9h 30m, 13h, 22h 30m	A1 type second pulses during the 5 minutes preceding the indicated times. Minute pulses are prolonged. DUT1 : in Morse code.
GBR	Rugby United Kingdom + 52°22' + 1°11'	16	at 3h, 9h, 15h, 21h	A1 type second pulses during the 5 minutes preceding the indicated times. DUT1 : CCIR code by double pulse.

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 100ms. The minutes are identified by a double pulse, the hours by a triple pulse. No transmission of DUT1.
IAM	Rome Italy + 41° 47' - 12° 27'	5000	10m every 15m, from 7h 30m to 8h 30 m and from 10h 30m to 11h 30m except Sun. Advanced by 1 hour in summer.	Second pulses of 5 cycles of 1 kHz modulation. Minute pulses of 20 cycles (Announcements 5m before the emission of time signals).
IBF	Torino Italy + 45° 2' - 7° 42'	5000	During 15m preceding 7h, 9h, 10h, 11h, 12h, 13h, 14h, 15h, 16h, 17h, 18h. 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. Time announcement by Morse Code every ten minutes beginning at 0h 0m. DUT1 : CCIR code by double pulse.
JG2AS	Chiba Japan + 35°38' - 140° 4'		from 23h 30m to 8h (exc. Sun.) and from 8h to 23h 30m on Monday. Interruptions during communications	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 interruptions 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	11h to 12h, 14h to 15h, 17h to 18h, 20h to 21h 23h to 24h	Second pulses of 5 cycles of 1000Hz modulation. Second 59 is omitted. Announcement of hours and minutes every 5 minutes, followed by 3m of 1000Hz and 440Hz modulation. DUT1 : CCIR code by lengthening.
LOL2 LOL3	Buenos-Aires Argentina - 34°37' + 58°21'	8030 17180	1h, 13h, 21h	A1 second pulses during the 5 minutes preceding the indicated times. Minute pulses are prolonged. DUT1 : CCIR code by double pulse.
LQB9 LQC20	Planta Gral Pacheco - 34°26' + 58°37'	8167.5 17551.5	22h 5m, 23h 50m 10h 5m, 11h 50m	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 maintenance from 10h 0m to 14h 0m on the first Tuesday in each month.	Interruptions of the carrier of 100ms for the second pulses, of 500ms for the minute pulses. The signal is given by the beginning of the interruption. Time-of-day code (hours, minutes), 13-bit BCD, during minute interruptions. DUT1 : CCIR code by double pulse.
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 (2)	Summit Canal Zone + 9° 3' + 39° 39'	24	Every even hour except 24h	FSK second pulses during 5 minutes preceding indicated times on American code time format. See (2), p. C-13.
NDT	Yosami Japan + 34° 58' - 137° 1'	17.4	To be determined	To be determined
NPG	Dixon, CA U S A + 38° 23' + 121° 46'	3268 6428.5 9277.5 12966	6h, 12h, 18h, 24h	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 (2)	Annapolis, MD U S A + 38° 59' + 76° 27'	21.4	Every even hour	FSK second pulses during 5 minutes preceding indicated times on American code format. See (2) p. C-13. VLF time signals may be suspended after 1 July 1976.
		8090 12135	5h, 11h, 17h, 23h	CW second pulses during 5 minutes preceding the indicated times on the American Code time format. DUT1 : by Morse Code, each minute between second 56 and 59

