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# ANNUAL REPORT FOR 1987

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Table 9 - Offsets and step adjustments of UTC , until 1988 June 30

| Date(at 0h UTC) | Offsets | Steps | Date(at 0h UTC) | Offsets | Steps |
|---|---|---|---|---|---|
| 1961 Jan. 1 | $-150\times10^{-10}$ | | 1972 Jan. 1 | 0 | - 0.107 7580s |
| Aug. 1 | " | + 0.050s | July 1 | " | - 1s |
| | --- | | 1973 Jan. 1 | " | - 1s |
| 1962 Jan. 1 | $-130\times10^{-10}$ | | 1974 Jan. 1 | " | - 1s |
| 1963 Nov. 1 | " | - 0.100s | 1975 Jan. 1 | " | - 1s |
| | --- | | 1976 Jan. 1 | " | - 1s |
| 1964 Jan. 1 | $-150\times10^{-10}$ | | 1977 Jan. 1 | " | - 1s |
| April 1 | " | - 0.100s | 1978 Jan. 1 | " | - 1s |
| Sept. 1 | " | - 0.100s | 1979 Jan. 1 | " | - 1s |
| 1965 Jan. 1 | " | - 0.100s | 1980 Jan. 1 | " | - 1s |
| March 1 | " | - 0.100s | 1981 July 1 | " | - 1s |
| July 1 | " | - 0.100s | 1982 July 1 | " | - 1s |
| Sept. 1 | " | - 0.100s | 1983 July 1 | " | - 1s |
| | --- | | 1985 July 1 | " | - 1s |
| 1966 Jan. 1 | $-300\times10^{-10}$ | | 1988 Jan. 1 | " | - 1s |
| 1968 Feb. 1 | " | + 0.100s | | | |
| | --- | | | | |

Table 10 - Relationship between TAI and UTC, until 1988 June 30

| Limits of validity(at 0h UTC) | | TAI - UTC |
|---|---|---|
| 1961 Jan. 1 - 1961 Aug. 1 | | 1.422 818 0s + (MJD - 37 300) x 0.001 296s |
| Aug. 1 - 1962 Jan. 1 | | 1.372 818 0s + " " |
| 1962 Jan. 1 - 1963 Nov. 1 | | 1.845 858 0s + (MJD - 37 665) x 0.001 123 2s |
| 1963 Nov. 1 - 1964 Jan. 1 | | 1.945 858 0s + " " |
| 1964 Jan. 1 - | April 1 | 3.240 130 0s + (MJD - 38 761) x 0.001 296s |
| April 1 - | Sept. 1 | 3.340 130 0s + " " |
| Sept. 1 - 1965 | Jan. 1 | 3.440 130 0s + " " |
| 1965 Jan. 1 - | March 1 | 3.540 130 0s + " " |
| March 1 - | July 1 | 3.640 130 0s + " " |
| July 1 - | Sept. 1 | 3.740 130 0s + " " |
| Sept. 1 - 1966 | Jan. 1 | 3.840 130 0s + " " |
| 1966 Jan. 1 - 1968 | Feb. 1 | 4.313 170 0s + (MJD - 39 126) x 0.002 592s |
| 1968 Feb. 1 - 1972 | Jan. 1 | 4.213 170 0s + " " |
| 1972 Jan. 1 - | July 1 | 10s (integral number of seconds) |
| July 1 - 1973 | Jan. 1 | 11s |
| 1973 Jan. 1 - 1974 | Jan. 1 | 12s |
| 1974 Jan. 1 - 1975 | Jan. 1 | 13s |
| 1975 Jan. 1 - 1976 | Jan. 1 | 14s |
| 1976 Jan. 1 - 1977 | Jan. 1 | 15s |
| 1977 Jan. 1 - 1978 | Jan. 1 | 16s |
| 1978 Jan. 1 - 1979 | Jan. 1 | 17s |
| 1979 Jan. 1 - 1980 | Jan. 1 | 18s |
| 1980 Jan. 1 - 1981 | July 1 | 19s |
| 1981 July 1 - 1982 | July 1 | 20s |
| 1982 July 1 - 1983 | July 1 | 21s |
| 1983 July 1 - 1985 | July 1 | 22s |
| 1985 July 1 - 1988 | Jan. 1 | 23s |
| 1988 Jan. 1 - | | 24s |

TABLE 11 - Atomic time, collaborating laboratories

| | |
|---|---|
| AOS | Astronomical Latitude Observatory, Borowiec, Polska |
| APL | Applied Physics Laboratory, Laurel, USA |
| ASMW | Amt für Standardisierung, Messwesen und Warenprüfung, Berlin, Deutsche Demokratische Republik |
| ATC | Australian Telecommunications Commission, Melbourne, Australia |
| AUS | Consortium of laboratories in Australia |
| BEV | Bundesamt für Eich - und Vermessungswesen, Wien, Oesterreich |
| BAO | Beijing Observatory, Beijing, China |
| CAO | Astronomical Observatory of Cagliari University, Cagliari, Italy |
| CH | Consortium of laboratories in Switzerland (see Table 12) |
| CSAO | Shaanxi Astronomical Observatory, Lintong, China |
| DDR | Consortium of laboratories in Deutsche Demokratische Republik |
| DNM | Division of National Mapping, Canberra, Australia |
| F | Commission Nationale de l'Heure, Paris, France (see Table 12) |
| FTZ | Fernmeldetechnisches Zentralamt, Darmstadt, Bundesrepublik Deutschland |
| IEN | Istituto Elettrotecnico Nazionale Galileo Ferraris, Torino, Italia |
| IFAG | Institut für Angewandte Geodäsie, Frankfurt am Main, Bundesrepublik Deutschland |
| IGMA | Instituto Geografico Militar, Buenos-Aires, Argentina |
| ILOM | International Latitude Observatory, Mizusawa, Japan |
| INPL | National Physical Laboratory, Jerusalem, Israel |
| INTI | Instituto Nacional de Tecnologia Industrial, Buenos-Aires, Argentina |
| JATC | Joint Atomic Time Commission, Lintong, Shaanxi, P. R. China |
| KSRI | Korea Standards Research Institute, Taejon, Ch'ungnam, Rep. of Korea |
| NBS | National Bureau of Standards, Boulder, USA |
| NIM | National Institute of Metrology, Beijing, China |
| NML | National Measurement Laboratory, CSIRO, Sydney, Australia |
| NPL | National Physical Laboratory, Teddington, U.K. |
| NPLI | National Physical Laboratory, New-Delhi, India |
| NPRL | National Physical Research Laboratory, Pretoria, South Africa |
| NRC | National Research Council of Canada, Ottawa, Canada |
| NRLM | National Research Laboratory of Metrology, Ibaraki, Japan |
| OMH | Orszagos Mérésügyi Hivatal, Budapest, Hungary |
| OMSF | Real Instituto y Observatorio de la Armada, San Fernando, España |
| 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 |
| PKNM | Polski Komitet Normalizacji Miar I Jakości, Warszawa, Polska |
| PTB | Physikalisch-Technische Bundesanstalt, Braunschweig, Bundesrepublik Deutschland |

TABLE 11 - Atomic time, collaborating laboratories (cont.)

| | |
|---|---|
| RGO | Royal Greenwich Observatory, Herstmonceux, U.K. |
| RRL | Radio Research Laboratory, Tokyo, Japan |
| SO | Shanghai Observatory, Shanghai, China |
| STA | Swedish Telecommunications Administration, Stockholm, Sweden |
| SU | Laboratoire d'état de l'étalon de temps et de fréquences, URSS |
| TAO | Tokyo Astronomical Observatory, Tokyo, Japan |
| TID | Tidbinbilla Deep Space Communications Center, Australia |
| TL | Telecommunication Laboratories, Taiwan, China |
| TP(1) | Ústav Radiotechniky a Elektroniky ČSAV, Praha, Československo<br>Astronomicky ústav ČSAV, Praha, Československo |
| TUG | Technische Universität Graz, Oesterreich |
| USNO | U.S. Naval Observatory, Washington D.C., USA |
| VSL | Van Swinden Laboratorium, Delft, Nederland |
| YUZM | Bureau Fédéral des Mesures et Métaux Précieux, Belgrade, République Socialiste Fédérative de Yougoslavie |
| ZIPE | Zentralinstitut Physik der Erde, Potsdam, Deutsche Demokratische Republik |

(1) Both laboratories cooperate in the derivation of UTC(TP).

TABLE 12 - Laboratories keeping an independent local atomic time

| Laboratories (i) | Equipment in atomic standards (1) | Information on TA(i) - UTC(i) Interval of validity (in MJD at 0 h UTC) | TA(i) - UTC(i) in s |
|---|---|---|---|
| AOS | 1 Ind. Cs | 46796-47038 | 23.000 000 360 $+180\times10^{-9}\times(MJD-46796)$ |
| | | 47038-47099 | 23.000 043 920 $+280\times10^{-9}\times(MJD-47038)$ |
| | | 47099- | 23.000 061 000 $+230\times10^{-9}\times(MJD-47099)$ |
| CH | 14 Ind. Cs (2) | 46693-46823 | 23.000 039 237 $+22\times10^{-9}\times(MJD-46693)$ |
| | | 46823- | 23.000 042 100 $+18\times10^{-9}\times(MJD-46823)$ |
| DDR | 2 Ind. Cs (3) | year 1987 | TA(DDR)-UTC(ASMW) is sent to BIH |
| F | 19 Ind. Cs (4) | year 1987 | TA(F)-UTC(OP) is published in bulletin H by OP (LPTF) |
| JATC | 1 Lab. Cs<br>15 Ind. Cs<br>6 H Masers (5) | year 1987 | TA(JATC)-UTC(JATC) is sent to BIH |
| NBS | 1 Lab. Cs<br>19 Ind. Cs<br>1 H Maser (6) | year 1987 | TA(NBS)-UTC(NBS) is published in the NBS T and F Bulletin |
| NRC | 1 2.1 m Lab. Cs<br>3 1 m Lab. Cs<br>1 Ind. Cs (7) | year 1987 | 22.999 968 931 |
| PTB | 2 Lab. Cs<br>9 Ind. Cs (8) | year 1987 | 23.000 363 400 |
| RGO (9) | 6 Ind. Cs | year 1987 | 22.999 926 090 |
| RRL | 1 Lab. Cs<br>11 Ind. Cs<br>3 H Masers | year 1987 | published in RRL Standard Frequency and Time Bulletin |
| SO | 1 Lab. Cs<br>4 Ind. Cs<br>3 H Masers | year 1987 | TA(SO)-UTC(SO) is published by the SO Atomic Time Bulletin |

Table 12 - (cont.)

| Laboratories (i) | Information on TA(i) - UTC(i) Equipment in atomic standards (1) | Interval of validity (in MJD at 0 h UTC) | TA(i) - UTC(i) in s |
|---|---|---|---|
| SU | 2 Lab. Cs<br>2 Ind. Cs<br>8 H Clocks | year 1987 | 20.172 750 000 |
| USNO | 42 Ind. Cs<br>4 H Masers<br>(4 VLG 11 B serial = 18,19,22,23)<br>3 Prototype Mercury Ion freq. Std serial = 1,2,3<br>(10) | year 1987 | A.1(MEAN)-UTC(USNO,MC) values are available upon request. (11) |

Notes of Table 12

(1) Ind. Cs designates an industry made Cs standard; Lab. Cs a laboratory Cs standard and H Maser an Hydrogen Maser.

(2) The standards are located as follows (at the end of 1987).

| | | |
|---|---|---|
| Office Fédéral de Métrologie (Berne) | (OFM) | 7 Cs |
| Observatoire de Neuchâtel (Neuchâtel) | (ON ) | 5 Cs |
| Direction Générale des PTT (Berne) | (PTT) | 2 Cs |

They are intercompared by LORAN-C (OFM-ON) and TV method (OFM-PTT) and linked to the foreign laboratories through the Swiss Federal Office of Metrology.

(3) The standards are located as follows : ASMW, 1Cs ; ZIPE, 1 Cs.

(4) The standards are located as follows (at the end of 1987).

| | |
|---|---|
| Centre Electronique de l'Armement (Rennes) | 2 Cs |
| Centre National d'Etudes Spatiales | 2 Cs |
| Centre National d'Etudes des Télécommunications | 3 Cs |
| Centre d'Etudes et de Recherches Géodynamiques et Astronomiques | 3 Cs |
| Electronique Serge Dassault (Trappes) | 1 Cs |
| Hewlett-Packard (Orsay) | 1 Cs |
| Observatoire de Paris : Laboratoire Primaire du Temps et des Fréquences (LPTF) | 4 Cs |
| Observatoire de Besançon | 2 Cs |
| Lab. de Physique et de Métrologie des Oscillateurs (Besançon) | 1 Cs |

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

Notes of Table 12 (cont.)

(5) JATC. The standards are located in the following laboratories
Shaanxi Astronomical Observatory (CSAO)
Shanghai Astronomical Observatory (SO)
Beijing Astronomical Observatory
Wuhan Time Observatory
Beijing National Institute of Metrology (NIM)

(6) The laboratory primary standards control TA(NBS) via an accuracy algorithm. Six of the commercial standards provide the reference for WWV and WWVB and two for GOES Satellite time but do not contribute directly to TA(NBS); they are available for NBS time scales back-up and are compared to TA(NBS) to within 0.01 $\mu$s. The hydrogen maser is passively operated.

(7) The 2.1 meter primary cesium clock, CsV, operated continuously during 1987 producing the scale of proper time PT(NRC CsV).
The time scales UTC(NRC) and TA(NRC) were derived from PT(NRC CsV) according to the following expressions given in microseconds :

UTC(NRC) = PT(NRC CsV) - (MJD - 43144) x 0.000 97 + 52.041

TA(NRC) = PT(NRC CsV) - (MJD - 43144) x 0.000 97 + 20.972

with integral seconds disregarded.

Three 1 meter laboratory cesium clocks, CsVIA, -B, and -C, operated continuously as primary standards during 1987 producing the scales of proper time PT(NRC CsVIA), PT(NRC CsVIB) and PT(NRC CsVIC).

(8) The two Lab. Cs are functionning continuously (primary clocks).
TA(PTB) and UTC(PTB) are derived directly from a local oscillator monitored by the primary clock CS1.
MEZ(D) = UTC(PTB) + 1 h or MESZ(D) = UTC(PTB) + 2 h (summer time) is the legal time of the Federal Republic of Germany.

(9) RGO. The royal Greenwich Observatory has terminated the provision of services related to the definition and dissemination of atomic time in March 1987. All enquiries about atomic time and frequency services in the United Kingdom should be directed to the National Physical Laboratory (NPL).

(10) The time scales UTC(USNO) and TA(USNO) depend on nominally 25 Cs selected clocks (selected on the basis of observed 5-day stability).

(11) TA(USNO) is designated by A.1 (MEAN) by USNO.

Table 13 - Equipment and links of the collaborating laboratories in 1987

| Laboratory (i) | Equipment (1) | Source of UTC(i) | LORAN-C reception (2) | Television link with | GPS reception |
|---|---|---|---|---|---|
| AOS | 1 Ind. Cs | 1 Cs | | TP, ZIPE | |
| APL | 1 Ind. Cs<br>4 H Masers | 1 H Maser | | USNO | * |
| ASMW | 1 Ind. Cs | 1 Cs + microstepper | 7970-W | ZIPE, TP, PTB | |
| ATC | 7 Ind. Cs | 1 Cs + microstepper | | other lab. in Australia | * |
| BEV | 1 Ind. Cs | 1 Cs | 7970-W<br>7990-M<br>7990-X<br>7990-Y | OMH, TUG, lab. in Czechoslovakia | |
| CAO | 2 Ind. Cs | 1 Cs | 7990-M<br>7990-X<br>7990-Z | IEN, other lab. in Italy | |
| CH | see Table 12 | all the Cs | 7970-W<br>7990-Z | PTT | * |
| CSAO | 4 Ind. Cs<br>3 H Masers | all the Cs | 9970-Y | lab. in China | |
| DNM (3) | 4 Ind. Cs | all the Cs | | other lab. in Australia | * |
| FTZ | 7 Ind. Cs | 1 Cs | 7970-W | | |
| IEN | 5 Ind. Cs | 1 Cs + microstepper | 7990-Z | CAO, other lab. in Italy | * |
| IFAG | 4 Ind. Cs<br>2 H Masers | 1 Cs + microstepper | 7970-W | | * |
| IGMA | 4 Ind. Cs | 1 Cs + microstepper | | ONBA, other lab. in Argentina | * (since Aug.1986) |

Table 13 - (cont.)

| Laboratory (i) | Equipment (1) | Source of UTC(i) | LORAN-C reception (2) | Television link with | GPS reception |
|---|---|---|---|---|---|
| ILOM | 5 Ind. Cs | 1 Cs | 9970-M | RRL, TAO, NRLM | |
| INPL | 3 Ind. Cs | 1 Cs | | | * |
| JATC | see Table 12 | Cs | 9970-Y | | |
| KSRI | 4 Ind. Cs | 1 Cs | 9970-Y | | |
| NBS | see Table 12 | 11 Cs<br>1 Lab. Cs<br>1 H Maser | 9940-M<br>9960-Z | | * |
| NIM | 3 Ind. Cs | 1 Cs + microstepper | 9970-Y | lab. in China | |
| NML | 2 Ind. Cs<br>2 H masers | all the Cs | | other lab. in Sydney region | * |
| NPL | 7 Ind. Cs | 1 Cs | 7970-W | transmitting station at Rugby | * |
| NPLI | 5 Ind. Cs | 1 Cs | | | * |
| NPRL(4) | 2 Ind. Cs | 1 Cs | | | * (since Oct.1987) |
| NRC | see Table 12 | Cs V | 9960-M | | * |
| NRLM | 3 Ind. Cs<br>2 Lab. Cs | 1 Cs | 9970-M | ILOM, RRL, TAO | |
| OMH | 1 Ind. Cs | 1 Cs | | BEV, SU, TP | |
| OMSF | 6 Ind. Cs | all the Cs | 7990-Z | | * (since May 1987) |
| ONBA | 2 Ind. Cs | 2 Cs | | IGMA<br>other lab. in Argentina | |
| ONRJ | 2 Ind. Cs | 2 Cs | | other lab. in Brasil | |
| OP | 4 Ind. Cs | 1 Cs | 7970-W<br>7990-Z<br>8940-M | 16 Lab. in France. | * |

Table 13 - (cont.)

| Laboratory (i) | Equipment (1) | Source of UTC(i) | LORAN-C reception (2) | Television link with | GPS reception |
|---|---|---|---|---|---|
| ORB | 2 Ind. Cs | 1 Cs | 7970-W | | * (since Feb.1987) |
| PKNM | 4 Ind. Cs | corrected mean of 4 Cs | 7970-W (5) | | |
| PTB | see Table 12 | Ind. Cs + microstepper steered by PTB primary st. | 7970-W | ASMW, TP, ZIPE and other lab. | * |
| RGO (6) | see Table 12 | selection of the Cs | 7970-M 7970-W 7990-Z 9980-X | | * |
| RRL | see Table 12 | 8 Cs | 9970-M | ILOM, TAO, NRLM | * |
| SO | see Table 12 | 1 Cs + microstepper | 9970-Y | lab. in China | |
| STA | 3 Ind. Cs | 1 Cs | 7970-W | other lab. in Sweden | * (since May 1987) |
| SU | see Table 12 | 2 Lab. Cs 1 Cs 8 H Clocks | 7970-W 7990-X 7990-Y 9970-X | TP, OMH | |
| TAO | 8 Ind. Cs | 1 Cs + microstepper | 9970-M 9970-Y | ILOM, RRL NRLM | * |
| TL | 4 Ind. Cs | 1 Cs + microstepper | 9970-Y | | |
| TP | 1 Ind. Cs | 1 Cs + microstepper | 7970-W | PTB, AOS, SU, ZIPE, ASMW, OMH | |
| TUG | 3 Ind. Cs | 1 Cs | 7970-W 7990-M | BEV | * |
| USNO(7) | see table 12 | Master clock is H Maser + freq. synthesizer steered to UTC(USNO) (see table 12) | (8) | APL | * |

Table 13 - (cont.)

| Laboratory (i) | Equipment (1) | Source of UTC(i) | LORAN-C reception (2) | Television link with | GPS reception |
|---|---|---|---|---|---|
| VSL | 4 Ind. Cs | 1 Cs + microstepper | 7970-M<br>7970-W<br>9980-X | 11 Lab. in Netherlands | * |
| YUZM | 1 Ind. Cs | Cs | 7990-M | | |
| ZIPE | 1 Ind. Cs | 1 Cs | 7970-W | AOS, ASMW, TP, PTB | |

Notes of Table 13

(1) Ind. Cs designates an industry made Cs standard;
Lab. Cs a laboratory Cs standard, H. Maser an Hydrogen Maser, and Rb designates a Rubidium standard.