Station	Location Latitude Longitude	Frequency (kHz))	Schedule (UT)	Form of the time signals
NWC (2)	Exmouth Australia - 21° 48' - 113° 9'	22.3	Keyed from 28 to 30 minutes after every other even hour beginning 0h TU	Experimental FSK second pulses during the indicated times on the American Code time format. DUT1 : by Morse Code, between seconds 56 and 59. See (2) p. C-13.
OLB5	Poděbrady Czechoslovakia + 50° 9' - 15° 9'	3170	continuous except from 6h to 12h on the first Wednesday of every month	A1 type, second pulses No transmission of DUT1.
OMA (3)	Poděbrady Czechoslovakia + 50° 9' - 15° 8,	50	continuous except from 6h to 12h on the first Wednesday of every month	Interruption of the carrier of 100ms at the beginning of every second, of 500ms at the beginning of every minute. The precise time is given by the beginning of the interruption. (3)
	Liblice Czechoslovakia + 50° 4' - 14° 53'	2500	between minutes 5 and 15 25 and 30, 35 and 40, 50 and 60 of every hour except from 5h to 11h 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-deJaneiro Brasil - 22° 54' + 43° 13'	8721	0h 30m, 11h 30m, 13h 30m 19h 30m, 20h 30m, 23h 30m	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	01h 30m, 14h 30m, 21h 30m,	Second ticks, of A1 type, during the five minutes preceding the indicated hours. The minute ticks are longer.
RBU (4) see p. C-14	Moscow USSR + 55° 19' - 38°41'	66 2/3	between minutes 0 and 5 from 0h to 12h 5m from 13h to 19h 5m and from 20h to 23h 5m	A1 type. Second pulses. The pulses at beginning of the minute are prolonged to 0.5s
RCH (4)	Tashkent USSR + 41° 19' - 69° 15'	2500	between minutes 15 and 20, 25 and 30, 35 and 40, 45 and 50 from 0h to 3h 50m from 5h 35m to 9h 30m from 10h 15m to 13h 30m from 14h 15m to 24h	Second pulses. The pulses at the beginning of the minute are prolonged to 0.5s.
RID (4)	Irkutsk USSR + 52°18' - 104° 18'	5004 10004 15004	The station simultaneously operates on three frequencies between minutes 5 and 10, 15 15 and 20, 25 and 30, 51 and 60	Second pulses.The pulses at the beginning of the minute are prolonged to 0.5s.
RIM (4)	Tashkent USSR + 41° 19' - 69° 15'	5000	between minutes 15 and 20, 25 and 30, 35 and 40, 45 and 50, from 0h to 1h 30m from 2h 15m to 3h 50m from 14h 15m to 17h 30m from 18h 15m to 24h	Second pulses. The pulses at the beginning of the minute are prolonged to 0.5s.
		10000	between minutes 15 and 20, 25 and 30, 35 and 40, 45 and 50 from 5h 35m to 9h 30m from 10h 15m to 13h 30m	

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
RTA (4) see p. C-14	Novossibirsk USSR + 55° 4' - 82°58'	10000	between minutes 5 and 10, 15 and 20, 25 and 29, 35 and 39 from 0h to 1h 29m from 3h 5m to 4h 39m from 14h 5m to 17h 29m from 18h 5m to 24h	Second pulses. The pulses at the beginning of the minute are prolonged.
		15000	between minutes 5 and 10, 15 and 20, 25 and 29, 35 and 39 from 5h 35m to 9h 29m from 10h 5m to 13h 29m	
RWM (4)	Moscow USSR + 55° 19' - 38°41'	4996 9996 14996	The station simultaneously operates on three frequencies between minutes 30 and 35, 41 and 45, 50 and 60	Second pulses. The pulses at the beginning of the minute are prolonged to 0.5s
RTZ (4)	Irkutsk USSR + 52°18' -104°18'	50	between minutes 0 and 5 from 0h to 20h 5m from 22h to 23h 5m	A1 type second pulses. The pulses at the beginning of the minute are prolonged to 0.5s.
VNG	Lyndhurst Australia - 38° 3' - 145°16'	4500 7500 12000	9h 45m to 21h 30m continuous except 22h 30m to 22h 45m 21h 45m to 9h 30m	Second markers of 50 cycles of 1 kHz modulation ; 5 cycles only for second markers 55 to 58; second marker 59 is omitted ; 500 cycles for minute markers. During the 5th, 10th, 15th, etc... minutes, 5 cycles for second markers 50 to 58. Identification by voice announcement during 15th, 30th, 45th and 60th minutes. DUT1 : CCIR code by 45 cycles of 900 Hz modulation immediately following the normal second markers.
WWV	Fort-Collins U S A + 40°41' +105° 2'	2500 5000 10000 15000 20000 25000	continuous	Pulses of 5 cycles of 1 kHz modulation. 59th and 29th second pulses 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. BCD Time code given on 100 Hz subcarrier, includes DUT1 correction.
WWVB	Fort Collins U S A + 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 U S A + 21° 59' +159° 46'	2500 5000 10000 15000 20000	continuous	Pulses of 6 cycles of 1200 Hz modulation. 59th and 29th second pulses omitted. Hour identified by 0.8second long 1500Hz tone. Beginning of each minute identified by 0.8 second long, 1200 Hz tone. DUT1 : CCIR code by double pulse. BCD Time code given on 100 Hz subcarrier, includes DUT1 correction.
YVTO	Caracas Venezuela + 10° 30' + 66°56'	6100	continuous	Second pulses of 1 kHz modulation with 0.1s duration. The minute is identified by a 800 Hz tone and a 0.5s duration. Second 30 is omitted Between seconds 52 and 57 of each minute, voice announcement of hour, minute and second