(2) LORAN-C stations :

| | | |
|---|---|---|
| 7970-M | Norwegian Sea chain, | Ejde |
| 7970-W | " " | Sylt |
| 7990-M | Mediterranean chain, | Simeri Crichi |
| 7990-X | " " | Lampedusa |
| 7990-Y | " " | Kargabarun |
| 7990-Z | " " | Estartit |
| 8940-M | French chain, | Lessay |
| 9940-M | West Coast chain, | Fallon |
| 9960-M | Northeast Coast chain, | Seneca |
| 9960-X | " " | Nantucket |
| 9960-Z | " " | Dana |
| 9970-M | Northwest Pacific chain, | Iwo Jima |
| 9970-X | " " | Hokkaido |
| 9970-Y | " " | Gesashi |
| 9980-M | North Atlantic chain, | Angissoq |
| 9980-X | " " | Ejde |

Notes of Table 13 (cont.)

(3) DNM. In the future, the laboratory will appear with the acronym ORR.

(4) VLF link until 1987 Oct.1, then GPS link.

(5) Reception of the Soviet Union LORAN chain 8000.

(6) RGO. See note (9) of the Table 12. GPS data not available.

(7) USNO Time Service Publication, Series 16, entitled Precise Time Transfer Report, lists UTC(USNO MC) - UTC(Reference Clock). Difference from Satellite Communication terminals and international timing centers using the Global Positioning System are reported. USNO Time Service Publication, Series 17, entitled Transit Satellite Reports, lists UTC(USNO MC) - UTC(Satellite Clock) and also the frequency offset of each satellite. Series 17 is available via the Automated Data Service and the General Electric Mark 3 international computer network (RC28 catalog).

(8) The daily phase values (published weekly, Series 4 of USNO) gives the values of UTC(USNO MC) - transmitting station for :

| | |
|---|---|
| the LORAN-C chains | the US TV Network NBC |
| the OMEGA stations AR, AU, H, L, ND | the GPS satellite systems |

These data are also available via the Automated Data Service (ADS) and the General Electric Mark 3 international computer network (RC28 catalog).
The ADS may be accessed on :

| | |
|---|---|
| BELL 103/212 (300 or 1200 Baud) | 202-653-1079 |
| CCITT V.21 (300 Baud) | 202-653-1095 |
| CCITT V.22/V.22 bis (1200 or 2400 Baud) | 202-653-1783 |

* Laboratories with GPS receiver equipment.

TABLE 14 - ABSOLUTE TIME COMPARISONS BETWEEN LABORATORIES IN 1987

A - CLOCK TRANSPORTATION

Unless otherwise stated, the transportation was carried out by the first mentioned laboratory.

| DATE | | MJD | TIME COMPARISONS | | UNCERT. | SOURCE | |
|---|---|---|---|---|---|---|---|
| 1987 | | | (Unit : 1 microsecond) | | | | |
| JAN | 20 | 46815.05 | UTC(TAO ) - UTC(RRL ) = | -1.618 | 0.003 | TAO | message |
| FEB | 16 | 46842.66 | UTC(CH ) - UTC(PTB ) = | 2.68 | 0.03 | CH | letter |
| FEB | 24 | 46850.63 | UTC(CH ) - UTC(PTB ) = | 2.63 | 0.03 | CH | letter |
| FEB | 25 | 46851.05 | UTC(RRL ) - UTC(TAO ) = | 1.512 | 0.005 | RRL | letter |
| MAR | 24 | 46878.08 | UTC(TAO ) - UTC(RRL ) = | -1.571 | 0.003 | TAO | message |
| APR | 22 | 46907.21 | UTC(RRL ) - UTC(TAO ) = | 1.197 | 0.005 | RRL | letter |
| MAY | 20 | 46935.05 | UTC(TAO ) - UTC(RRL ) = | -0.731 | 0.005 | TAO | message |
| MAY | 22 | 46937.12 | UTC(TAO ) - UTC(NRLM) = | -16.714 | 0.008 | TAO | message |
| MAY | 26 | 46941.02 | UTC(TAO ) - UTC(ILOM) = | -32.618 | 0.020 | TAO | message |
| JUN | 18 | 46964.05 | UTC(NPL ) - UTC(SU ) = | 20.858 | 0.025 | NPL | letter |
| JUN | 24 | 46970.05 | UTC(RRL ) - UTC(TAO ) = | 0.006 | 0.005 | RRL | letter |
| JUL | 23 | 46999.07 | UTC(TAO ) - UTC(RRL ) = | 0.631 | 0.005 | TAO | message |
| AUG | 25 | 47032.06 | UTC(RRL ) - UTC(TAO ) = | -1.185 | 0.005 | RRL | letter |
| SEP | 13 | 47051.74 | UTC(STA ) - UTC(SU ) = | 22.034 | 0.020 | STA | letter |
| SEP | 16 | 47054.35 | UTC(YUZM) - UTC(OP ) = | 0.072 | | YUZM | telex |
| SEP | 18 | 47056.32 | UTC(STA ) - UTC(SU ) = | 21.949 | 0.020 | STA | letter |
| SEP | 22 | 47060.05 | UTC(TAO ) - UTC(RRL ) = | 1.435 | 0.005 | TAO | message |
| NOV | 2 | 47101.10 | UTC(RRL ) - UTC(TAO ) = | -1.529 | 0.005 | RRL | letter |
| NOV | 4 | 47103.09 | UTC(TAO ) - UTC(NRLM) = | -19.267 | 0.010 | TAO | message |
| NOV | 10 | 47109.00 | UTC(TAO ) - UTC(ILOM) = | -33.383 | 0.020 | TAO | message |
| NOV | 24 | 47123.04 | UTC(TAO ) - UTC(RRL ) = | 1.411 | 0.005 | TAO | message |

B - GPS TIME COMPARISONS WITH DIFFERENTIAL CALIBRATION OF RECEIVER DELAYS

Unless otherwise stated, under the heading SOURCE is designated the laboratory which has organized the measurement of delays.

| DATE | | MJD | TIME COMPARISONS | | UNCERT. | SOURCE |
|---|---|---|---|---|---|---|
| 1987 | | | (Unit : 1 microsecond) | | | |
| APR | 14 | 46899.00 | UTC(NBS ) - UTC(USNO) = | -5.016 | 0.008 | NBS |
| JUN | 3 | 46949.00 | UTC(OP ) - UTC(OMSF) = | 2.830 | 0.008 | BIPM |
| SEP | 1 | 47039.00 | UTC(OP ) - UTC(INPL) = | 37.312 | 0.017 | BIPM |
| DEC | 30 | 47159.00 | UTC(NBS ) - UTC(OP ) = | 0.018 | 0.018 | NBS, BIPM |

TABLE 15 - INDEPENDENT ATOMIC TIMES

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

Unit is one microsecond

| DATE 1987 | MJD | TAI - TA(i) AOS | CH (1) | DDR | F | JATC |
|---|---|---|---|---|---|---|
| JAN 4 | 46799 | -1.37 | -40.28 | -14.52 | 32.872 | -3.16 |
| JAN 14 | 46809 | -2.88 | -40.12 | -14.51 | 33.263 | -3.21 |
| JAN 24 | 46819 | -4.57 | -40.34 | -14.47 | 33.707 | -3.34 |
| FEB 3 | 46829 | -6.33 | -40.760 | -14.32 | 34.193 | -3.24 |
| FEB 13 | 46839 | -8.27 | -40.918 | -14.31 | 34.714 | -3.12 |
| FEB 23 | 46849 | -10.18 | -41.083 | -14.33 | 35.169 | -3.10 |
| MAR 5 | 46859 | -11.89 | -41.232 | -14.38 | 35.643 | -3.03 |
| MAR 15 | 46869 | -13.50 | -41.380 | -14.32 | 36.136 | -2.76 |
| MAR 25 | 46879 | -15.16 | -41.523 | -14.24 | 36.634 | -2.70 |
| APR 4 | 46889 | -16.66 | -41.684 | -14.29 | 37.125 | -3.01 |
| APR 14 | 46899 | -18.55 | -41.877 | -14.43 | 37.568 | -2.99 |
| APR 24 | 46909 | -20.16 | -42.085 | -14.61 | 38.041 | -2.89 |
| MAY 4 | 46919 | -21.79 | -42.276 | -14.83 | 38.538 | -2.83 |
| MAY 14 | 46929 | -23.80 | -42.481 | -15.07 | 39.003 | -2.75 |
| MAY 24 | 46939 | -25.78 | -42.675 | -15.34 | 39.469 | -2.62 |
| JUN 3 | 46949 | -28.01 | -42.889 | -15.66 | 39.942 | -2.50 |
| JUN 13 | 46959 | -30.05 | -43.090 | -15.95 | 40.387 | -2.38 |
| JUN 23 | 46969 | -32.40 | -43.313 | -16.30 | 40.812 | -2.36 |
| JUL 3 | 46979 | -34.63 | -43.501 | -16.68 | 41.263 | -2.28 |
| JUL 13 | 46989 | -37.06 | -43.718 | -17.12 | 41.752 | -2.19 |
| JUL 23 | 46999 | -39.01 | -43.891 | -17.49 | 42.256 | -2.02 |
| AUG 2 | 47009 | -41.32 | -44.058 | -17.97 | 42.750 | -1.95 |
| AUG 12 | 47019 | -43.53 | -44.238 | -18.46 | 43.233 | -1.97 |
| AUG 22 | 47029 | -45.60 | -44.426 | -18.84 | 43.725 | -1.88 |
| SEP 1 | 47039 | -47.63 | -44.575 | -19.38 | 44.197 | -1.70 |
| SEP 11 | 47049 | -49.95 | -44.750 | -19.84 | 44.713 | -1.47 |
| SEP 21 | 47059 | -52.13 | -44.923 | -20.21 | 45.226 | -1.35 |
| OCT 1 | 47069 | -54.51 | -45.119 | -20.74 | 45.679 | -1.22 |
| OCT 11 | 47079 | -56.62 | -45.293 | -21.18 | 46.151 | -1.10 |
| OCT 21 | 47089 | -58.78 | -45.461 | -21.60 | 46.607 | -0.93 |
| OCT 31 | 47099 | -60.93 | -45.634 | -22.00 | 47.041 | -0.77 |
| NOV 10 | 47109 | -63.08 | -45.793 | -22.40 | 47.466 | -0.78 |
| NOV 20 | 47119 | -65.58 | -45.973 | -22.74 | 47.882 | -0.77 |
| NOV 30 | 47129 | -67.74 | -46.170 | -23.14 | 48.302 | -0.68 |
| DEC 10 | 47139 | -69.97 | -46.335 | -23.43 | 48.686 | -0.54 |
| DEC 20 | 47149 | -72.35 | -46.494 | -23.74 | 49.044 | -0.57 |
| DEC 30 | 47159 | -74.36 | -46.660 | -24.04 | 49.449 | -0.53 |

(1) CH . Introduction of GPS time link on MJD=46829

TABLE 15 - (CONT.)

Unit is one microsecond

| DATE 1987 | MJD | TAI - TA(i) NBS | NIM | NRC | PTB | RGO |
|---|---|---|---|---|---|---|
| JAN 4 | 46799 | -45094.572 | - | 23.195 | -359.351 | 65.34 |
| JAN 14 | 46809 | -45094.912 | - | 23.140 | -359.348 | 65.27 |
| JAN 24 | 46819 | -45095.206 | - | 23.128 | -359.338 | 65.38 |
| FEB 3 | 46829 | -45095.487 | - | 23.220 | -359.301 | 65.37 |
| FEB 13 | 46839 | -45095.790 | - | 23.169 | -359.252 | 65.59 |
| FEB 23 | 46849 | -45096.099 | - | 23.109 | -359.266 | 65.62 |
| MAR 5 | 46859 | -45096.413 | -5.33 | 23.134 | -359.260 | 65.67 |
| MAR 15 | 46869 | -45096.701 | -5.28 | 23.173 | -359.225 | 65.68 |
| MAR 25 | 46879 | -45096.999 | -5.31 | 23.224 | -359.158 | 65.75 |
| APR 4 | 46889 | -45097.288 | -5.56 | 23.280 | -359.133 | - |
| APR 14 | 46899 | -45097.584 | -5.82 | 23.266 | -359.120 | - |
| APR 24 | 46909 | -45097.874 | -6.03 | 23.244 | -359.096 | - |
| MAY 4 | 46919 | -45098.151 | -6.16 | 23.205 | -359.076 | - |
| MAY 14 | 46929 | -45098.434 | -6.34 | 23.143 | -359.065 | - |
| MAY 24 | 46939 | -45098.698 | -6.55 | 23.049 | -359.074 | - |
| JUN 3 | 46949 | -45098.986 | -6.67 | 22.935 | -359.090 | - |
| JUN 13 | 46959 | -45099.254 | -6.70 | 22.857 | -359.069 | - |
| JUN 23 | 46969 | -45099.542 | -6.89 | 22.751 | -359.120 | - |
| JUL 3 | 46979 | -45099.814 | -7.10 | 22.652 | -359.090 | - |
| JUL 13 | 46989 | -45100.067 | -7.14 | 22.521 | -359.092 | - |
| JUL 23 | 46999 | -45100.318 | -7.18 | 22.393 | -359.053 | - |
| AUG 2 | 47009 | -45100.576 | -7.28 | 22.245 | -359.061 | - |
| AUG 12 | 47019 | -45100.838 | -7.28 | 22.104 | -359.053 | - |
| AUG 22 | 47029 | -45101.118 | -7.38 | 21.909 | -359.007 | - |
| SEP 1 | 47039 | -45101.391 | -7.33 | 21.754 | -359.044 | - |
| SEP 11 | 47049 | -45101.687 | -7.35 | 21.593 | -359.083 | - |
| SEP 21 | 47059 | -45101.970 | -7.41 | 21.472 | -359.070 | - |
| OCT 1 | 47069 | -45102.284 | -7.50 | 21.310 | -359.114 | - |
| OCT 11 | 47079 | -45102.600 | -7.44 | 21.193 | -359.124 | - |
| OCT 21 | 47089 | -45102.933 | -7.38 | 21.099 | -359.146 | - |
| OCT 31 | 47099 | -45103.264 | -7.33 | 21.002 | -359.163 | - |
| NOV 10 | 47109 | -45103.571 | -7.30 | 20.906 | -359.147 | - |
| NOV 20 | 47119 | -45103.911 | -7.34 | 20.763 | -359.143 | - |
| NOV 30 | 47129 | -45104.261 | -7.43 | 20.650 | -359.139 | - |
| DEC 10 | 47139 | -45104.620 | -7.40 | 20.549 | -359.147 | - |
| DEC 20 | 47149 | -45105.000 | -7.39 | 20.482 | -359.127 | - |
| DEC 30 | 47159 | -45105.380 | -7.40 | 20.628 | -359.135 | - |

TABLE 15 - (CONT.)

Unit is one microsecond

| DATE 1987 | MJD | TAI - TA(i) RRL | SO | SU (2) | USNO |
|---|---|---|---|---|---|
| JAN 4 | 46799 | -3.230 | -47.56 | 2827275.40 | -34531.860 |
| JAN 14 | 46809 | -3.329 | -47.50 | 2827274.96 | -34532.407 |
| JAN 24 | 46819 | -3.354 | -47.75 | 2827275.04 | -34532.926 |
| FEB 3 | 46829 | -3.379 | -47.96 | 2827275.58 | -34533.451 |
| FEB 13 | 46839 | -3.442 | -47.94 | 2827275.10 | -34533.998 |
| FEB 23 | 46849 | -3.487 | -47.70 | 2827274.40 | -34534.570 |
| MAR 5 | 46859 | -3.525 | -47.70 | 2827274.31 | -34535.111 |
| MAR 15 | 46869 | -3.586 | -47.86 | 2827273.75 | -34535.664 |
| MAR 25 | 46879 | -3.613 | -47.67 | 2827273.53 | -34536.222 |
| APR 4 | 46889 | -3.619 | -47.71 | 2827273.39 | -34536.769 |
| APR 14 | 46899 | -3.606 | -47.59 | 2827273.25 | -34537.296 |
| APR 24 | 46909 | -3.588 | -47.38 | 2827273.43 | -34537.838 |
| MAY 4 | 46919 | -3.557 | -47.07 | 2827273.32 | -34538.365 |
| MAY 14 | 46929 | -3.522 | -46.88 | 2827273.28 | -34538.892 |
| MAY 24 | 46939 | -3.463 | -46.66 | 2827273.08 | -34539.417 |
| JUN 3 | 46949 | -3.383 | -46.49 | 2827273.24 | -34539.954 |
| JUN 13 | 46959 | -3.251 | -46.37 | 2827273.10 | -34540.448 |
| JUN 23 | 46969 | -3.218 | -46.21 | 2827272.84 | -34540.968 |
| JUL 3 | 46979 | -3.179 | -45.99 | 2827272.77 | -34541.483 |
| JUL 13 | 46989 | -3.135 | -45.84 | 2827272.92 | -34542.020 |
| JUL 23 | 46999 | -3.063 | -45.71 | 2827272.93 | -34542.515 |
| AUG 2 | 47009 | -2.905 | -45.58 | 2827272.79 | -34543.030 |
| AUG 12 | 47019 | -2.844 | -45.44 | 2827272.47 | -34543.548 |
| AUG 22 | 47029 | -2.752 | -45.29 | 2827272.35 | -34544.084 |
| SEP 1 | 47039 | -2.656 | -45.05 | 2827272.48 | -34544.594 |
| SEP 11 | 47049 | -2.582 | -45.02 | 2827272.42 | -34545.158 |
| SEP 21 | 47059 | -2.488 | -44.93 | 2827272.40 | -34545.667 |
| OCT 1 | 47069 | -2.431 | -44.84 | 2827272.46 | -34546.172 |
| OCT 11 | 47079 | -2.396 | -44.80 | 2827272.24 | -34546.749 |
| OCT 21 | 47089 | -2.390 | -44.61 | 2827272.24 | -34547.294 |
| OCT 31 | 47099 | -2.372 | -44.58 | 2827272.15 | -34547.836 |
| NOV 10 | 47109 | -2.352 | -44.55 | 2827272.17 | -34548.357 |
| NOV 20 | 47119 | -2.395 | -44.61 | 2827272.23 | -34548.877 |
| NOV 30 | 47129 | -2.489 | -44.64 | 2827271.89 | -34549.450 |
| DEC 10 | 47139 | -2.562 | -44.65 | 2827271.79 | -34550.009 |
| DEC 20 | 47149 | -2.598 | -44.73 | 2827271.78 | -34550.557 |
| DEC 30 | 47159 | -2.640 | -44.87 | 2827271.49 | -34551.102 |

(2) SU . The values of TAI-TA(SU) for December 1986, given as "provisional" in the Annual Report for 1986, are confirmed.