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
ZUO	Olifantsfontein South Africa - 25° 58' -28° 14'	2500 5000 100000	18h to 4h continuous continuous	Pulses of 5 cycles of 1 kHz modulation. Second 0 is prolonged. DUT1 CCIR code by lengthening

Other time signals (see also page C-17)

Station	Location Latitude Longitude	Frequency (kHz)	Schedule (UT)	Form of the time signals
BPV	Shanghaï China + 31° 12' -121° 26'	5430 9351	0h, 6h, 11h, 13h, 15h, 17h, 19h, 21h, 22h, 23h (On 6h and 23h, only 9531 kHz is used)	During 5m before and after the indicated times A1 type rhythmic signals . Second pulse of 0.1 s duration, minute pulse of 0.5 s duration.
		5000 10000 15000	16h to 1h continuous 1h to 16h	from 10m 0s to 14m 59s and 40m 0s to 44m 59s of every hour, second pulses of 0.1 s duration, minute pulses of 0.5 s duration.
XSG	Shanghaï China + 31° 12' -121° 26'	458 6414 8502 12871.5	3h, 9h	During 3m before the indicated times, second pulses. During 5m after the indicated times, rhythmic signals.

Notes on the characteristics of time signals

(1) DUT1 information in CCIR code

dUT1 information. This additional information specifies more precisely the difference UT1 - UTC down to multiples of 0.02 s, the total value of the correction being DUT1+dUT1.

A positive value of dUT1 is indicated by doupling a number (p) of consecutive seconds markers from seconds marker 21 to seconds marker (20+p) inclusive ; (p) being an integer from 1 to 5 inclusive

$$dUT1 = p \, . \, 0.02 \text{ s.}$$

A negative value of dUT1 is indicated by doupling a number (q) of consecutive seconds markers following the minute marker from seconds marker 31 to seconds marker (30+q) inclusive ; (q) being an integer from 1 to 5 inclusive

$$dUT1 = - (q \, . \, 0.02) \text{ s}$$

The seconds marker 28 following the minute marker is doubled as parity bit, if the value of (p) or (q) is an even number, or if dUT1 = 0.

Time- information. During the last 20 seconds of each minute in a BCD-code an information about the value "minute" and "hour" in the UTC time scale of the following minute marker is given.

(2) NBA, NSS, NWC - Several U.S. Naval VLF stations transmit time signals on FSK format (NWC, NBA, NSS).

Both frequencies, MARK (assigned frequency) and SPACE (plus 50 Hz), are 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 halfway point of the transition will be maintained within ±10 μs 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 assigned carrier cycle will be controlled in time to ± 1 μs of the station clock.

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 assigned carrier cycle + 50 Hz (SPACE). The beginning of the second will occur at the half transition point at the start of the reversals (SPACE ⟶ MARK).

(3) OMA, 50 kHz.
a. Owing to the reconstruction of the transmitter site in Liblice the OMA signal 50 kHz is being radiated with reduced power (approx. 50 W) from an auxilliary transmitter in Poděbrady (50° 9', - 15° 8'), as from September 23, 1974. Resumption of the transmission from Liblice is not expected before the end of 1975.

b. Time of the day (seconds, minutes and units of hours) transmission was started by the station OMA 50 kHz from July 1974 on an experimental basis. In the segment 0.55 s - 0.95 s of each second the time in BCD is encoded in the transmission through reversals of the carrier phase. Phase 0° corresponds to logical zero and phase 180° corresponds to logical one. The duration of 1 bit is 20 ms.

The users interested in continuous phase only have the possibility to suppress the coding by by simple doubling of the carrier frequency Sequential modification permitting to include the full date, MJD and DUT1 in the coded transmission is envisaged, possibly for the end of 1975.

(4) 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 s × 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 s × q.

ACCURACY OF THE CARRIER FREQUENCY

The carriers of the following time signals are standard frequencies.

Station	Relative accuracy of the carrier frequency in 10^{-10}
CHU	0.05
DCF77	0.02
FFH	0.2
GBR	0.02
HBG	0.02
IAM	0.5
IBF	0.1
JJY, JG2AS	0.1
LOL1	0.2
MSF (60 kHz)	0.02
MSF (h.f.)	0.02
NBA (V.L.F.), NDT	0.03
NSS (V.L.F.), NWC	0.03
OMA (all frequencies)	0.5
RBU, RTZ	0.1
VNG	1
WWV	0.1
WWVB	0.1
WWVH	0.1
ZUO	0.1

TIME OF EMISSION OF THE TIME SIGNALS IN 1975.

Unless otherwise stated, the values of UTC-signal are valid for the whole year 1975.

Signal	UTC-Signal (unit : 0.0001 s)	Remarks
BPV (10 MHz, 15 MHz)	-210	
CHU	0	+ 6 from 1975 Aug. 20 to Sept. 23
DAM, DAN, DAO	0	
DCF77	0	
DGI	0	
DIZ	0	
FFH	0	
FTA91	0	
FTH42, FTK77, FTN87	0	
GBR	0	
HBG	0	
IAM	0	
IBF	0	
JJY	0	
LOL (all emissions)	0	
LQB9	0	
LQC20	0	
MSF	0	
NSS(h f)	0	
OLB5	+ 8	
OMA	0	
PPE	0	
RWM (and other t.s. from USSR)	0	
VNG	0	
WWV, WWVB, WWVH	0	
ZUO	0	

TIME OF EMISSION OF BPV ON 9351 kHz, 11h UT.

From receptions made at the Deutsches Hydrographisches Institut, Hamburg.

The missing data can be interpolated except when a step adjustement occurs (marked by —— in the following table)

1975						UTC – BPV (9351 kHz) (unit : 0.0001 s)						
Date	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	-6974	-6262	-	-4416	-3529	-	-	-	- 726	-	-	+ 1892
2	-6942	-	-5339	-4403	-3500	-	-2020	-	- 697	- 39	-	+ 1916
3	-6916	-6205	-5295	-4388	-3472	-2681	-1994	-	- 688	- 3	+ 945	+ 1956
4	-6883	-6176	-5278	-4361	-	-2655	-1976	- 1363	- 664	-	+ 972	+ 1983
5	-	-6146	-5246	-4335	-3397	-	-1955	-1335	- 635	-	+ 1009	+ 2015
6	-6836	-6116	-5218	-4320	-3368	-2611	-	-1311	-	+ 84	+ 1041	-
7	-6797	-6089	-5190	-4265	-3347	-	-1894	-1282	-	-	+ 1075	-
8	-	-6057	-5161	-4231	-	-	-1876	-1277	-	-	-	+ 2096
9	-	-6031	-	-4195	-3282	-	-1854	-	-	-	-	+ 2127
10	-	-6000	-5103	-4166	-3259	-	-1844	-	- 520	+208	+ 1138	+ 2152
11	-	-5966	-5074	-4132	-	-2482	-1824	-1207	- 542	-	-	+ 2178
12	-6710	-5945	-5016	-	-3196	-	-	-1177	-	-	+ 1245	+ 2199
13	-6658	-5899	-4991	-	-3171	-2425	-	-1159	-	+292	+ 1266	-
14	-	-5869	-4963	-4035	-3118	-2402	-1765	-1135	-	-	+ 1296	-
15	-6627	-	-	-	-3090	-2374	-1736	-	- 468	+357	-	+ 2293
16	-6601	-5822	-	-3973	-3083	-2349	-1721	-	-	+375	-	+ 2309
17	-6571	-5791	-4866	-3938	-3064	-	-1703	-	- 414	+401	+ 1386	+ 2344
18	-6545	-5766	-4835	-3899	-3042	-2312	-1672	-1050	- 376	-	+ 1418	+ 2369
19	-	-	-4805	-3868	-3015	-2288	-	-1031	- 352	+463	-	+ 2392
20	-6497	-5703	-4767	-	-2993	-2286	-	-1006	-	-	+ 1476	-
21	-6550	-5614	-4739	-3812	-2972	-	-1613	- 985	-	+522	+ 1566	-
22	-	-5582		-3781	-2954	-	-1584	-	- 288	-	-	+ 2474
23	-6496	-5551	-	-	-2932	-2221	-1558	-	- 273	-	-	+ 2499
24	-6467	-5522	-4649	-3716	-	-2182	-	-	- 245	+619	+ 1666	-
25	-6444	-5493	-4622	-3687	-	-	-1522	- 894	- 223	-	+ 1691	-
26	-6414	-5457	-4579	-3652	-	-2135	-	-	- 197	-	+ 1727	+ 2587
27	-6381	-5425	-4549	-	-2865	-2114	-	- 853	-	+728	+ 1762	-
28	-6366	-5402	-4510	-3590	-2838	-	-1456	- 825	-	+756	+ 1797	-
29	-		-4480	-3559	-2812	-	-1425	- 797	- 112	+782	-	+ 2662
30	-6324		-4456	-3522	-2788	-2051	-1428	- 782	- 81	+816	-	+ 2691
31	-6294		-		-2739		-1391	-		+850		-

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Imprimeur : Observatoire de Paris

Le Gérant : R. Michard