TABLE 16 - PRIMARY FREQUENCY STANDARDS USED AS CLOCKS

Unit is one microsecond

TAI-LAB.STD.

| DATE 1987 | MJD | PTB (1) | | NRC (2) | | | |
|---|---|---|---|---|---|---|---|
| | | CS1 | CS2 | CsV | CsVI A | CsVI B | CsVI C |
| JAN 4 | 46799 | 4.064 | 3.632 | 40.622 | 30.168 | 41.263 | 32.476 |
| JAN 14 | 46809 | 4.066 | 3.619 | 40.556 | 30.109 | 41.317 | 32.499 |
| JAN 24 | 46819 | 4.073 | 3.623 | 40.535 | 30.103 | 41.442 | 32.583 |
| FEB 3 | 46829 | 4.106 | 3.647 | 40.618 | 30.117 | 41.580 | 32.702 |
| FEB 13 | 46839 | 4.099 | 3.610 | 40.557 | 30.109 | 41.654 | 32.760 |
| FEB 23 | 46849 | 4.131 | 3.611 | 40.487 | 30.101 | 41.706 | 32.779 |
| MAR 5 | 46859 | 4.151 | 3.618 | 40.502 | 30.061 | 41.742 | 32.796 |
| MAR 15 | 46869 | 4.188 | 3.615 | 40.531 | 30.039 | 41.762 | 32.840 |
| MAR 25 | 46879 | 4.230 | 3.605 | 40.572 | 30.010 | 41.749 | 32.863 |
| APR 4 | 46889 | 4.263 | 3.604 | 40.609 | 30.105 | 41.750 | 32.995 |
| APR 14 | 46899 | 4.284 | 3.577 | 40.595 | 30.091 | 41.817 | 32.932 |
| APR 24 | 46909 | 4.294 | 3.558 | 40.564 | 30.062 | 41.890 | 33.060 |
| MAY 4 | 46919 | 4.315 | 3.545 | 40.513 | 30.018 | 41.970 | 33.102 |
| MAY 14 | 46929 | 4.324 | 3.523 | 40.441 | 29.960 | 42.029 | 33.117 |
| MAY 24 | 46939 | 4.329 | 3.494 | 40.338 | 29.911 | 42.084 | 33.163 |
| JUN 3 | 46949 | 4.311 | 3.460 | 40.213 | 29.829 | 42.097 | 33.161 |
| JUN 13 | 46959 | 4.302 | 3.434 | 40.125 | 29.773 | 42.156 | 33.168 |
| JUN 23 | 46969 | 4.283 | 3.395 | 40.012 | 29.731 | 42.205 | 33.108 |
| JUL 3 | 46979 | 4.282 | 3.355 | 39.904 | 29.680 | 42.241 | 33.004 |
| JUL 13 | 46989 | 4.309 | 3.327 | 39.762 | 29.581 | 42.267 | 32.908 |
| JUL 23 | 46999 | 4.309 | 3.286 | 39.624 | 29.470 | 42.321 | 32.834 |
| AUG 2 | 47009 | 4.350 | 3.265 | 39.467 | 29.390 | 42.337 | 32.730 |
| AUG 12 | 47019 | 4.370 | 3.244 | 39.316 | 29.266 | 42.341 | 32.628 |
| AUG 22 | 47029 | 4.364 | 3.188 | 39.111 | 29.170 | 42.324 | 32.514 |
| SEP 1 | 47039 | 4.347 | 3.175 | 38.947 | 28.957 | 42.308 | 32.379 |
| SEP 11 | 47049 | 4.335 | 3.142 | 38.776 | 28.920 | 42.235 | 32.273 |
| SEP 21 | 47059 | 4.320 | 3.120 | 38.644 | 28.859 | 42.173 | 32.198 |
| OCT 1 | 47069 | 4.317 | 3.083 | 38.474 | 28.825 | 42.128 | 31.985 |
| OCT 11 | 47079 | 4.272 | 3.049 | 38.348 | 28.800 | 42.074 | 31.736 |
| OCT 21 | 47089 | 4.263 | 3.023 | 38.244 | 28.850 | 42.056 | 31.451 |
| OCT 31 | 47099 | 4.252 | 2.991 | 38.138 | 28.962 | 41.987 | 31.683 |
| NOV 10 | 47109 | 4.255 | 2.959 | 38.032 | 28.955 | 42.210 | 31.578 |
| NOV 20 | 47119 | 4.258 | 2.943 | 37.879 | 28.899 | 42.372 | 31.477 |
| NOV 30 | 47129 | 4.246 | 2.929 | 37.757 | 28.983 | 42.567 | 31.371 |
| DEC 10 | 47139 | 4.271 | 2.939 | 37.646 | 29.054 | 42.722 | 31.232 |
| DEC 20 | 47149 | 4.268 | 2.892 | 37.569 | 29.146 | 42.893 | 31.142 |
| DEC 30 | 47159 | 4.258 | 2.855 | 37.706 | 29.316 | 43.313 | 31.046 |

TABLE 16 - (CONT.)

NOTES

(1) The time scales under the headline PTB are coordinate time scales at sea level derived from the scales of proper time produced by standards CS1 and CS2 of PTB. The gravitational correction is -0.00066 μs/d .

(2) The time scales under the headline NRC are the scales of proper time PT(NRC Cs V), PT(NRC Cs VI A), PT(NRC Cs VI B), PT(NRC Cs VI C) produced directly by standards Cs V, Cs VI A, Cs VI B, Cs VI C of NRC. The gravitational frequency correction to these time scales of proper time to obtain coordinate times at sea level is -0.00097 μs/d .

TABLE 17 - COORDINATED UNIVERSAL TIME

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

Unit is one microsecond

| DATE 1987 | MJD | UTC - UTC(i) AOS | APL | ASMW | AUS | BEV (1) | CAO |
|---|---|---|---|---|---|---|---|
| JAN 4 | 46799 | -0.47 | -0.980 | -0.25 | -5.983 | -8.60 | -3.66 |
| JAN 14 | 46809 | -0.18 | -1.003 | -0.15 | -6.123 | -9.04 | -3.81 |
| JAN 24 | 46819 | -0.07 | -0.960 | 0.00 | -6.227 | -9.49 | -3.71 |
| FEB 3 | 46829 | -0.03 | -0.921 | 0.14 | -6.294 | -9.49 | -2.95 |
| FEB 13 | 46839 | -0.17 | -0.911 | 0.19 | -6.521 | -9.54 | -2.76 |
| FEB 23 | 46849 | -0.28 | -0.910 | 0.20 | -6.517 | -9.37 | -2.77 |
| MAR 5 | 46859 | -0.19 | -0.907 | 0.18 | -6.686 | -9.28 | -2.81 |
| MAR 15 | 46869 | 0.01 | -0.893 | 0.29 | -6.844 | 10.53 | -2.54 |
| MAR 25 | 46879 | 0.14 | -0.876 | 0.39 | -6.947 | 10.19 | -2.30 |
| APR 4 | 46889 | 0.44 | -0.858 | 0.39 | -7.039 | 9.83 | -1.86 |
| APR 14 | 46899 | 0.35 | -0.872 | 0.29 | -7.177 | 9.29 | -1.73 |
| APR 24 | 46909 | 0.54 | -0.861 | 0.12 | -7.298 | 8.82 | -1.60 |
| MAY 4 | 46919 | 0.71 | -0.851 | 0.14 | -7.450 | 8.35 | -1.40 |
| MAY 14 | 46929 | 0.51 | -0.844 | 0.13 | -7.582 | 7.97 | -1.23 |
| MAY 24 | 46939 | 0.32 | -0.838 | 0.10 | -7.739 | 7.46 | -1.05 |
| JUN 3 | 46949 | -0.11 | -0.857 | 0.01 | -7.894 | 7.14 | -0.88 |
| JUN 13 | 46959 | -0.35 | - | -0.07 | -8.079 | 6.62 | -0.75 |
| JUN 23 | 46969 | -0.90 | -0.861 | -0.22 | -8.209 | 6.29 | -0.54 |
| JUL 3 | 46979 | -1.33 | -0.893 | -0.44 | -8.443 | 5.86 | -0.31 |
| JUL 13 | 46989 | -1.96 | -0.923 | -0.72 | -8.611 | 5.46 | -0.09 |
| JUL 23 | 46999 | -2.11 | -0.932 | -0.70 | -8.818 | 4.94 | -0.02 |
| AUG 2 | 47009 | -2.62 | -0.950 | -0.78 | -8.991 | 4.56 | 0.08 |
| AUG 12 | 47019 | -3.03 | -0.973 | -0.84 | -9.177 | 4.07 | 0.16 |
| AUG 22 | 47029 | -3.30 | -0.993 | -0.81 | -9.441 | 3.69 | 0.14 |
| SEP 1 | 47039 | -3.43 | -0.989 | -0.85 | -9.613 | 3.33 | 0.07 |
| SEP 11 | 47049 | -2.95 | -1.011 | -0.65 | -9.845 | 2.87 | 0.12 |
| SEP 21 | 47059 | -2.33 | -1.035 | -0.33 | -10.081 | 2.48 | 0.14 |
| OCT 1 | 47069 | -1.91 | -1.036 | -0.16 | -10.248 | 2.06 | 0.01 |
| OCT 11 | 47079 | -1.22 | -1.046 | -0.15 | -10.418 | 1.59 | -0.14 |
| OCT 21 | 47089 | -0.58 | -1.054 | -0.13 | -10.574 | 1.16 | -0.14 |
| OCT 31 | 47099 | 0.07 | -1.078 | -0.06 | -10.780 | 0.75 | -0.18 |
| NOV 10 | 47109 | 0.22 | -1.082 | 0.00 | -10.894 | 0.36 | -0.24 |
| NOV 20 | 47119 | 0.02 | -1.095 | 0.15 | -11.090 | 0.00 | -0.24 |
| NOV 30 | 47129 | 0.16 | -1.116 | 0.25 | -11.274 | -0.40 | -0.32 |
| DEC 10 | 47139 | 0.23 | -1.112 | 0.29 | -11.438 | -0.67 | -0.32 |
| DEC 20 | 47149 | 0.15 | -1.140 | 0.36 | -11.583 | -1.20 | -0.20 |
| DEC 30 | 47159 | 0.45 | -1.154 | 0.32 | -11.749 | -1.71 | -0.17 |

TABLE 17 - (CONT.)

Unit is one microsecond

| DATE 1987 | MJD | UTC - UTC(i) CH (2) | CSAO | FTZ | IEN | IFAG (3) | ILOM |
|---|---|---|---|---|---|---|---|
| JAN 4 | 46799 | 1.29 | -0.49 | 9.32 | 0.781 | -3.513 | -30.20 |
| JAN 14 | 46809 | 1.68 | -0.63 | 9.49 | 0.621 | -3.543 | -30.51 |
| JAN 24 | 46819 | 1.67 | -0.77 | 9.67 | 0.372 | -3.506 | -30.72 |
| FEB 3 | 46829 | 1.449 | -0.90 | 9.85 | 0.098 | -3.435 | -30.92 |
| FEB 13 | 46839 | 1.471 | -0.88 | 9.98 | -0.119 | -3.453 | -31.20 |
| FEB 23 | 46849 | 1.487 | -0.90 | 10.13 | -0.358 | -3.545 | -31.42 |
| MAR 5 | 46859 | 1.517 | -0.92 | 10.25 | -0.564 | -4.941 | -31.69 |
| MAR 15 | 46869 | 1.550 | -0.93 | 10.41 | -0.797 | -4.850 | -31.77 |
| MAR 25 | 46879 | 1.588 | -0.88 | 10.48 | -1.061 | -4.445 | -31.94 |
| APR 4 | 46889 | 1.607 | -1.02 | 10.56 | -1.257 | -3.841 | -32.14 |
| APR 14 | 46899 | 1.594 | -1.04 | 10.67 | -1.489 | -3.514 | -32.32 |
| APR 24 | 46909 | 1.566 | -1.00 | 10.78 | -1.721 | -3.490 | -32.50 |
| MAY 4 | 46919 | 1.556 | -0.91 | 10.84 | -1.818 | -3.733 | -32.70 |
| MAY 14 | 46929 | 1.531 | -0.88 | 10.92 | -1.836 | -3.848 | -32.92 |
| MAY 24 | 46939 | 1.518 | -0.73 | 11.04 | -1.899 | -3.672 | -33.11 |
| JUN 3 | 46949 | 1.482 | -0.54 | 11.14 | -1.982 | -3.937 | -33.25 |
| JUN 13 | 46959 | 1.463 | -0.60 | 11.28 | -1.946 | -4.221 | -33.43 |
| JUN 23 | 46969 | 1.421 | -0.60 | 11.35 | -1.936 | -4.474 | -33.61 |
| JUL 3 | 46979 | 1.414 | -0.60 | 11.51 | -1.906 | -4.450 | -33.83 |
| JUL 13 | 46989 | 1.378 | -0.60 | 11.59 | -1.929 | -4.664 | -33.97 |
| JUL 23 | 46999 | 1.385 | -0.50 | 11.62 | -2.003 | -5.112 | -34.27 |
| AUG 2 | 47009 | 1.399 | -0.57 | 11.63 | -1.942 | -5.227 | -34.43 |
| AUG 12 | 47019 | 1.399 | -0.56 | 11.63 | -1.879 | -4.913 | -34.60 |
| AUG 22 | 47029 | 1.392 | -0.51 | 11.65 | -1.786 | -4.733 | -34.74 |
| SEP 1 | 47039 | 1.424 | -0.22 | 11.62 | -1.672 | -5.038 | -34.87 |
| SEP 11 | 47049 | 1.430 | 0.01 | 11.82 | -1.611 | -5.301 | -34.92 |
| SEP 21 | 47059 | 1.438 | -0.08 | 12.02 | -1.461 | -5.189 | -34.92 |
| OCT 1 | 47069 | 1.423 | 0.14 | 12.23 | -1.382 | -4.905 | -34.75 |
| OCT 11 | 47079 | 1.429 | 0.27 | 12.55 | -1.262 | -4.960 | -34.86 |
| OCT 21 | 47089 | 1.443 | 0.57 | 12.69 | -1.208 | -4.849 | -35.02 |
| OCT 31 | 47099 | 1.450 | 0.62 | 12.82 | -1.164 | -4.229 | -34.96 |
| NOV 10 | 47109 | 1.473 | 0.50 | 13.03 | -1.091 | -4.555 | -34.95 |
| NOV 20 | 47119 | 1.474 | 0.53 | 13.33 | -1.047 | -5.103 | -34.90 |
| NOV 30 | 47129 | 1.458 | 0.73 | 13.61 | -1.132 | -5.234 | -34.90 |
| DEC 10 | 47139 | 1.474 | 0.76 | 13.86 | -1.212 | -4.805 | -34.94 |
| DEC 20 | 47149 | 1.497 | 0.67 | 14.14 | -1.216 | -4.612 | -35.02 |
| DEC 30 | 47159 | 1.511 | 0.67 | 14.43 | -1.209 | -4.227 | -35.10 |

TABLE 17 - (CONT.)

Unit is one microsecond

| DATE 1987 | MJD | UTC - UTC(i) INPL | JATC | KSRI (4) | NBS | NIM | NPL |
|---|---|---|---|---|---|---|---|
| JAN 4 | 46799 | - | -1.82 | 7.33 | -0.279 | 12.86 | 2.296 |
| JAN 14 | 46809 | - | -1.64 | 7.34 | -0.336 | 12.42 | 2.393 |
| JAN 24 | 46819 | - | -1.63 | 7.34 | -0.333 | 12.35 | 2.482 |
| FEB 3 | 46829 | - | -1.26 | 7.42 | -0.308 | 12.35 | 2.578 |
| FEB 13 | 46839 | - | -1.00 | 7.44 | -0.306 | 12.37 | 2.633 |
| FEB 23 | 46849 | - | -0.87 | 7.46 | -0.308 | 12.32 | 2.687 |
| MAR 5 | 46859 | - | -0.77 | 7.52 | -0.304 | 12.31 | 2.758 |
| MAR 15 | 46869 | - | -0.53 | 7.58 | -0.273 | 12.39 | 2.840 |
| MAR 25 | 46879 | - | -0.38 | 7.51 | -0.250 | 12.40 | 2.932 |
| APR 4 | 46889 | - | -0.41 | 7.23 | -0.222 | 12.23 | 3.018 |
| APR 14 | 46899 | - | -0.24 | 7.03 | -0.203 | 11.91 | 3.087 |
| APR 24 | 46909 | - | -0.08 | 7.03 | -0.181 | 11.76 | 3.162 |
| MAY 4 | 46919 | - | 0.11 | 7.02 | -0.147 | 11.60 | 3.194 |
| MAY 14 | 46929 | - | 0.26 | 6.91 | -0.116 | 11.46 | 3.244 |
| MAY 24 | 46939 | - | 0.49 | 7.44 | -0.064 | 11.32 | 3.280 |
| JUN 3 | 46949 | - | 0.64 | -0.81 | -0.032 | 11.32 | 3.293 |
| JUN 13 | 46959 | - | 0.74 | -2.47 | 0.017 | 11.30 | 3.309 |
| JUN 23 | 46969 | 32.294 | 0.79 | -4.10 | 0.046 | 11.14 | 3.289 |
| JUL 3 | 46979 | 32.975 | 0.76 | -5.74 | 0.098 | 11.12 | 3.283 |
| JUL 13 | 46989 | 33.688 | 0.86 | -7.39 | 0.135 | 11.22 | 3.291 |
| JUL 23 | 46999 | 34.338 | 0.99 | -8.90 | 0.178 | 11.27 | 3.316 |
| AUG 2 | 47009 | 35.182 | 1.03 | -10.59 | 0.221 | 11.13 | 3.321 |
| AUG 12 | 47019 | 36.095 | 1.03 | -12.28 | 0.249 | 11.15 | 3.353 |
| AUG 22 | 47029 | 36.996 | 1.06 | -13.91 | 0.266 | 11.07 | 3.375 |
| SEP 1 | 47039 | 37.893 | 1.28 | -15.50 | 0.289 | 11.11 | 3.430 |
| SEP 11 | 47049 | 38.758 | 1.60 | -18.14 | 0.289 | 11.11 | 3.455 |
| SEP 21 | 47059 | 39.639 | 1.80 | -116.87 | 0.312 | 11.02 | 3.515 |
| OCT 1 | 47069 | 40.439 | 1.91 | -117.83 | 0.299 | 10.95 | 3.541 |
| OCT 11 | 47079 | 41.266 | 2.09 | -118.62 | 0.290 | 10.95 | 3.570 |
| OCT 21 | 47089 | 42.130 | 2.34 | 0.95 | 0.260 | 10.96 | 3.621 |
| OCT 31 | 47099 | 43.007 | 2.39 | 0.48 | 0.220 | 10.91 | 3.658 |
| NOV 10 | 47109 | 44.003 | 2.28 | 0.14 | 0.192 | 10.75 | 3.698 |
| NOV 20 | 47119 | 45.000 | 2.21 | -0.43 | 0.133 | 10.63 | 3.756 |
| NOV 30 | 47129 | 45.984 | 2.32 | -1.01 | 0.075 | 10.53 | 3.803 |
| DEC 10 | 47139 | 46.983 | 2.16 | -1.66 | 0.013 | 10.54 | 3.849 |
| DEC 20 | 47149 | 47.965 | 1.81 | -2.11 | -0.060 | 10.55 | 3.874 |
| DEC 30 | 47159 | 48.993 | 1.68 | -2.62 | -0.138 | 10.49 | 3.891 |

TABLE 17 - (CONT.)

Unit is one microsecond

| DATE 1987 | | MJD | UTC - UTC(i) ORB (6) | PKNM | PTB | RGO | RRL | SO (7) |
|---|---|---|---|---|---|---|---|---|
| JAN | 4 | 46799 | -31.83 | -3.21 | 4.049 | -8.57 | -1.450 | 0.70 |
| JAN | 14 | 46809 | -32.30 | -3.20 | 4.052 | -8.64 | -1.559 | 0.77 |
| JAN | 24 | 46819 | -32.17 | -3.22 | 4.062 | -8.53 | -1.644 | 0.53 |
| FEB | 3 | 46829 | -32.008 | -3.13 | 4.099 | -8.54 | -1.699 | 0.32 |
| FEB | 13 | 46839 | -32.175 | -3.43 | 4.148 | -8.32 | -1.792 | 0.36 |
| FEB | 23 | 46849 | -32.364 | -3.36 | 4.133 | -8.29 | -1.867 | 0.62 |
| MAR | 5 | 46859 | -32.255 | -2.98 | 4.140 | -8.24 | -1.945 | 0.61 |
| MAR | 15 | 46869 | -32.903 | -2.91 | 4.175 | -8.23 | -2.046 | 0.41 |
| MAR | 25 | 46879 | -33.295 | -3.21 | 4.242 | -8.16 | -2.113 | 0.56 |
| APR | 4 | 46889 | -34.587 | -3.14 | 4.267 | - | -2.099 | 0.45 |
| APR | 14 | 46899 | -34.942 | -3.04 | 4.280 | - | -1.966 | 0.46 |
| APR | 24 | 46909 | -35.308 | -2.77 | 4.304 | - | -1.828 | 0.55 |
| MAY | 4 | 46919 | -35.658 | -3.15 | 4.324 | - | -1.707 | 0.75 |
| MAY | 14 | 46929 | -35.981 | -3.55 | 4.335 | - | -1.582 | 0.81 |
| MAY | 24 | 46939 | -36.334 | -3.65 | 4.326 | - | -1.443 | 0.92 |
| JUN | 3 | 46949 | -36.708 | -3.85 | 4.309 | - | -1.273 | 0.97 |
| JUN | 13 | 46959 | -37.124 | -4.05 | 4.331 | - | -1.051 | 1.00 |
| JUN | 23 | 46969 | -37.516 | -4.15 | 4.279 | - | -0.908 | 1.08 |
| JUL | 3 | 46979 | -37.959 | -3.89 | 4.310 | - | -0.769 | 1.23 |
| JUL | 13 | 46989 | -38.371 | -3.91 | 4.308 | - | -0.615 | 1.37 |
| JUL | 23 | 46999 | -38.744 | -3.87 | 4.347 | - | -0.493 | 1.48 |
| AUG | 2 | 47009 | -39.121 | -3.54 | 4.339 | - | -0.345 | 1.59 |
| AUG | 12 | 47019 | -39.484 | -3.19 | 4.347 | - | -0.254 | 1.69 |
| AUG | 22 | 47029 | -39.876 | -3.20 | 4.393 | - | -0.152 | 1.81 |
| SEP | 1 | 47039 | -40.312 | -3.08 | 4.355 | - | -0.056 | 1.99 |
| SEP | 11 | 47049 | -40.713 | -2.97 | 4.317 | - | 0.018 | 2.10 |
| SEP | 21 | 47059 | -41.152 | -2.85 | 4.330 | - | 0.042 | 2.24 |
| OCT | 1 | 47069 | -41.592 | -2.77 | 4.286 | - | 0.049 | 2.37 |
| OCT | 11 | 47079 | -42.022 | -2.74 | 4.276 | - | 0.034 | 2.49 |
| OCT | 21 | 47089 | -42.422 | -2.84 | 4.254 | - | 0.000 | 2.69 |
| OCT | 31 | 47099 | -42.839 | -2.91 | 4.236 | - | -0.032 | 2.75 |
| NOV | 10 | 47109 | -43.267 | -3.11 | 4.253 | - | -0.082 | 2.81 |
| NOV | 20 | 47119 | -43.695 | -2.96 | 4.257 | - | -0.175 | 2.78 |
| NOV | 30 | 47129 | -44.143 | -2.79 | 4.261 | - | -0.319 | 2.80 |
| DEC | 10 | 47139 | -44.596 | -2.45 | 4.253 | - | -0.432 | 2.87 |
| DEC | 20 | 47149 | -45.105 | -2.42 | 4.273 | - | -0.518 | 2.94 |
| DEC | 30 | 47159 | -45.569 | -2.66 | 4.265 | - | -0.600 | 2.79 |

TABLE 17 - (CONT.)

Unit is one microsecond

| DATE 1987 | MJD | UTC - UTC(i) STA (8) | SU (9) | TAO (10) | TL | TP (11) |
|---|---|---|---|---|---|---|
| JAN 4 | 46799 | 1.82 | 25.40 | 0.220 | 210.44 | -0.13 |
| JAN 14 | 46809 | 1.71 | 24.96 | 0.061 | 211.50 | -0.18 |
| JAN 24 | 46819 | 1.74 | 25.05 | -0.040 | 212.39 | 0.00 |
| FEB 3 | 46829 | 1.56 | 25.58 | -0.112 | 213.16 | 0.08 |
| FEB 13 | 46839 | 1.57 | 25.10 | -0.232 | 214.11 | -0.06 |
| FEB 23 | 46849 | 1.37 | 24.41 | -0.352 | 215.28 | 0.00 |
| MAR 5 | 46859 | 1.24 | 24.31 | -0.469 | 216.57 | 0.11 |
| MAR 15 | 46869 | 1.18 | 23.75 | -0.517 | 217.84 | 0.23 |
| MAR 25 | 46879 | 1.02 | 23.53 | -0.537 | 219.18 | 0.27 |
| APR 4 | 46889 | 0.91 | 23.39 | -0.559 | 220.39 | 0.22 |
| APR 14 | 46899 | 0.75 | 23.25 | -0.605 | 221.43 | 0.31 |
| APR 24 | 46909 | 0.62 | 23.43 | -0.655 | 222.71 | 0.70 |
| MAY 4 | 46919 | 0.46 | 23.32 | -0.703 | 224.01 | 0.76 |
| MAY 14 | 46929 | 0.360 | 23.28 | -0.733 | 225.11 | 0.73 |
| MAY 24 | 46939 | 0.225 | 23.08 | -0.768 | 226.22 | 0.74 |
| JUN 3 | 46949 | 0.121 | 23.24 | -0.827 | 227.58 | 0.89 |
| JUN 13 | 46959 | 0.138 | 23.10 | -0.856 | 228.89 | 1.14 |
| JUN 23 | 46969 | 0.162 | 22.84 | -0.907 | 230.30 | 1.36 |
| JUL 3 | 46979 | 0.228 | 22.77 | -0.977 | 232.10 | 1.47 |
| JUL 13 | 46989 | 0.337 | 22.92 | -1.051 | 233.88 | 1.68 |
| JUL 23 | 46999 | 0.464 | 22.93 | -1.109 | 235.52 | 1.86 |
| AUG 2 | 47009 | 0.629 | 22.79 | -1.163 | 236.94 | 2.04 |
| AUG 12 | 47019 | 0.746 | 22.47 | -1.228 | 238.56 | 2.15 |
| AUG 22 | 47029 | 0.812 | 22.35 | -1.270 | 240.38 | 2.32 |
| SEP 1 | 47039 | 0.925 | 22.48 | -1.290 | 242.10 | 2.31 |
| SEP 11 | 47049 | 1.013 | 22.42 | -1.331 | 243.80 | 2.29 |
| SEP 21 | 47059 | 1.118 | 22.40 | -1.361 | 245.33 | 2.37 |
| OCT 1 | 47069 | 1.205 | 22.46 | -1.412 | 246.79 | 2.38 |
| OCT 11 | 47079 | 1.146 | 22.24 | -1.454 | 248.24 | 2.61 |
| OCT 21 | 47089 | 0.971 | 22.24 | -1.494 | 249.76 | 2.73 |
| OCT 31 | 47099 | 0.753 | 22.15 | -1.551 | 251.13 | 2.88 |
| NOV 10 | 47109 | 0.544 | 22.17 | -1.575 | 252.41 | 3.07 |
| NOV 20 | 47119 | 0.364 | 22.23 | -1.614 | 253.77 | 3.32 |
| NOV 30 | 47129 | 0.169 | 21.89 | -1.657 | 255.25 | 3.49 |
| DEC 10 | 47139 | -0.018 | 21.80 | -1.685 | 256.65 | 3.63 |
| DEC 20 | 47149 | -0.114 | 21.78 | -1.721 | 258.06 | 3.79 |
| DEC 30 | 47159 | -0.071 | 21.49 | -1.739 | 259.36 | 4.01 |

TABLE 17 - (CONT.)

Unit is one microsecond

| DATE 1987 | MJD | UTC - UTC(i) TUG (12) | USNO | VSL | YUZM (13) | ZIPE |
|---|---|---|---|---|---|---|
| JAN 4 | 46799 | 4.60 | -4.845 | 4.031 | -103.23 | -0.40 |
| JAN 14 | 46809 | 4.98 | -4.885 | 4.004 | -104.69 | -0.27 |
| JAN 24 | 46819 | -3.76 | -4.909 | 4.016 | -105.81 | -0.14 |
| FEB 3 | 46829 | -3.684 | -4.926 | 4.020 | -106.73 | 0.02 |
| FEB 13 | 46839 | -3.404 | -4.983 | 4.013 | -107.53 | -0.05 |
| FEB 23 | 46849 | -3.07 | -5.059 | 4.005 | -108.16 | 0.06 |
| MAR 5 | 46859 | -2.70 | -5.098 | 4.039 | -108.89 | 0.05 |
| MAR 15 | 46869 | -2.43 | -5.156 | 4.069 | -110.01 | 0.12 |
| MAR 25 | 46879 | -2.34 | -5.199 | 4.066 | -110.79 | 0.24 |
| APR 4 | 46889 | -2.02 | -5.221 | 4.067 | -111.26 | 0.21 |
| APR 14 | 46899 | -1.73 | -5.239 | 4.051 | -111.77 | 0.08 |
| APR 24 | 46909 | -1.498 | -5.260 | 4.088 | -112.33 | -0.02 |
| MAY 4 | 46919 | -1.235 | -5.262 | 4.159 | -112.84 | -0.10 |
| MAY 14 | 46929 | -0.972 | -5.264 | 4.179 | -113.12 | -0.14 |
| MAY 24 | 46939 | -0.691 | -5.271 | 4.129 | -113.65 | -0.17 |
| JUN 3 | 46949 | -0.434 | -5.276 | 4.095 | -113.88 | -0.24 |
| JUN 13 | 46959 | -0.162 | -5.241 | 4.066 | -114.14 | -0.26 |
| JUN 23 | 46969 | 0.107 | -5.221 | 4.034 | -113.86 | -0.31 |
| JUL 3 | 46979 | 0.386 | -5.175 | 4.086 | -113.66 | -0.29 |
| JUL 13 | 46989 | 0.666 | -5.133 | 4.109 | -113.70 | -0.37 |
| JUL 23 | 46999 | 0.923 | -5.090 | 4.108 | -113.60 | -0.30 |
| AUG 2 | 47009 | 1.188 | -5.063 | 4.092 | -113.48 | -0.38 |
| AUG 12 | 47019 | 1.402 | -5.049 | 4.059 | -113.59 | -0.54 |
| AUG 22 | 47029 | 1.639 | -5.023 | 4.085 | -113.81 | -0.53 |
| SEP 1 | 47039 | 1.930 | -4.985 | 4.119 | -114.01 | -0.36 |
| SEP 11 | 47049 | 2.185 | -4.967 | 4.148 | -113.34 | -0.15 |
| SEP 21 | 47059 | 2.467 | -4.903 | 4.211 | 0.94 | 0.00 |
| OCT 1 | 47069 | 2.729 | -4.870 | 4.226 | 1.63 | 0.02 |
| OCT 11 | 47079 | 2.977 | -4.860 | 4.210 | 1.70 | -0.29 |
| OCT 21 | 47089 | 3.225 | -4.846 | 4.189 | 2.21 | -0.31 |
| OCT 31 | 47099 | 3.480 | -4.822 | 4.196 | 2.50 | -0.31 |
| NOV 10 | 47109 | 3.736 | -4.766 | 4.226 | 2.44 | -0.35 |
| NOV 20 | 47119 | 4.003 | -4.732 | 4.195 | 2.79 | -0.36 |
| NOV 30 | 47129 | 4.252 | -4.706 | 4.183 | 2.92 | -0.45 |
| DEC 10 | 47139 | 4.515 | -4.660 | 4.232 | 2.85 | -0.42 |
| DEC 20 | 47149 | -4.233 | -4.625 | 4.208 | 2.29 | -0.48 |
| DEC 30 | 47159 | -3.964 | -4.591 | 4.233 | 2.09 | -0.38 |

TABLE 17 - (CONT.)

NOTES

(1) BEV . Time step of UTC(BEV) of -20 μs on MJD=46864.54.

(2) CH . Introduction of GPS time link on MJD=46829.

(3) IFAG. Rate adjustment of UTC(IFAG) of 40 ns/day on MJD=46794.00
Change of master clock on MJD=46853.38 and time step of UTC(IFAG) of 1.5 μs on MJD=46855.4 .

(4) KSRI. Change of master clock on MJD=46948 and time steps of 97 μs on MJD=47052.46 and of -120 μs on MJD=47080.10.

(5) OMSF. The time step of UTC-UTC(OMSF) between MJD=46909 and MJD=46919 by about 0.40 μs is an adjustment made by the BIH, as a consequence of the implementation of GPS reception at OMSF.

(6) ORB . Introduction of GPS time link on MJD=46829.

(7) SO . Change of master clock and time step of UTC(SO) of -14 μs on MJD=46796.00.

(8) STA . Introduction of GPS time link on MJD=46929.

(9) SU . The values of UTC-UTC(SU) for December 1986, given as "provisional" in the Annual Report for 1986, are confirmed.

(10) TAO . Change of master clock on MJD=46863.

(11) TP . Time step of UTC(TP) of 4 μs on MJD=46796.00.

(12) TUG . Time step of UTC(TUG) of 9 μs on MJD=46814.33 and of 9 μs on MJD=47143.73.
LORAN-C time link from MJD=46799 to MJD=46819, and from MJD=46849 to MJD=46899.

(13) YUZM. Time step of UTC(YUZM) between MJD=47049 and 47059; the precise amount is not know. The new origin of UTC-UTC(YUZM) is given by a clock transportation on MJD=47054.35.

TABLE 17 A - COORDINATED UNIVERSAL TIME (VLF)

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

Unit is one microsecond

| DATE 1987 | | MJD | UTC - UTC(i) |
|---|---|---|---|
| JAN | 4 | 46799 | |
| JAN | 14 | 46809 | |
| JAN | 24 | 46819 | |
| FEB | 3 | 46829 | |
| FEB | 13 | 46839 | |
| FEB | 23 | 46849 | |
| MAR | 5 | 46859 | |
| MAR | 15 | 46869 | |
| MAR | 25 | 46879 | |
| APR | 4 | 46889 | |
| APR | 14 | 46899 | |
| APR | 24 | 46909 | |
| MAY | 4 | 46919 | |
| MAY | 14 | 46929 | |
| MAY | 24 | 46939 | |
| JUN | 3 | 46949 | No data available for 1987 |
| JUN | 13 | 46959 | |
| JUN | 23 | 46969 | |
| JUL | 3 | 46979 | |
| JUL | 13 | 46989 | |
| JUL | 23 | 46999 | |
| AUG | 2 | 47009 | |
| AUG | 12 | 47019 | |
| AUG | 22 | 47029 | |
| SEP | 1 | 47039 | |
| SEP | 11 | 47049 | |
| SEP | 21 | 47059 | |
| OCT | 1 | 47069 | |
| OCT | 11 | 47079 | |
| OCT | 21 | 47089 | |
| OCT | 31 | 47099 | |
| NOV | 10 | 47109 | |
| NOV | 20 | 47119 | |
| NOV | 30 | 47129 | |
| DEC | 10 | 47139 | |
| DEC | 20 | 47149 | |
| DEC | 30 | 47159 | |

TABLE 18 - COMPARISONS BETWEEN ABSOLUTE TIME COMPARISONS AND THE BIH RESULTS

The Table gives the differences between the absolute time comparisons results and those derived from the data of Table 17 (before rounding-off)

A - CLOCK TRANSPORTATION

| DATE 1987 | MJD | TIME COMPARISONS | DIFFERENCE CLOCK TR. - BIH (Unit : 1 microsecond) |
|---|---|---|---|
| JAN 20 | 46815.05 | UTC(TAO ) - UTC(RRL ) | -0.008 |
| FEB 16 | 46842.66 | UTC(CH ) - UTC(PTB ) | 0.01 |
| FEB 24 | 46850.63 | UTC(CH ) - UTC(PTB ) | -0.01 |
| FEB 25 | 46851.05 | UTC(RRL ) - UTC(TAO ) | 0.005 |
| MAR 24 | 46878.08 | UTC(TAO ) - UTC(RRL ) | 0.001 |
| APR 22 | 46907.21 | UTC(RRL ) - UTC(TAO ) | -0.010 |
| MAY 20 | 46935.05 | UTC(TAO ) - UTC(RRL ) | 0.013 |
| MAY 22 | 46937.12 | UTC(TAO ) - UTC(NRLM) | -0.068 |
| MAY 26 | 46941.02 | UTC(TAO ) - UTC(ILOM) | -0.261 |
| JUN 18 | 46964.05 | UTC(NPL ) - UTC(SU ) | 1.199 |
| JUN 24 | 46970.05 | UTC(RRL ) - UTC(TAO ) | 0.027 |
| JUL 23 | 46999.07 | UTC(TAO ) - UTC(RRL ) | 0.014 |
| AUG 25 | 47032.06 | UTC(RRL ) - UTC(TAO ) | -0.031 |
| SEP 13 | 47051.74 | UTC(STA ) - UTC(SU ) | 0.662 |
| SEP 16 | 47054.35 | UTC(YUZM) - UTC(OP ) | 0.0 * |
| SEP 18 | 47056.32 | UTC(STA ) - UTC(SU ) | 0.636 |
| SEP 22 | 47060.05 | UTC(TAO ) - UTC(RRL ) | 0.026 |
| NOV 2 | 47101.10 | UTC(RRL ) - UTC(TAO ) | -0.015 |
| NOV 4 | 47103.09 | UTC(TAO ) - UTC(NRLM) | -0.018 |
| NOV 10 | 47109.00 | UTC(TAO ) - UTC(ILOM) | -0.009 |
| NOV 24 | 47123.04 | UTC(TAO ) - UTC(RRL ) | 0.013 |

* New origin. See Table 17.

B - GPS TIME COMPARISONS WITH DIFFERENTIAL CALIBRATION OF RECEIVER DELAYS

| DATE 1987 | MJD | TIME COMPARISONS | DIFFERENCE GPS COMP. - BIH (Unit : 1 microsecond) |
|---|---|---|---|
| APR 14 | 46899.00 | UTC(NBS ) - UTC(USNO) | 0.020 |
| JUN 3 | 46949.00 | UTC(OP ) - UTC(OMSF) | 0.012 |
| SEP 1 | 47039.00 | UTC(OP ) - UTC(INPL) | 0.018 |
| DEC 30 | 47159.00 | UTC(NBS ) - UTC(OP ) | -0.014 |

TABLE 19 - INTERNATIONAL ATOMIC TIME , BI-MONTHLY RATES OF TAI-CLOCK FOR 1987

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

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

| LAB. | CLOCK | | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|---|
| AOS | 19 | 7 | -164.96 | -165.80 | -205.25 | -220.18 | -220.83 | -225.65 |
| APL | 14 | 773 | -140.49 | -141.22 | -134.66 | -142.12 | -143.13 | -146.56 |
| APL | 42 | 6 | 1.92 | 0.91 | -0.02 | -2.07 | -1.21 | -1.28 |
| APL | 42 | 13 | 1.99 | 2.78 | -0.28 | -1.59 | 0.71 | 0.85 |
| APL | 42 | 14 | 8.24 | 0.84 | 0.18 | -2.49 | -1.69 | -0.53 |
| ASMW | 16 | 76 | 25.56 | 22.14 | -17.59 | -54.25 | -57.15 | -28.72 |
| AUS | 12 | 590 | 122.57 | 121.01 | 119.27 | 120.93 | 126.01 | 125.74 |
| AUS | 12 | 1708 | -164.11 | -188.27 | -183.96 | *** | *** | *** |
| AUS | 12 | 1823 | -5.97 | -6.79 | -11.51 | -23.18 | -41.21 | -32.87 |
| AUS | 12 | 2196 | *** | -48.91 | *** | *** | *** | *** |
| AUS | 14 | 902 | -107.14 | *** | *** | -116.64 | -109.85 | -95.32 |
| AUS | 14 | 1443 | 5.39 | 2.10 | *** | *** | *** | -2.01 |
| AUS | 14 | 1694 | 54.39 | *** | *** | *** | *** | *** |
| AUS | 14 | 1719 | 27.35 | 28.30 | 26.93 | 28.81 | *** | 32.39 |
| AUS | 14 | 1777 | 31.53 | 39.22 | *** | *** | -152.25 | -143.60 |
| AUS | 14 | 1844 | 43.43 | 40.78 | 38.94 | 31.46 | 31.66 | 39.23 |
| AUS | 14 | 2010 | -49.82 | -50.53 | -44.66 | -45.79 | -47.01 | -43.20 |
| AUS | 14 | 2020 | -55.50 | -53.21 | -48.38 | -45.56 | -45.57 | -46.21 |
| AUS | 44 | 1 | 25.39 | 28.59 | *** | *** | *** | 0.39 |
| AUS | 44 | 2 | 38.06 | 38.33 | 35.22 | 36.11 | 36.87 | 37.76 |
| AUS | 44 | 3 | *** | *** | -26.23 | -30.17 | *** | *** |
| BEV | 16 | 71 | -17.85 | -32.16 | -42.39 | -43.87 | -42.46 | -39.91 |
| CAO | 16 | 52 | *** | *** | -9.45 | *** | *** | *** |
| CAO | 16 | 183 | 18.48 | 22.66 | 17.31 | 11.28 | -5.07 | 0.13 |
| CH | 12 | 285 | -28.60 | *** | *** | -15.31 | -16.92 | -12.23 |
| CH | 12 | 863 | -31.11 | -28.89 | -39.29 | -44.64 | -43.97 | -32.87 |
| CH | 13 | 14 | -4.91 | 10.32 | -0.38 | 6.50 | -0.46 | 10.68 |
| CH | 14 | 1156 | 32.77 | 15.07 | 1.81 | *** | *** | *** |
| CH | 16 | 64 | -2.99 | -8.65 | -24.91 | -45.77 | -24.97 | 3.56 |
| CH | 16 | 69 | -91.83 | -93.37 | -105.93 | -103.06 | -108.75 | -106.43 |
| CH | 16 | 77 | 15.60 | 13.66 | 8.48 | 9.96 | 2.18 | 5.81 |
| CH | 16 | 114 | 8.53 | 2.08 | -8.57 | *** | *** | -8.60 |
| CH | 16 | 140 | 115.23 | 111.37 | 58.70 | -27.02 | -5.28 | 70.63 |
| CH | 17 | 206 | 60.54 | 63.41 | *** | *** | *** | *** |
| CH | 17 | 208 | -34.83 | -32.00 | -33.68 | -29.67 | -22.04 | -27.50 |

TABLE 19 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| CH | 21 179 | -65.07 | -60.56 | -60.11 | -56.23 | -55.11 | -56.58 |
| CH | 21 194 | 115.53 | 111.96 | 104.39 | 100.76 | 100.53 | 100.42 |
| CH | 21 217 | -141.10 | -129.99 | -128.06 | -116.34 | -103.57 | -92.95 |
| CH | 21 243 | 23.54 | 17.45 | 3.95 | -10.05 | -0.96 | -2.15 |
| CSAO | 12 1646 | 63.02 | 55.16 | 62.28 | 52.07 | 65.47 | 38.44 |
| CSAO | 12 1647 | 91.90 | 98.28 | 122.40 | 136.89 | 147.05 | 100.36 |
| CSAO | 12 1648 | 106.37 | 80.35 | 92.57 | 82.48 | 91.79 | 77.44 |
| F | 12 158 | -181.63 | *** | *** | *** | *** | *** |
| F | 12 439 | *** | *** | -138.04 | -139.85 | -152.09 | -159.35 |
| F | 12 475 | 230.75 | 223.66 | 210.37 | *** | *** | *** |
| F | 12 2405 | -329.13 | -353.24 | -358.88 | -325.41 | -326.73 | -342.27 |
| F | 14 51 | *** | -134.82 | -142.01 | -158.93 | -179.52 | -176.21 |
| F | 14 134 | -24.42 | -19.89 | -16.01 | -2.55 | 5.56 | -27.75 |
| F | 14 158 | *** | *** | *** | *** | 52.74 | 55.40 |
| F | 14 195 | -100.45 | -79.28 | -75.85 | -74.89 | -74.05 | -87.45 |
| F | 14 500 | *** | -7.84 | -4.84 | 7.98 | 5.78 | *** |
| F | 14 753 | 204.92 | 210.81 | 212.12 | 223.01 | 216.19 | 208.75 |
| F | 14 1120 | -58.07 | -58.95 | -65.26 | -55.83 | -61.21 | -58.06 |
| F | 14 1407 | -145.93 | -131.49 | -129.24 | -122.87 | -133.41 | -146.66 |
| F | 14 1645 | *** | *** | 21.58 | 14.81 | 3.87 | -10.41 |
| F | 14 1712 | *** | *** | *** | *** | -104.29 | -111.09 |
| F | 16 106 | *** | -140.37 | *** | *** | -305.02 | *** |
| F | 16 187 | -34.31 | -25.72 | -33.40 | -41.21 | -35.04 | -33.54 |
| FTZ | 14 312 | 28.08 | 20.56 | 19.26 | *** | *** | 16.92 |
| FTZ | 14 895 | 15.03 | 9.87 | 14.64 | 11.24 | 12.42 | 22.75 |
| FTZ | 14 1217 | 16.43 | 10.49 | 10.10 | 4.20 | 19.01 | 27.06 |
| FTZ | 14 1482 | *** | *** | 20.84 | 29.72 | 42.61 | 42.42 |
| FTZ | 14 1656 | *** | 15.86 | 16.37 | 13.83 | 20.34 | 24.43 |
| FTZ | 14 1674 | 14.96 | 14.52 | 18.27 | 14.39 | 18.52 | 16.75 |
| FTZ | 16 130 | 14.76 | 16.93 | 19.95 | 11.34 | 14.56 | 18.20 |
| IEN | 12 303 | 113.93 | 107.91 | 109.16 | 112.48 | 121.47 | 121.88 |
| IEN | 12 609 | 58.31 | 57.44 | *** | *** | *** | *** |
| IEN | 14 893 | 10.66 | 9.17 | 13.46 | 27.38 | 36.95 | 25.69 |
| IEN | 14 1230 | -78.07 | -79.84 | -68.24 | -37.78 | -34.58 | -71.38 |
| IEN | 16 84 | 153.86 | 144.52 | *** | 117.65 | 123.79 | 141.71 |
| IFAG | 14 1105 | -119.76 | -118.32 | -110.48 | -120.87 | -123.17 | -130.25 |
| IFAG | 16 131 | 123.42 | *** | 75.81 | 69.92 | 72.25 | 81.46 |
| IFAG | 16 138 | *** | *** | *** | *** | -17.61 | 14.48 |
| IFAG | 16 173 | 128.07 | 145.61 | 152.90 | 149.47 | 168.17 | *** |
| ILOM | 11 176 | 5632.61 | 6185.31 | 6754.68 | 9752.04 | 9885.70 | 8153.18 |

TABLE 19 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| ILOM | 14 614 | -183.51 | -158.80 | -173.52 | -212.78 | -221.02 | -243.85 |
| ILOM | 14 885 | -19.80 | -13.00 | -11.98 | -1.64 | -4.19 | -10.01 |
| ILOM | 14 1315 | -86.01 | -84.69 | -91.23 | -81.70 | -84.93 | -86.93 |
| ILOM | 14 2146 | -32.73 | -26.88 | -27.63 | -28.70 | *** | *** |
| INPL | 14 2308 | *** | *** | *** | *** | *** | -95.55 |
| INPL | 31 145 | *** | *** | *** | *** | *** | -125.05 |
| KSRI | 12 1403 | -328.57 | -343.88 | -318.66 | -302.37 | -287.88 | -268.15 |
| KSRI | 12 1406 | 217.12 | 224.21 | 285.53 | 271.55 | 242.84 | 134.98 |
| KSRI | 12 1903 | 1.45 | -9.26 | *** | *** | *** | *** |
| KSRI | 14 1516 | *** | *** | *** | -114.31 | -125.66 | -53.72 |
| NBS | 12 352 | -241.17 | -236.08 | -237.33 | -246.65 | -254.83 | -261.84 |
| NBS | 13 61 | -87.60 | -95.63 | -137.21 | -139.19 | -113.70 | -87.71 |
| NBS | 14 323 | -173.85 | -177.07 | -180.24 | -183.12 | -184.06 | -183.08 |
| NBS | 14 324 | -3.98 | -1.55 | 0.69 | 8.14 | 2.02 | -14.65 |
| NBS | 14 601 | -97.76 | -98.74 | -95.74 | *** | *** | -58.16 |
| NBS | 14 1316 | -107.34 | -108.18 | -110.27 | -110.02 | -109.80 | -111.62 |
| NBS | 14 1343 | *** | *** | 11027.46 | 11026.26 | *** | 11029.17 |
| NBS | 14 1653 | *** | *** | 10964.88 | *** | *** | *** |
| NBS | 14 2165 | *** | *** | 13624.05 | 13654.73 | *** | *** |
| NBS | 16 217 | -54.48 | -48.26 | -42.41 | -44.50 | *** | *** |
| NBS | 18 8 | 258.49 | *** | *** | -22.95 | -27.08 | *** |
| NBS | 18 113 | *** | *** | *** | -363.47 | -376.90 | -381.15 |
| NIM | 12 1615 | -1021.35 | -975.33 | -955.00 | -1020.62 | -1049.56 | -285.41 |
| NIM | 12 1633 | 8.57 | 12.29 | 12.13 | 20.97 | 18.68 | 15.45 |
| NIM | 12 1640 | -11.18 | -12.98 | -19.18 | -5.02 | 18.57 | 18.83 |
| NPL | 12 316 | *** | -150.31 | -166.69 | -164.75 | -173.38 | -159.99 |
| NPL | 12 418 | -114.89 | -118.53 | -109.08 | -102.21 | -134.65 | -142.07 |
| NPL | 12 832 | -302.69 | -303.28 | -300.74 | -300.13 | -286.05 | -288.20 |
| NPL | 14 1334 | *** | *** | *** | *** | -33.06 | -32.33 |
| NPL | 14 1813 | 14.50 | 14.09 | 8.45 | 7.58 | 9.98 | 10.15 |
| NPL | 14 2064 | -20.15 | -10.62 | -5.18 | -7.75 | 0.15 | -11.30 |
| NRC | 14 267 | -31.49 | -39.72 | -40.31 | -43.49 | -38.03 | -40.15 |
| NRC | 90 5 | -1.11 | 1.79 | -9.47 | -14.90 | -14.01 | -8.77 |
| NRC | 90 61 | -0.99 | 0.05 | -5.74 | -9.64 | -2.83 | 5.72 |
| NRC | 90 62 | 9.14 | 2.48 | 4.97 | 2.25 | -4.93 | 20.33 |
| NRC | 90 63 | 6.73 | 4.55 | 1.17 | -9.67 | -14.61 | -10.81 |
| NRLM | 12 363 | *** | *** | *** | 140.66 | 136.80 | 144.45 |
| NRLM | 14 906 | -73.04 | -76.70 | -84.20 | -93.22 | -92.29 | -84.67 |
| NRLM | 14 1632 | -15.22 | -14.30 | -18.58 | -20.88 | -21.25 | -18.21 |
| OMH | 12 1067 | 16.90 | 16.82 | 2.20 | 9.02 | 10.54 | *** |

TABLE 19 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| OMSF | 12 1223 | 168.40 | 180.94 | 179.26 | 153.39 | 148.79 | 160.21 |
| OMSF | 14 1569 | -16.20 | -13.99 | 2.54 | -21.31 | -19.26 | -12.50 |
| OMSF | 16 121 | 32.34 | 25.13 | 16.35 | 28.78 | 27.39 | 33.47 |
| OMSF | 16 177 | -12.54 | -18.93 | -24.21 | -22.88 | -25.63 | -27.60 |
| ORB | 12 205 | -119.25 | -147.47 | -146.64 | -148.52 | -152.58 | -155.20 |
| ORB | 12 804 | *** | *** | -54.47 | -70.78 | -81.10 | -90.02 |
| PKNM | 14 1144 | -58.28 | -43.30 | -51.10 | -17.00 | -32.80 | -36.08 |
| PKNM | 16 124 | 17.79 | 15.28 | -48.38 | -20.89 | -35.48 | -5.03 |
| PKNM | 16 125 | *** | *** | *** | 6.60 | -18.59 | -21.85 |
| PKNM | 16 154 | -77.99 | -57.56 | -106.14 | -74.77 | -101.09 | -99.19 |
| PTB | 12 320 | -57.53 | -56.31 | -60.56 | -68.11 | -59.96 | -62.40 |
| PTB | 12 462 | 2.49 | 2.55 | 1.91 | 0.20 | -3.51 | -2.47 |
| PTB | 14 394 | -31.99 | -27.59 | -28.82 | -24.76 | -22.89 | -32.37 |
| PTB | 14 867 | -188.26 | -187.85 | -189.92 | -186.04 | -184.74 | -190.29 |
| PTB | 14 1103 | -4.78 | -1.82 | -1.27 | 0.61 | 2.68 | 5.97 |
| PTB | 14 2379 | -57.78 | -60.79 | -58.19 | -45.77 | -24.35 | -25.60 |
| PTB | 16 119 | 11.79 | -2.64 | -9.20 | -15.31 | -5.79 | 11.33 |
| PTB | 92 1 | 1.49 | 2.99 | -0.23 | 1.64 | -1.65 | 0.21 |
| PTB | 92 2 | -0.31 | -0.88 | -2.75 | -3.23 | -2.91 | -1.95 |
| RGO | 12 348 | -37.25 | *** | *** | *** | *** | *** |
| RGO | 12 484 | -198.20 | *** | *** | *** | *** | *** |
| RGO | 14 202 | -591.69 | *** | *** | *** | *** | *** |
| RGO | 14 560 | -57.04 | *** | *** | *** | *** | *** |
| RGO | 14 868 | -129.76 | *** | *** | *** | *** | *** |
| RGO | 20 133 | -329.48 | *** | *** | *** | *** | *** |
| RRL | 12 1725 | -56.50 | *** | *** | *** | *** | *** |
| RRL | 14 764 | -106.80 | -112.55 | -104.13 | -115.09 | -118.29 | -113.33 |
| RRL | 14 865 | -315.99 | -314.84 | *** | *** | *** | -100.57 |
| RRL | 14 932 | -163.30 | -158.41 | -148.52 | -140.32 | -133.55 | -144.25 |
| RRL | 14 1729 | -154.51 | -150.66 | -138.78 | -131.43 | *** | -120.82 |
| RRL | 14 2456 | -16.80 | -15.54 | -11.72 | -6.73 | -20.34 | -49.66 |
| RRL | 31 131 | *** | *** | -18.77 | -12.64 | -11.63 | 7.57 |
| RRL | 45 3 | 53.54 | 55.47 | 53.40 | 58.63 | 63.55 | 67.38 |
| SO | 12 67 | -17.63 | -4.19 | 59.46 | 83.02 | 46.24 | 19.84 |
| SO | 12 997 | -93.99 | -86.38 | -85.50 | -89.79 | -84.77 | -98.64 |
| SO | 14 574 | -27.47 | -28.43 | -19.64 | -23.59 | -11.61 | -42.00 |
| SO | 16 180 | 15.48 | 17.59 | 27.29 | 34.02 | 38.93 | 39.51 |
| STA | 14 900 | -61.60 | -68.26 | -72.31 | -61.93 | -72.92 | -69.62 |
| STA | 14 1376 | -80.67 | -82.52 | -81.38 | -70.26 | -72.56 | -74.27 |
| STA | 16 137 | 33.45 | -122.41 | -132.69 | -128.16 | -127.57 | -97.06 |

TABLE 19 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| SU | 40 381 | -5.54 | -19.08 | -8.22 | -7.76 | -3.68 | *** |
| SU | 40 382 | -5.64 | -19.13 | -8.23 | -7.77 | -3.81 | *** |
| TAO | 12 204 | 223.63 | 225.46 | *** | *** | *** | *** |
| TAO | 14 390 | -75.89 | -71.42 | -77.20 | -81.49 | -83.39 | -74.45 |
| TAO | 14 1075 | -31.20 | -30.43 | -34.30 | -35.70 | -33.57 | -30.00 |
| TAO | 14 1498 | -116.02 | *** | -131.35 | -138.52 | -150.85 | -154.35 |
| TAO | 14 2494 | -8.52 | -8.54 | -10.15 | -12.13 | -10.08 | -9.34 |
| TL | 12 1145 | 96.73 | 123.45 | 125.06 | 165.04 | 152.82 | 138.77 |
| TL | 12 1455 | 142.86 | 152.08 | 153.65 | 144.16 | 145.09 | 143.40 |
| TL | 12 2276 | *** | -51.03 | -52.75 | -58.62 | -55.10 | -61.40 |
| TP | 12 335 | 6.07 | 8.93 | 10.47 | 16.54 | 8.34 | 18.40 |
| TUG | 12 524 | 89.97 | 91.53 | 94.61 | 90.90 | 90.59 | 89.32 |
| TUG | 14 1654 | 23.60 | 25.22 | 26.82 | 25.56 | 26.21 | 25.87 |
| TUG | 18 108 | *** | 173.68 | 209.41 | 220.38 | 235.96 | 253.42 |
| USNO | 12 573 | -11.23 | -6.52 | -7.50 | -9.23 | -8.82 | -7.96 |
| USNO | 12 752 | -52.11 | -32.62 | -42.75 | -52.32 | -29.86 | 88.23 |
| USNO | 12 778 | 227.27 | 223.86 | 228.82 | 229.01 | 233.30 | *** |
| USNO | 14 116 | *** | -58.85 | -59.26 | -60.63 | *** | -92.16 |
| USNO | 14 444 | *** | 413.04 | 396.66 | 397.94 | 397.70 | 332.01 |
| USNO | 14 571 | *** | *** | *** | 21.14 | *** | *** |
| USNO | 14 583 | *** | *** | *** | *** | *** | -43.18 |
| USNO | 14 653 | 32.89 | 37.96 | 45.66 | 43.97 | *** | *** |
| USNO | 14 656 | *** | 50.25 | -152.16 | -171.43 | -171.20 | -173.47 |
| USNO | 14 834 | -95.12 | -81.37 | -87.80 | -93.62 | -93.82 | -96.12 |
| USNO | 14 837 | -19.88 | -17.07 | -4.21 | 3.49 | 3.32 | -8.14 |
| USNO | 14 854 | *** | *** | *** | 154.68 | *** | *** |
| USNO | 14 862 | 205.99 | 237.09 | 271.90 | 277.87 | 272.19 | 266.65 |
| USNO | 14 871 | 98.76 | 107.32 | 102.38 | 88.49 | *** | *** |
| USNO | 14 875 | -122.08 | -121.12 | -122.07 | -125.84 | -119.86 | -114.39 |
| USNO | 14 1028 | *** | -320.95 | -293.55 | -290.47 | *** | *** |
| USNO | 14 1035 | -104.80 | -94.51 | -90.38 | -95.63 | -92.41 | -87.21 |
| USNO | 14 1094 | *** | *** | *** | -173.84 | -172.59 | -180.21 |
| USNO | 14 1104 | *** | *** | *** | *** | *** | -32.68 |
| USNO | 14 1114 | *** | *** | *** | *** | -61.69 | *** |
| USNO | 14 1117 | -71.52 | -70.54 | -61.07 | -53.35 | -60.41 | -61.23 |
| USNO | 14 1300 | -307.30 | -300.46 | -291.77 | -288.94 | -284.83 | -290.99 |
| USNO | 14 1301 | -152.64 | -152.56 | *** | -106.64 | *** | *** |
| USNO | 14 1305 | *** | -95.44 | *** | *** | *** | *** |
| USNO | 14 1362 | *** | -526.65 | -520.80 | -526.91 | -523.29 | -398.69 |
| USNO | 14 1423 | -45.79 | -48.65 | -44.20 | -40.48 | *** | *** |

TABLE 19 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| USNO | 14 1452 | 49.48 | *** | *** | *** | *** | *** |
| USNO | 14 1586 | -98.18 | -91.61 | *** | -64.23 | -85.90 | *** |
| USNO | 14 1605 | 39.61 | 45.57 | 46.58 | 47.11 | 40.34 | 43.83 |
| USNO | 14 1809 | -129.03 | -134.74 | -141.56 | -136.22 | -138.51 | *** |
| USNO | 14 1846 | -25.67 | -28.32 | -24.63 | -24.78 | -28.17 | -26.52 |
| USNO | 14 2081 | *** | -353.03 | *** | *** | *** | *** |
| USNO | 14 2098 | 7.44 | 6.47 | *** | -135.66 | *** | 23.77 |
| USNO | 14 2100 | -111.85 | -116.59 | -112.94 | -118.08 | -118.81 | -120.54 |
| USNO | 14 2277 | *** | *** | -164.88 | -156.42 | *** | *** |
| USNO | 14 2312 | -111.09 | -121.25 | -129.48 | -117.68 | *** | -114.97 |
| USNO | 14 2314 | *** | *** | *** | -40.81 | -43.66 | -56.02 |
| USNO | 14 2481 | -32.43 | -29.53 | -28.95 | -27.26 | -25.41 | -22.56 |
| USNO | 14 2482 | -37.51 | -41.84 | -37.86 | -35.34 | -34.20 | -33.57 |
| USNO | 14 2483 | -44.02 | -42.96 | -42.74 | -42.26 | -40.40 | -49.09 |
| USNO | 14 2484 | -78.60 | -81.83 | -84.64 | -87.48 | -92.28 | -95.48 |
| USNO | 14 2485 | -166.87 | -168.88 | -176.95 | -183.29 | -176.21 | -181.68 |
| USNO | 14 2486 | -21.92 | -18.53 | -18.93 | *** | -13.59 | -20.12 |
| USNO | 14 2487 | -37.75 | -52.40 | -45.63 | -41.33 | -25.11 | *** |
| USNO | 18 133 | -9.53 | *** | *** | *** | *** | *** |
| USNO | 40 18 | -3.44 | *** | *** | *** | *** | *** |
| USNO | 40 19 | -3.42 | *** | *** | *** | *** | *** |
| USNO | 43 8 | -6.41 | *** | 1.84 | 1.52 | 8.34 | *** |
| VSL | 12 349 | 66.43 | 65.88 | *** | *** | 55.00 | *** |
| VSL | 12 1489 | -391.18 | -402.03 | -408.03 | -464.46 | -475.98 | -548.26 |
| VSL | 14 503 | -143.34 | -160.08 | -145.77 | -135.97 | -145.39 | -140.78 |
| VSL | 14 1034 | -80.39 | -80.24 | -82.77 | -79.73 | -79.58 | -80.81 |
| YUZM | 12 1189 | -101.20 | -69.77 | -28.34 | 1.77 | *** | -5.19 |
| ZIPE | 12 979 | -177.26 | -190.31 | -203.62 | -204.16 | -217.05 | -223.91 |

The clocks are designated by their type (2 digits) and serial number in the type.

The codes for the types are

11 HEWLETT-PACKARD 5060A
12 HEWLETT-PACKARD 5061A
13 EBAUCHES , OSCILLATOM B5000
14 HEWLETT-PACKARD 5061A OPT.4
16 OSCILLOQUARTZ 3200
17 OSCILLOQUARTZ 3000
18 FREQ. AND TIME SYSTEMS INC. 4000
19 ROHDE AND SCHWARZ XSC
20 FREQ. AND TIME SYSTEMS INC. 5000
21 OSCILLOQUARTZ 3210
25 HEWLETT-PACKARD 5062C
30 HEWLETT-PACKARD 5061B
31 HEWLETT-PACKARD 5061B OPT. 4
4x HYDROGEN MASERS
9x PRIMARY CLOCKS AND PROTOTYPES

TABLE 20 - INTERNATIONAL ATOMIC TIME , WEIGHTS OF THE CLOCKS FOR 1987

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

*** DENOTES THAT THE CLOCK WAS NOT USED

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| AOS | 19 7 | 0 | 200 | 14 | 10 | 11 | 13 |
| APL | 14 773 | 87 | 200 | 200 | 196 | 200 | 200 |
| APL | 42 6 | 200 | 200 | 200 | 200 | 200 | 200 |
| APL | 42 13 | 200 | 200 | 200 | 200 | 200 | 200 |
| APL | 42 14 | 200 | 196 | 200 | 200 | 200 | 200 |
| ASMW | 16 76 | 25 | 23 | 21 | 11 | 7 | 8 |
| AUS | 12 590 | 191 | 200 | 200 | 200 | 200 | 200 |
| AUS | 12 1708 | 200 | 29 | 39 | *** | *** | *** |
| AUS | 12 1823 | 200 | 200 | 200 | 175 | 54 | 46 |
| AUS | 12 2196 | *** | 0 | *** | *** | *** | *** |
| AUS | 14 902 | 200 | *** | *** | 0 | 199 | 62 |
| AUS | 14 1443 | 147 | 200 | *** | *** | *** | 0 |
| AUS | 14 1694 | 0 | *** | *** | *** | *** | *** |
| AUS | 14 1719 | 200 | 200 | 200 | 200 | *** | 0 |
| AUS | 14 1777 | 200 | 153 | *** | *** | 0 | 175 |
| AUS | 14 1844 | 200 | 200 | 200 | 196 | 200 | 196 |
| AUS | 14 2010 | 112 | 140 | 121 | 200 | 200 | 200 |
| AUS | 14 2020 | 0 | 200 | 200 | 200 | 200 | 200 |
| AUS | 44 1 | 200 | 200 | *** | *** | *** | 0 |
| AUS | 44 2 | 200 | 200 | 200 | 200 | 200 | 200 |
| AUS | 44 3 | *** | *** | 0 | 0 | *** | *** |
| BEV | 16 71 | 32 | 115 | 149 | 114 | 101 | 99 |
| CAO | 16 52 | *** | *** | 0 | *** | *** | *** |
| CAO | 16 183 | 76 | 61 | 53 | 61 | 63 | 82 |
| CH | 12 285 | 19 | *** | *** | 0 | 200 | 200 |
| CH | 12 863 | 200 | 200 | 182 | 200 | 174 | 178 |
| CH | 13 14 | 36 | 25 | 38 | 34 | 198 | 178 |
| CH | 14 1156 | 24 | 15 | 12 | *** | *** | *** |
| CH | 16 64 | 25 | 22 | 29 | 32 | 39 | 30 |
| CH | 16 69 | 200 | 200 | 171 | 200 | 190 | 193 |
| CH | 16 77 | 200 | 200 | 200 | 200 | 194 | 200 |
| CH | 16 114 | 52 | 54 | 101 | *** | *** | 0 |
| CH | 16 140 | 0 | 2 | 0 | 0 | 3 | 0 |
| CH | 17 206 | 200 | 200 | *** | *** | *** | *** |
| CH | 17 208 | 200 | 200 | 200 | 200 | 195 | 200 |

TABLE 20 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| CH | 21 179 | 200 | 200 | 200 | 200 | 200 | 200 |
| CH | 21 194 | 200 | 200 | 196 | 164 | 164 | 200 |
| CH | 21 217 | 81 | 76 | 70 | 56 | 42 | 31 |
| CH | 21 243 | 0 | 200 | 72 | 37 | 49 | 61 |
| CSAO | 12 1646 | 162 | 194 | 197 | 182 | 166 | 98 |
| CSAO | 12 1647 | 9 | 12 | 17 | 20 | 22 | 1 |
| CSAO | 12 1648 | 115 | 66 | 64 | 54 | 53 | 86 |
| F | 12 158 | 25 | *** | *** | *** | *** | *** |
| F | 12 439 | *** | *** | 0 | 200 | 123 | 78 |
| F | 12 475 | 88 | 79 | 113 | *** | *** | *** |
| F | 12 2405 | 10 | 8 | 8 | 11 | 31 | 47 |
| F | 14 51 | *** | 0 | 198 | 47 | 21 | 23 |
| F | 14 134 | 128 | 105 | 119 | 125 | 78 | 58 |
| F | 14 158 | *** | *** | *** | *** | 0 | 200 |
| F | 14 195 | 60 | 61 | 64 | 72 | 63 | 93 |
| F | 14 500 | *** | 0 | 200 | 101 | 133 | *** |
| F | 14 753 | 112 | 200 | 200 | 143 | 159 | 195 |
| F | 14 1120 | 200 | 200 | 200 | 186 | 200 | 200 |
| F | 14 1407 | 186 | 161 | 200 | 163 | 165 | 109 |
| F | 14 1645 | *** | *** | 0 | 199 | 90 | 41 |
| F | 14 1712 | *** | *** | *** | *** | 0 | 198 |
| F | 16 106 | *** | 0 | *** | *** | 0 | *** |
| F | 16 187 | 0 | 170 | 195 | 194 | 200 | 200 |
| FTZ | 14 312 | 200 | 196 | 200 | *** | *** | 0 |
| FTZ | 14 895 | 200 | 200 | 200 | 200 | 200 | 182 |
| FTZ | 14 1217 | 13 | 21 | 30 | 41 | 38 | 154 |
| FTZ | 14 1482 | *** | *** | 0 | 159 | 60 | 73 |
| FTZ | 14 1656 | *** | 0 | 200 | 200 | 200 | 200 |
| FTZ | 14 1674 | 200 | 200 | 200 | 200 | 200 | 200 |
| FTZ | 16 130 | 198 | 200 | 200 | 190 | 200 | 200 |
| IEN | 12 303 | 198 | 200 | 186 | 200 | 188 | 200 |
| IEN | 12 609 | 140 | 108 | *** | *** | *** | *** |
| IEN | 14 893 | 145 | 104 | 94 | 106 | 79 | 79 |
| IEN | 14 1230 | 0 | 200 | 175 | 21 | 19 | 24 |
| IEN | 16 84 | 31 | 28 | *** | 0 | 200 | 47 |
| IFAG | 14 1105 | 196 | 200 | 168 | 181 | 200 | 197 |
| IFAG | 16 131 | 116 | *** | 0 | 200 | 200 | 188 |
| IFAG | 16 138 | *** | *** | *** | *** | 0 | 12 |
| IFAG | 16 173 | 8 | 8 | 10 | 13 | 13 | *** |
| ILOM | 11 176 | 0 | 0 | 0 | 0 | 0 | 0 |

TABLE 20 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| ILOM | 14 614 | 14 | 15 | 16 | 14 | 14 | 10 |
| ILOM | 14 885 | 192 | 173 | 186 | 115 | 186 | 200 |
| ILOM | 14 1315 | 0 | 200 | 200 | 186 | 200 | 200 |
| ILOM | 14 2146 | 200 | 200 | 200 | 200 | *** | *** |
| INPL | 14 2308 | *** | *** | *** | *** | *** | 0 |
| INPL | 31 145 | *** | *** | *** | *** | *** | 0 |
| KSRI | 12 1403 | 45 | 30 | 43 | 41 | 25 | 13 |
| KSRI | 12 1406 | 18 | 29 | 0 | 11 | 12 | 0 |
| KSRI | 12 1903 | 198 | 180 | *** | *** | *** | *** |
| KSRI | 14 1516 | *** | *** | *** | 0 | 97 | 0 |
| NBS | 12 352 | 200 | 200 | 200 | 187 | 175 | 94 |
| NBS | 13 61 | 15 | 13 | 14 | 17 | 19 | 18 |
| NBS | 14 323 | 200 | 200 | 200 | 200 | 200 | 200 |
| NBS | 14 324 | 42 | 32 | 32 | 50 | 200 | 150 |
| NBS | 14 601 | 175 | 147 | 171 | *** | *** | 0 |
| NBS | 14 1316 | 200 | 200 | 200 | 200 | 200 | 200 |
| NBS | 14 1343 | *** | *** | 0 | 200 | *** | 0 |
| NBS | 14 1653 | *** | *** | 0 | *** | *** | *** |
| NBS | 14 2165 | *** | *** | 0 | 13 | *** | *** |
| NBS | 16 217 | 65 | 55 | 70 | 102 | *** | *** |
| NBS | 18 8 | 200 | *** | *** | 0 | 200 | *** |
| NBS | 18 113 | *** | *** | *** | 0 | 70 | 83 |
| NIM | 12 1615 | 11 | 5 | 13 | 0 | 8 | 0 |
| NIM | 12 1633 | 127 | 173 | 200 | 172 | 175 | 200 |
| NIM | 12 1640 | 163 | 152 | 148 | 163 | 56 | 36 |
| NPL | 12 316 | *** | 0 | 48 | 91 | 87 | 124 |
| NPL | 12 418 | 70 | 62 | 67 | 184 | 72 | 42 |
| NPL | 12 832 | 180 | 200 | 200 | 200 | 128 | 169 |
| NPL | 14 1334 | *** | *** | *** | *** | 0 | 200 |
| NPL | 14 1813 | 200 | 200 | 200 | 200 | 200 | 200 |
| NPL | 14 2064 | 181 | 186 | 200 | 200 | 189 | 175 |
| NRC | 14 267 | 200 | 192 | 190 | 179 | 200 | 200 |
| NRC | 90 5 | 200 | 200 | 178 | 192 | 149 | 200 |
| NRC | 90 61 | 200 | 200 | 182 | 145 | 199 | 191 |
| NRC | 90 62 | 200 | 200 | 200 | 200 | 197 | 109 |
| NRC | 90 63 | 200 | 200 | 200 | 179 | 124 | 123 |
| NRLM | 12 363 | *** | *** | *** | 0 | 200 | 195 |
| NRLM | 14 906 | 200 | 200 | 196 | 146 | 120 | 153 |
| NRLM | 14 1632 | 200 | 200 | 200 | 200 | 200 | 200 |
| OMH | 12 1067 | 55 | 52 | 53 | 199 | 200 | *** |

TABLE 20 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| OMSF | 12 1223 | 32 | 33 | 144 | 74 | 55 | 56 |
| OMSF | 14 1569 | 54 | 142 | 105 | 115 | 105 | 137 |
| OMSF | 16 121 | 159 | 197 | 190 | 171 | 200 | 200 |
| OMSF | 16 177 | 86 | 100 | 200 | 200 | 193 | 200 |
| ORB | 12 205 | 9 | 13 | 14 | 47 | 41 | 59 |
| ORB | 12 804 | *** | *** | 0 | 47 | 40 | 35 |
| PKNM | 14 1144 | 47 | 45 | 38 | 42 | 41 | 46 |
| PKNM | 16 124 | 16 | 16 | 0 | 11 | 10 | 14 |
| PKNM | 16 125 | *** | *** | *** | 0 | 20 | 30 |
| PKNM | 16 154 | 14 | 16 | 0 | 14 | 15 | 27 |
| PTB | 12 320 | 200 | 200 | 200 | 195 | 193 | 200 |
| PTB | 12 462 | 80 | 102 | 113 | 124 | 200 | 200 |
| PTB | 14 394 | 200 | 200 | 200 | 200 | 200 | 185 |
| PTB | 14 867 | 200 | 200 | 200 | 200 | 200 | 200 |
| PTB | 14 1103 | 200 | 200 | 200 | 200 | 200 | 200 |
| PTB | 14 2379 | 194 | 200 | 200 | 171 | 54 | 36 |
| PTB | 16 119 | 13 | 13 | 18 | 98 | 120 | 82 |
| PTB | 92 1 | 200 | 200 | 200 | 200 | 200 | 200 |
| PTB | 92 2 | 200 | 200 | 200 | 200 | 200 | 200 |
| RGO | 12 348 | 200 | *** | *** | *** | *** | *** |
| RGO | 12 484 | 185 | *** | *** | *** | *** | *** |
| RGO | 14 202 | 25 | *** | *** | *** | *** | *** |
| RGO | 14 560 | 197 | *** | *** | *** | *** | *** |
| RGO | 14 868 | 200 | *** | *** | *** | *** | *** |
| RGO | 20 133 | 25 | *** | *** | *** | *** | *** |
| RRL | 12 1725 | 24 | *** | *** | *** | *** | *** |
| RRL | 14 764 | 200 | 200 | 191 | 179 | 200 | 200 |
| RRL | 14 865 | 196 | 200 | *** | *** | *** | 0 |
| RRL | 14 932 | 126 | 150 | 183 | 150 | 76 | 79 |
| RRL | 14 1729 | 161 | 200 | 173 | 136 | *** | 0 |
| RRL | 14 2456 | 200 | 200 | 200 | 200 | 165 | 43 |
| RRL | 31 131 | *** | *** | 0 | 200 | 200 | 63 |
| RRL | 45 3 | 0 | 0 | 0 | 200 | 200 | 200 |
| SO | 12 67 | 10 | 9 | 0 | 7 | 6 | 7 |
| SO | 12 997 | 200 | 195 | 200 | 200 | 200 | 163 |
| SO | 14 574 | 0 | 200 | 189 | 200 | 174 | 82 |
| SO | 16 180 | 200 | 200 | 165 | 91 | 80 | 90 |
| STA | 14 900 | 184 | 200 | 200 | 181 | 178 | 200 |
| STA | 14 1376 | 200 | 200 | 200 | 178 | 200 | 200 |
| STA | 16 137 | 0 | 0 | 1 | 1 | 2 | 2 |

TABLE 20 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| SU | 40 381 | 0 | 0 | 0 | 0 | 0 | *** |
| SU | 40 382 | 0 | 0 | 0 | 0 | 0 | *** |
| TAO | 12 204 | 6 | 18 | *** | *** | *** | *** |
| TAO | 14 390 | 180 | 200 | 200 | 200 | 200 | 189 |
| TAO | 14 1075 | 200 | 200 | 200 | 200 | 200 | 200 |
| TAO | 14 1498 | 200 | *** | 0 | 197 | 74 | 70 |
| TAO | 14 2494 | 200 | 200 | 200 | 200 | 200 | 200 |
| TL | 12 1145 | 18 | 19 | 24 | 15 | 12 | 17 |
| TL | 12 1455 | 57 | 40 | 39 | 39 | 48 | 200 |
| TL | 12 2276 | *** | 0 | 200 | 200 | 200 | 200 |
| TP | 12 335 | 151 | 187 | 200 | 200 | 192 | 184 |
| TUG | 12 524 | 187 | 200 | 200 | 200 | 200 | 200 |
| TUG | 14 1654 | 200 | 200 | 200 | 200 | 200 | 200 |
| TUG | 18 108 | *** | 0 | 10 | 12 | 12 | 10 |
| USNO | 12 573 | 19 | 56 | 200 | 200 | 200 | 200 |
| USNO | 12 752 | 0 | 3 | 3 | 5 | 13 | 0 |
| USNO | 12 778 | 200 | 200 | 200 | 200 | 200 | *** |
| USNO | 14 116 | *** | 0 | 200 | 200 | *** | 0 |
| USNO | 14 444 | *** | 0 | 48 | 88 | 134 | 0 |
| USNO | 14 571 | *** | *** | *** | 0 | *** | *** |
| USNO | 14 583 | *** | *** | *** | *** | *** | 0 |
| USNO | 14 653 | 191 | 185 | 106 | 137 | *** | *** |
| USNO | 14 656 | *** | 0 | 0 | 0 | 1 | 1 |
| USNO | 14 834 | 79 | 35 | 28 | 37 | 63 | 200 |
| USNO | 14 837 | 165 | 162 | 161 | 125 | 100 | 99 |
| USNO | 14 854 | *** | *** | *** | 0 | *** | *** |
| USNO | 14 862 | 200 | 79 | 16 | 10 | 9 | 12 |
| USNO | 14 871 | 182 | 190 | 200 | 164 | *** | *** |
| USNO | 14 875 | 200 | 200 | 200 | 200 | 200 | 200 |
| USNO | 14 1028 | *** | 0 | 17 | 25 | *** | *** |
| USNO | 14 1035 | 171 | 119 | 83 | 97 | 154 | 200 |
| USNO | 14 1094 | *** | *** | *** | 0 | 200 | 194 |
| USNO | 14 1104 | *** | *** | *** | *** | *** | 0 |
| USNO | 14 1114 | *** | *** | *** | *** | 0 | *** |
| USNO | 14 1117 | 200 | 200 | 185 | 194 | 198 | 200 |
| USNO | 14 1300 | 172 | 199 | 189 | 199 | 148 | 143 |
| USNO | 14 1301 | 199 | 200 | *** | 0 | *** | *** |
| USNO | 14 1305 | *** | 0 | *** | *** | *** | *** |
| USNO | 14 1362 | *** | 0 | 200 | 200 | 200 | 0 |
| USNO | 14 1423 | 200 | 200 | 200 | 200 | *** | *** |

TABLE 20 - (CONT.)

| LAB. | CLOCK | 46849 | 46909 | 46969 | 47029 | 47099 | 47159 |
|---|---|---|---|---|---|---|---|
| USNO | 14 1452 | 200 | *** | *** | *** | *** | *** |
| USNO | 14 1586 | 200 | 200 | *** | 0 | 27 | *** |
| USNO | 14 1605 | 170 | 158 | 112 | 112 | 170 | 200 |
| USNO | 14 1809 | 148 | 200 | 200 | 200 | 200 | *** |
| USNO | 14 1846 | 200 | 200 | 200 | 200 | 200 | 200 |
| USNO | 14 2081 | *** | 0 | *** | *** | *** | *** |
| USNO | 14 2098 | 144 | 200 | *** | 0 | *** | 0 |
| USNO | 14 2100 | 121 | 200 | 200 | 200 | 200 | 200 |
| USNO | 14 2277 | *** | *** | 0 | 175 | *** | *** |
| USNO | 14 2312 | 3 | 4 | 17 | 17 | *** | 0 |
| USNO | 14 2314 | *** | *** | *** | 0 | 200 | 108 |
| USNO | 14 2481 | 200 | 200 | 200 | 200 | 200 | 200 |
| USNO | 14 2482 | 200 | 200 | 200 | 200 | 200 | 200 |
| USNO | 14 2483 | 200 | 200 | 200 | 200 | 200 | 189 |
| USNO | 14 2484 | 200 | 200 | 200 | 200 | 200 | 200 |
| USNO | 14 2485 | 77 | 93 | 82 | 100 | 150 | 200 |
| USNO | 14 2486 | 79 | 159 | 174 | *** | 0 | 200 |
| USNO | 14 2487 | 174 | 117 | 102 | 101 | 84 | *** |
| USNO | 18 133 | 0 | *** | *** | *** | *** | *** |
| USNO | 40 18 | 0 | *** | *** | *** | *** | *** |
| USNO | 40 19 | 0 | *** | *** | *** | *** | *** |
| USNO | 43 8 | 0 | *** | 0 | 0 | 0 | *** |
| VSL | 12 349 | 0 | 200 | *** | *** | 0 | *** |
| VSL | 12 1489 | 171 | 97 | 60 | 0 | 7 | 0 |
| VSL | 14 503 | 146 | 150 | 161 | 160 | 160 | 149 |
| VSL | 14 1034 | 200 | 200 | 200 | 200 | 200 | 200 |
| YUZM | 12 1189 | 9 | 8 | 10 | 8 | *** | 0 |
| ZIPE | 12 979 | 200 | 168 | 72 | 72 | 44 | 34 |

The clocks are designated by their type (2 digits) and serial number in the type.

The codes for the types are

11 HEWLETT-PACKARD 5060A
12 HEWLETT-PACKARD 5061A
13 EBAUCHES , OSCILLATOM B5000
14 HEWLETT-PACKARD 5061A OPT.4
16 OSCILLOQUARTZ 3200
17 OSCILLOQUARTZ 3000
18 FREQ. AND TIME SYSTEMS INC. 4000
19 ROHDE AND SCHWARZ XSC
20 FREQ. AND TIME SYSTEMS INC. 5000
21 OSCILLOQUARTZ 3210
25 HEWLETT-PACKARD 5062C
30 HEWLETT-PACKARD 5061B
31 HEWLETT-PACKARD 5061B OPT. 4
4x HYDROGEN MASERS
9x PRIMARY CLOCKS AND PROTOTYPES

TABLE 21 - MEASUREMENTS OF THE EAL AND TAI FREQUENCY

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

f(EAL) - f(STANDARD) IN 10**-13

| INTERVAL MJD | CENTRAL DATE | NRC CsV | NRC CsVIA | NRC CsVIB | NRC CsVIC | PTB CS1 | PTB CS2 |
|---|---|---|---|---|---|---|---|
| 45309-45389 | 1983 JAN 15 | 7.86 | 6.36 | 6.26 | 6.10 | 8.62 | |
| 45389-45469 | 1983 APR 5 | 8.32 | 7.37 | 8.55 | 8.11 | 8.52 | |
| 45469-45549 | 1983 JUN 24 | 7.15 | 6.35 | 8.62 | 6.96 | 8.06 | |
| 45549-45629 | 1983 SEP 12 | 7.44 | 6.94 | 7.17 | 6.62 | 7.98 | |
| 45629-45699 | 1983 NOV 25 | 7.54 | 6.97 | 7.05 | 6.95 | 8.10 | |
| 45699-45759 | 1984 JAN 30 | 8.58 | 8.50 | 8.36 | 8.23 | 8.59 | |
| 45759-45819 | 1984 MAR 30 | 8.49 | 8.43 | 8.21 | 8.26 | 8.65 | |
| 45819-45879 | 1984 MAY 29 | - | 5.78 | 7.41 | 7.38 | 8.43 | |
| 45879-45939 | 1984 JUL 28 | 7.18 | 7.30 | 6.84 | 6.57 | 7.91 | |
| 45939-45999 | 1984 SEP 26 | 7.04 | 7.45 | 8.08 | 6.38 | 8.19 | |
| 45999-46059 | 1984 NOV 25 | 6.40 | 7.07 | 8.20 | 6.95 | 8.43 | |
| 46059-46119 | 1985 JAN 24 | 7.19 | 8.81 | 8.45 | 7.72 | 8.66 | |
| 46119-46179 | 1985 MAR 25 | 7.51 | 7.52 | 8.05 | 7.82 | 8.19 | |
| 46179-46239 | 1985 MAY 24 | 8.27 | 8.03 | 6.52 | 8.17 | 8.36 | |
| 46239-46299 | 1985 JUL 23 | 8.47 | 8.04 | 7.03 | 7.08 | 8.17 | |
| 46299-46369 | 1985 SEP 26 | 8.58 | 6.86 | 7.55 | 7.03 | 7.93 | |
| 46369-46429 | 1985 NOV 30 | 8.47 | 9.22 | 9.90 | 6.74 | 8.57 | |
| 46429-46489 | 1986 JAN 29 | 8.70 | 8.93 | 9.69 | 8.21 | 8.58 | |
| 46489-46549 | 1986 MAR 30 | 8.62 | 8.68 | 9.62 | 8.16 | 8.36 | |
| 46549-46609 | 1986 MAY 29 | 8.81 | 8.39 | 8.78 | 8.63 | 8.05 | |
| 46609-46669 | 1986 JUL 28 | 8.11 | 9.25 | 9.02 | 8.80 | 7.85 | |
| 46669-46729 | 1986 SEP 26 | 8.05 | 9.77 | 9.35 | 9.17 | 8.02 | 7.61 |
| 46729-46789 | 1986 NOV 25 | 8.56 | 8.53 | 8.99 | 8.79 | 8.06 | 7.85 |
| 46789-46849 | 1987 JAN 24 | 7.99 | 8.01 | 9.18 | 8.90 | 8.18 | 7.98 |
| 46849-46909 | 1987 MAR 25 | 8.33 | 8.13 | 8.41 | 8.65 | 8.36 | 7.91 |
| 46909-46969 | 1987 MAY 24 | 7.03 | 7.46 | 8.70 | 8.26 | 7.99 | 7.69 |
| 46969-47029 | 1987 JUL 23 | 6.40 | 7.01 | 8.38 | 7.00 | 8.20 | 7.64 |
| 47029-47099 | 1987 SEP 26 | 6.50 | 7.79 | 7.55 | 6.43 | 7.82 | 7.68 |
| 47099-47159 | 1987 NOV 30 | 7.11 | 8.78 | 10.48 | 6.87 | 8.04 | 7.79 |

TABLE 21 - (CONT.)

f(EAL) - f(STANDARD) IN 10**-13

| INTERVAL MJD | CENTRAL DATE | NBS NBS6 | RRL CS1 | SU MCsR 101 | SU MCsR 102 |
|---|---|---|---|---|---|
| 45428-45449 | 1983 APR 15 | | | | 8.16 |
| 45457-45474 | 1983 MAY 12 | | | | 7.13 |
| 45489-45569 | 1983 JUL 14 | 7.34 | | | |
| 45579-45585 | 1983 SEP 5 | | | | 7.59 |
| 45702-45722 | 1984 JAN 13 | | | 6.02 | |
| 45789-45849 | 1984 APR 29 | | 6.45 | | |
| 45794-45836 | 1984 APR 25 | | | 6.74 | |
| 45889-45949 | 1984 AUG 17 | 7.24 | | | |
| 45949-45967 | 1984 SEP 15 | | | | 6.22 |
| 45959-46019 | 1984 OCT 16 | 7.70 | | | |
| 45983-46004 | 1984 OCT 21 | | | | 5.93 |
| 45999-46059 | 1984 NOV 25 | | 7.53 | | |
| 46005-46034 | 1984 NOV 16 | | | | 6.12 |
| 46054-46059 | 1984 DEC 23 | | | | 6.37 |
| 46079-46139 | 1985 FEB 13 | | 7.54 | | |
| 46080-46096 | 1985 JAN 23 | | | | 6.14 |
| 46100-46110 | 1985 FEB 9 | | | | 5.78 |
| 46156-46159 | 1985 APR 3 | | | | 6.23 |
| 46201-46216 | 1985 MAY 24 | | | 5.87 | |
| 46230-46244 | 1985 JUN 21 | | | 7.04 | |
| 46247-46277 | 1985 JUL 16 | | | 6.39 | |
| 46279-46300 | 1985 AUG 13 | | | 5.75 | |
| 46312-46335 | 1985 SEP 16 | | | 6.84 | |
| 46339-46367 | 1985 OCT 15 | | | 5.90 | |
| 46370-46381 | 1985 NOV 7 | | | 5.83 | |
| 46502-46516 | 1986 MAR 20 | | | | 5.87 |
| 46509-46569 | 1986 APR 19 | | 7.22 | | |
| 46521-46543 | 1986 APR 12 | | | | 5.61 |
| 46563-46580 | 1986 MAY 22 | | | | 5.76 |
| 46585-46600 | 1986 JUN 11 | | | | 5.28 |
| 46684-46732 | 1986 OCT 5 | | | 5.99 | |
| 46737-46762 | 1986 NOV 16 | | | 5.58 | |
| 46773-46794 | 1986 DEC 19 | | | | 5.35 |
| 46801-46816 | 1987 JAN 14 | | | | 5.06 |
| 46886-46914 | 1987 APR 14 | | | 5.37 | |
| 46919-46941 | 1987 MAY 15 | | | 5.67 | |
| 46947-46976 | 1987 JUN 15 | | | 6.11 | |
| 46959-47019 | 1987 JUL 13 | 9.65 | | | |
| 46977-46998 | 1987 JUL 11 | | | 6.09 | |
| 47061-47063 | 1987 SEP 24 | | | 5.59 | |
| 47083-47097 | 1987 OCT 21 | | | | 5.76 |
| 47098-47124 | 1987 NOV 13 | | | | 5.76 |
| 47130-47150 | 1987 DEC 11 | | | | 5.36 |

TABLE 21 - (CONT.)

f(TAI) - f(STANDARD) IN 10**-13

| INTERVAL MJD | CENTRAL DATE | NRC CsV | NRC CsVIA | NRC CsVIB | NRC CsVIC | PTB CS1 | PTB CS2 |
|---|---|---|---|---|---|---|---|
| 45309-45389 | 1983 JAN 15 | 0.06 | -1.44 | -1.54 | -1.70 | 0.82 | |
| 45389-45469 | 1983 APR 5 | 0.52 | -0.43 | 0.75 | 0.31 | 0.72 | |
| 45469-45549 | 1983 JUN 24 | -0.65 | -1.45 | 0.82 | -0.84 | 0.26 | |
| 45549-45629 | 1983 SEP 12 | -0.36 | -0.86 | -0.63 | -1.18 | 0.18 | |
| 45629-45699 | 1983 NOV 25 | -0.26 | -0.83 | -0.75 | -0.85 | 0.30 | |
| 45699-45759 | 1984 JAN 30 | 0.78 | 0.70 | 0.56 | 0.43 | 0.79 | |
| 45759-45819 | 1984 MAR 30 | 0.49 | 0.43 | 0.21 | 0.26 | 0.65 | |
| 45819-45879 | 1984 MAY 29 | - | -2.22 | -0.59 | -0.62 | 0.43 | |
| 45879-45939 | 1984 JUL 28 | -0.82 | -0.70 | -1.16 | -1.43 | -0.09 | |
| 45939-45999 | 1984 SEP 26 | -0.96 | -0.55 | 0.08 | -1.62 | 0.19 | |
| 45999-46059 | 1984 NOV 25 | -1.60 | -0.93 | 0.20 | -1.05 | 0.43 | |
| 46059-46119 | 1985 JAN 24 | -0.81 | 0.81 | 0.45 | -0.28 | 0.66 | |
| 46119-46179 | 1985 MAR 25 | -0.49 | -0.48 | 0.05 | -0.18 | 0.19 | |
| 46179-46239 | 1985 MAY 24 | 0.27 | 0.03 | -1.48 | 0.18 | 0.36 | |
| 46239-46299 | 1985 JUL 23 | 0.47 | 0.04 | -0.97 | -0.92 | 0.17 | |
| 46299-46369 | 1985 SEP 26 | 0.58 | -1.14 | -0.45 | -0.97 | -0.07 | |
| 46369-46429 | 1985 NOV 30 | 0.47 | 1.22 | 1.90 | -1.26 | 0.57 | |
| 46429-46489 | 1986 JAN 29 | 0.70 | 0.93 | 1.69 | 0.21 | 0.58 | |
| 46489-46549 | 1986 MAR 30 | 0.62 | 0.68 | 1.62 | 0.16 | 0.36 | |
| 46549-46609 | 1986 MAY 29 | 0.81 | 0.39 | 0.78 | 0.63 | 0.05 | |
| 46609-46669 | 1986 JUL 28 | 0.11 | 1.25 | 1.02 | 0.80 | -0.15 | |
| 46669-46729 | 1986 SEP 26 | 0.05 | 1.77 | 1.35 | 1.17 | 0.02 | -0.39 |
| 46729-46789 | 1986 NOV 25 | 0.56 | 0.53 | 0.99 | 0.79 | 0.06 | -0.15 |
| 46789-46849 | 1987 JAN 24 | -0.02 | 0.00 | 1.17 | 0.89 | 0.17 | -0.04 |
| 46849-46909 | 1987 MAR 25 | 0.32 | 0.12 | 0.40 | 0.64 | 0.35 | -0.10 |
| 46909-46969 | 1987 MAY 24 | -0.99 | -0.55 | 0.69 | 0.25 | -0.03 | -0.32 |
| 46969-47029 | 1987 JUL 23 | -1.61 | -1.01 | 0.37 | -1.01 | 0.19 | -0.37 |
| 47029-47099 | 1987 SEP 26 | -1.51 | -0.22 | -0.46 | -1.58 | -0.19 | -0.34 |
| 47099-47159 | 1987 NOV 30 | -0.91 | 0.77 | 2.46 | -1.14 | 0.02 | -0.23 |

TABLE 21 - (CONT.)

f(TAI) - f(STANDARD) IN 10**-13

| INTERVAL MJD | CENTRAL DATE | NBS NBS6 | RRL CS1 | SU MCsR 101 | SU MCsR 102 |
|---|---|---|---|---|---|
| 45428-45449 | 1983 APR 15 | | | | 0.36 |
| 45457-45474 | 1983 MAY 12 | | | | -0.67 |
| 45489-45569 | 1983 JUL 14 | -0.46 | | | |
| 45579-45585 | 1983 SEP 5 | | | | -0.21 |
| 45702-45722 | 1984 JAN 13 | | | -1.78 | |
| 45789-45849 | 1984 APR 29 | | -1.55 | | |
| 45794-45836 | 1984 APR 25 | | | -1.26 | |
| 45889-45949 | 1984 AUG 17 | -0.76 | | | |
| 45949-45967 | 1984 SEP 15 | | | | -1.78 |
| 45959-46019 | 1984 OCT 16 | -0.30 | | | |
| 45983-46004 | 1984 OCT 21 | | | | -2.07 |
| 45999-46059 | 1984 NOV 25 | | -0.47 | | |
| 46005-46034 | 1984 NOV 16 | | | | -1.88 |
| 46054-46059 | 1984 DEC 23 | | | | -1.63 |
| 46079-46139 | 1985 FEB 13 | | -0.46 | | |
| 46080-46096 | 1985 JAN 23 | | | | -1.86 |
| 46100-46110 | 1985 FEB 9 | | | | -2.22 |
| 46156-46159 | 1985 APR 3 | | | | -1.77 |
| 46201-46216 | 1985 MAY 24 | | | -2.13 | |
| 46230-46244 | 1985 JUN 21 | | | -0.96 | |
| 46247-46277 | 1985 JUL 16 | | | -1.61 | |
| 46279-46300 | 1985 AUG 13 | | | -2.25 | |
| 46312-46335 | 1985 SEP 16 | | | -1.16 | |
| 46339-46367 | 1985 OCT 15 | | | -2.10 | |
| 46370-46381 | 1985 NOV 7 | | | -2.17 | |
| 46502-46516 | 1986 MAR 20 | | | | -2.13 |
| 46509-46569 | 1986 APR 19 | | -0.78 | | |
| 46521-46543 | 1986 APR 12 | | | | -2.39 |
| 46563-46580 | 1986 MAY 22 | | | | -2.24 |
| 46585-46600 | 1986 JUN 11 | | | | -2.72 |
| 46684-46732 | 1986 OCT 5 | | | -2.01 | |
| 46737-46762 | 1986 NOV 16 | | | -2.42 | |
| 46773-46794 | 1986 DEC 19 | | | | -2.65 |
| 46801-46816 | 1987 JAN 14 | | | | -2.94 |
| 46886-46914 | 1987 APR 14 | | | -2.64 | |
| 46919-46941 | 1987 MAY 15 | | | -2.34 | |
| 46947-46976 | 1987 JUN 15 | | | -1.09 | |
| 46959-47019 | 1987 JUL 13 | 1.64 | | | |
| 46977-46998 | 1987 JUL 11 | | | -1.92 | |
| 47061-47063 | 1987 SEP 24 | | | -2.42 | |
| 47083-47097 | 1987 OCT 21 | | | | -2.26 |
| 47098-47124 | 1987 NOV 13 | | | | -2.26 |
| 47130-47150 | 1987 DEC 11 | | | | -2.66 |

TABLE 22 - MEAN DURATION OF THE TAI SCALE INTERVAL IN SI SECOND AT SEA LEVEL.

| FOR THE MONTHS | MEAN DURATION | UNCERTAINTY (one sigma) |
|---|---|---|
| 1981 JAN - FEB | 1 - 0.3*10**-13 | 0.5*10**-13 |
| 1981 MAR - APR | - 0.4 | 0.5 |
| 1981 MAY - JUN | + 0.0 | 0.5 |
| 1981 JUL - AUG | + 0.6 | 0.5 |
| 1981 SEP - OCT | + 0.8 | 0.5 |
| 1981 NOV - DEC | + 0.5 | 0.5 |
| 1982 JAN - FEB | 1 + 0.1*10**-13 | 0.5*10**-13 |
| 1982 MAR - APR | + 0.0 | 0.5 |
| 1982 MAY - JUN | + 0.2 | 0.5 |
| 1982 JUL - AUG | + 0.5 | 0.5 |
| 1982 SEP - OCT | + 0.5 | 0.5 |
| 1982 NOV - DEC | + 0.3 | 0.5 |
| 1983 JAN - FEB | 1 - 0.1*10**-13 | 0.5*10**-13 |
| 1983 MAR - APR | - 0.2 | 0.5 |
| 1983 MAY - JUN | - 0.1 | 0.5 |
| 1983 JUL - AUG | + 0.1 | 0.5 |
| 1983 SEP - OCT | + 0.1 | 0.5 |
| 1983 NOV - DEC | + 0.0 | 0.5 |
| 1984 JAN - FEB | 1 - 0.2*10**-13 | 0.5*10**-13 |
| 1984 MAR - APR | - 0.0 | 0.5 |
| 1984 MAY - JUN | + 0.2 | 0.5 |
| 1984 JUL - AUG | + 0.3 | 0.5 |
| 1984 SEP - OCT | + 0.4 | 0.5 |
| 1984 NOV - DEC | + 0.3 | 0.5 |
| 1985 JAN - FEB | 1 + 0.2*10**-13 | 0.5*10**-13 |
| 1985 MAR - APR | + 0.2 | 0.5 |
| 1985 MAY - JUN | + 0.2 | 0.5 |
| 1985 JUL - AUG | + 0.1 | 0.5 |
| 1985 SEP - OCT | + 0.1 | 0.5 |
| 1985 NOV - DEC | - 0.1 | 0.5 |
| 1986 JAN - FEB | 1 - 0.3*10**-13 | 0.5*10**-13 |
| 1986 MAR - APR | - 0.2 | 0.5 |
| 1986 MAY - JUN | - 0.2 | 0.5 |
| 1986 JUL - AUG | - 0.1 | 0.5 |
| 1986 SEP - OCT | - 0.1 | 0.5 |
| 1986 NOV - DEC | - 0.0 | 0.5 |
| 1987 JAN - FEB | 1 - 0.0*10**-13 | 0.5*10**-13 |
| 1987 MAR - APR | + 0.0 | 0.5 |
| 1987 MAY - JUN | + 0.2 | 0.5 |
| 1987 JUL - AUG | + 0.3 | 0.5 |
| 1987 SEP - OCT | + 0.3 | 0.5 |
| 1987 NOV - DEC | + 0.2 | 0.5 |

ADDENDUM TO TABLE 17 - COORDINATED UNIVERSAL TIME

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

Unit is one microsecond

| DATE 1987 | MJD | UTC - UTC(i) IGMA (1) | INTI (2) | ONBA (3) | NPRL (1) |
|---|---|---|---|---|---|
| JAN 4 | 46799 | -12.979 | 22 | -64.37 | -23.11 |
| JAN 14 | 46809 | -13.009 | 22 | -65.53 | -23.52 |
| JAN 24 | 46819 | -12.829 | 21 | -66.23 | -23.93 |
| FEB 3 | 46829 | -12.659 | 22 | -66.98 | -23.53 |
| FEB 13 | 46839 | -12.606 | 22 | -67.79 | -23.51 |
| FEB 23 | 46849 | -12.518 | 20 | -68.64 | -23.86 |
| MAR 5 | 46859 | -12.433 | 21 | -68.86 | -24.07 |
| MAR 15 | 46869 | -12.258 | - | -69.84 | -24.39 |
| MAR 25 | 46879 | -12.096 | 21 | -70.38 | -24.87 |
| APR 4 | 46889 | -11.935 | 20 | -71.08 | -25.23 |
| APR 14 | 46899 | -11.825 | 19 | -71.59 | -25.43 |
| APR 24 | 46909 | -11.683 | 20 | -71.81 | -25.76 |
| MAY 4 | 46919 | -11.600 | 20 | -72.31 | -26.29 |
| MAY 14 | 46929 | -11.421 | 19 | -72.85 | -26.72 |
| MAY 24 | 46939 | -11.315 | 18 | -73.55 | -26.90 |
| JUN 3 | 46949 | -11.337 | 19 | -74.80 | -27.24 |
| JUN 13 | 46959 | -11.311 | 20 | -75.84 | -27.09 |
| JUN 23 | 46969 | -11.218 | 19.85 | -76.98 | -27.19 |
| JUL 3 | 46979 | -11.133 | 19.42 | 77.68 | -27.24 |
| JUL 13 | 46989 | -11.045 | 18.34 | -78.88 | -27.30 |
| JUL 23 | 46999 | -10.907 | 17.44 | -9.92 | -27.38 |
| AUG 2 | 47009 | -10.785 | 16.42 | -80.93 | -27.64 |
| AUG 12 | 47019 | -10.668 | 15.83 | -81.96 | -27.78 |
| AUG 22 | 47029 | -10.492 | 15.94 | -83.10 | -28.09 |
| SEP 1 | 47039 | -10.354 | 16.08 | -84.32 | -28.31 |
| SEP 11 | 47049 | -10.164 | 16.33 | -85.58 | -28.68 |
| SEP 21 | 47059 | -9.976 | 16.40 | -86.76 | -28.98 |
| OCT 1 | 47069 | -9.804 | 16.07 | -87.82 | -29.30 |
| OCT 11 | 47079 | -9.216 | 15.86 | -88.96 | -29.56 |
| OCT 21 | 47089 | -9.118 | 16.98 | -90.20 | -29.95 |
| OCT 31 | 47099 | -9.036 | 16.89 | -91.40 | -30.40 |
| NOV 10 | 47109 | -9.013 | 17.19 | -92.58 | -30.80 |
| NOV 20 | 47119 | -9.009 | 17.26 | -93.34 | -31.15 |
| NOV 30 | 47129 | -8.928 | 17.15 | -94.11 | -31.58 |
| DEC 10 | 47139 | -8.812 | 16.52 | -94.59 | -32.07 |
| DEC 20 | 47149 | -8.692 | 16.58 | - | -32.27 |
| DEC 30 | 47159 | -8.618 | 16.61 | - | -32.59 |

NOTES

(1) IGMA, NPRL . GPS tracking results, computed respectively by IGMA and NPRL.
(2) INTI . Since MJD=46969, the listed values use the GPS receptions at IGMA.
(3) ONBA . The step of 2000 μs between MJD=46789 and MJD=46799 is a delay correction of reception times at ONBA. The listed values, referred to clock ONBA1, use the GPS receptions at IGMA.

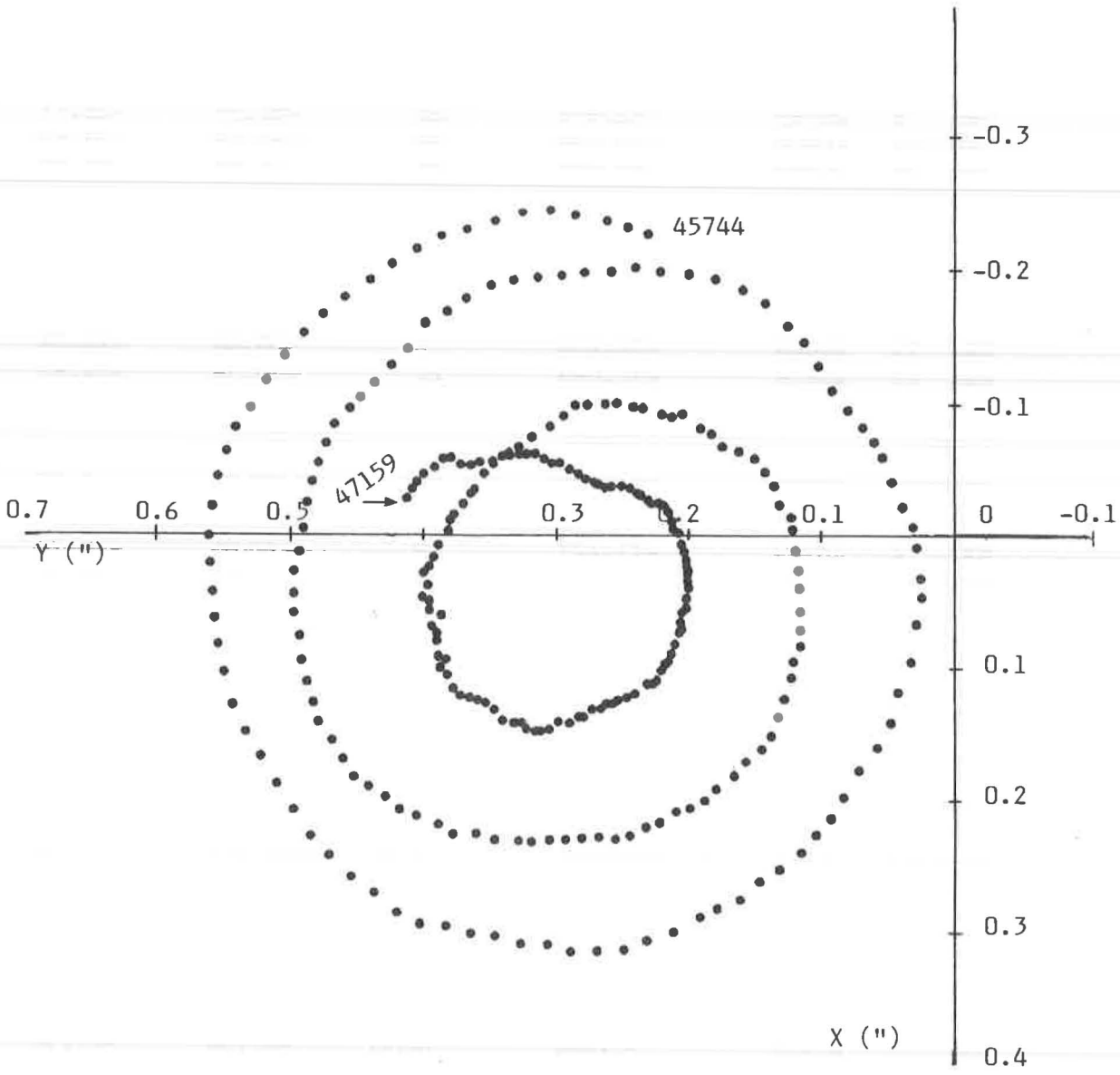


Figure 1 - Path of the pole from 1984 Feb.14 to 1987 Dec.30 (MJD 45744 - 47159). Raw values of Table 6.

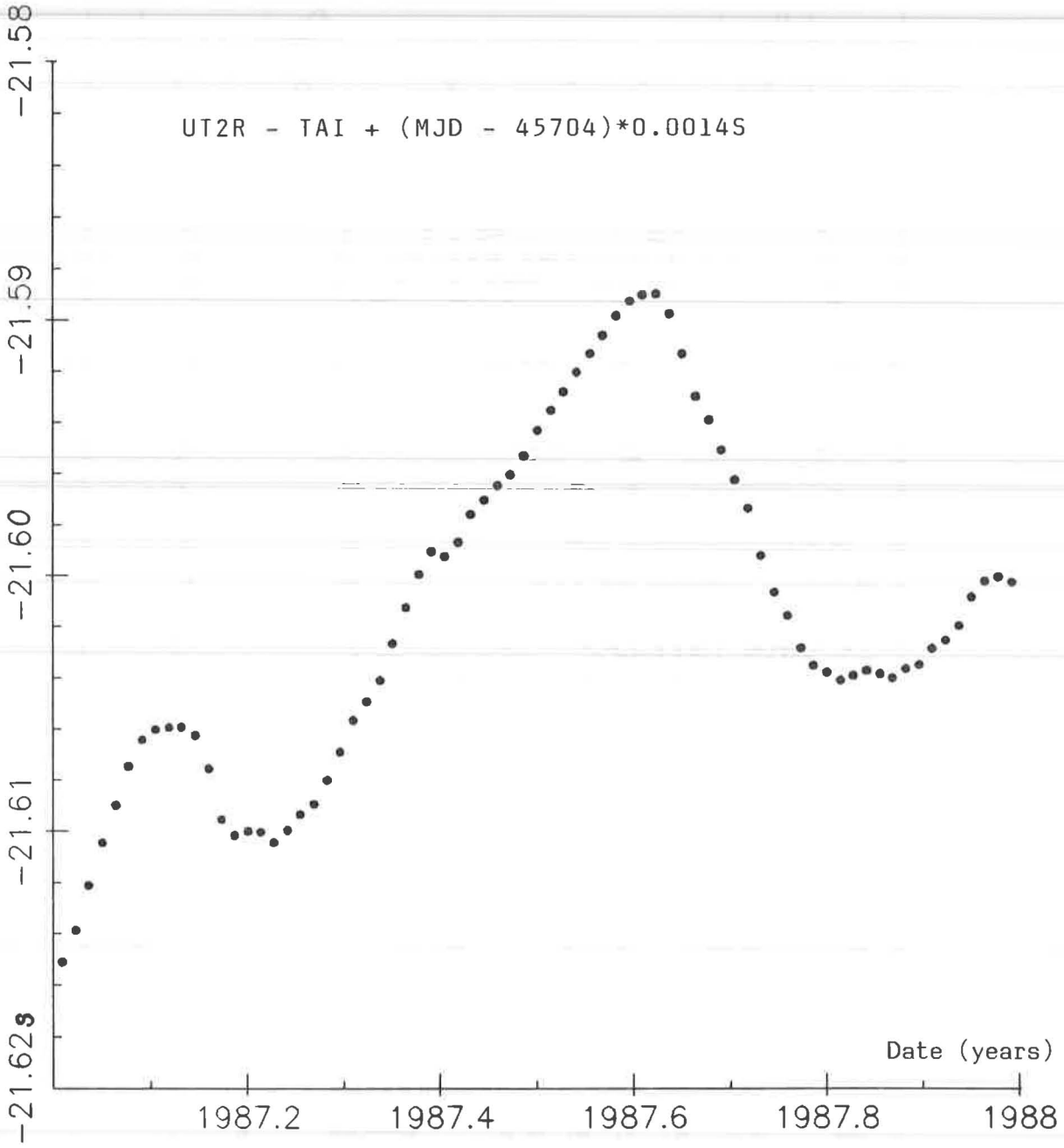


Figure 2 - Universal time from 1987 Jan.4 to Dec.30 (MJD 46799 - 47159). Raw values of Table 6.

The following conventional formula is used :

UT2-UT1 = 0.0220 $\sin 2\pi t$ - 0.0120 $\cos 2\pi t$ - 0.0060 $\sin 4\pi t$ + 0.0070 $\cos 4\pi t$, the unit being the second and t being the date in besselian years. UT2R is corrected for the effect of zonal tides for periods up to 35 days.

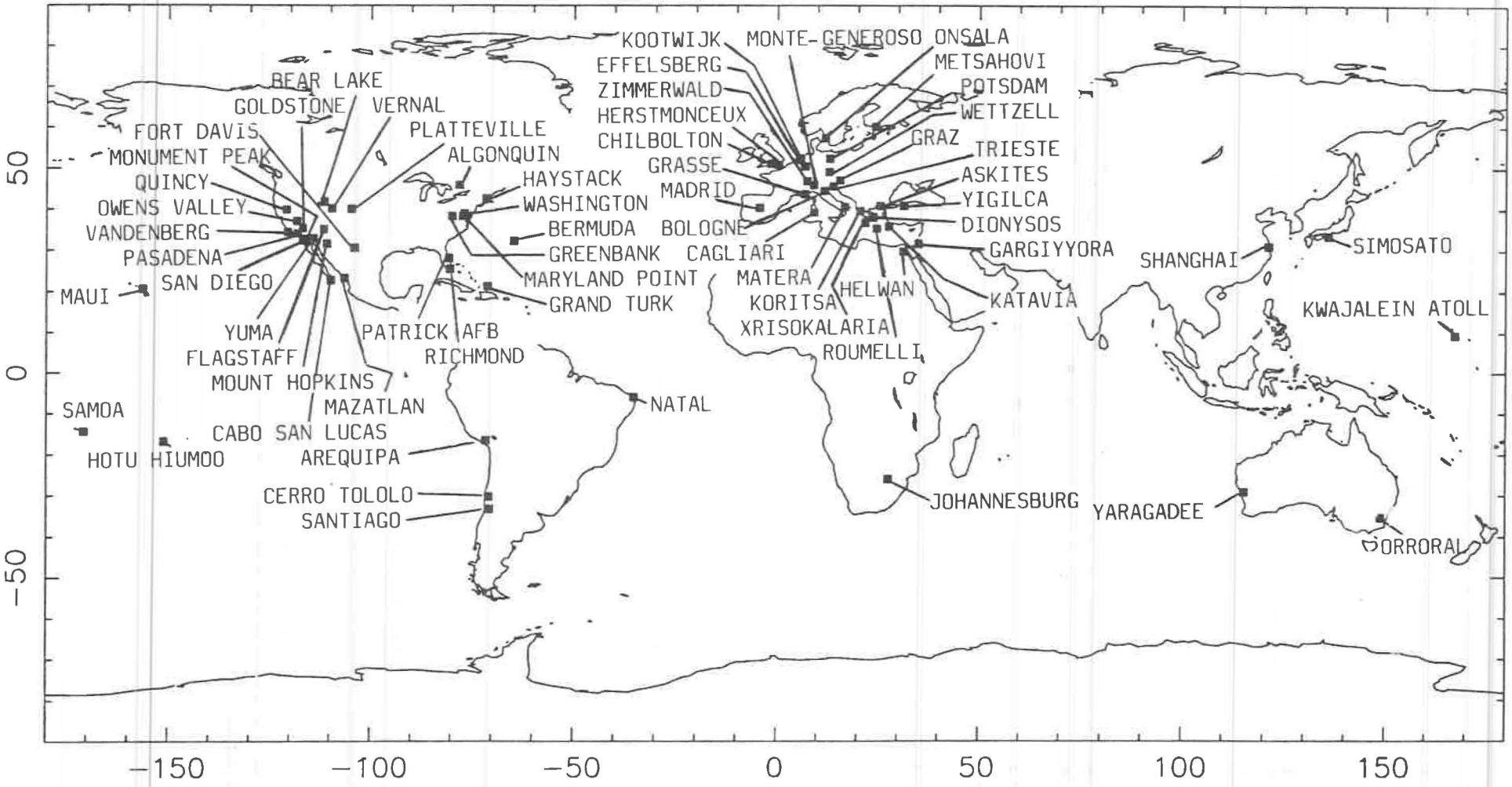


Figure 3 - Sites in the BIH Terrestrial System (1987).

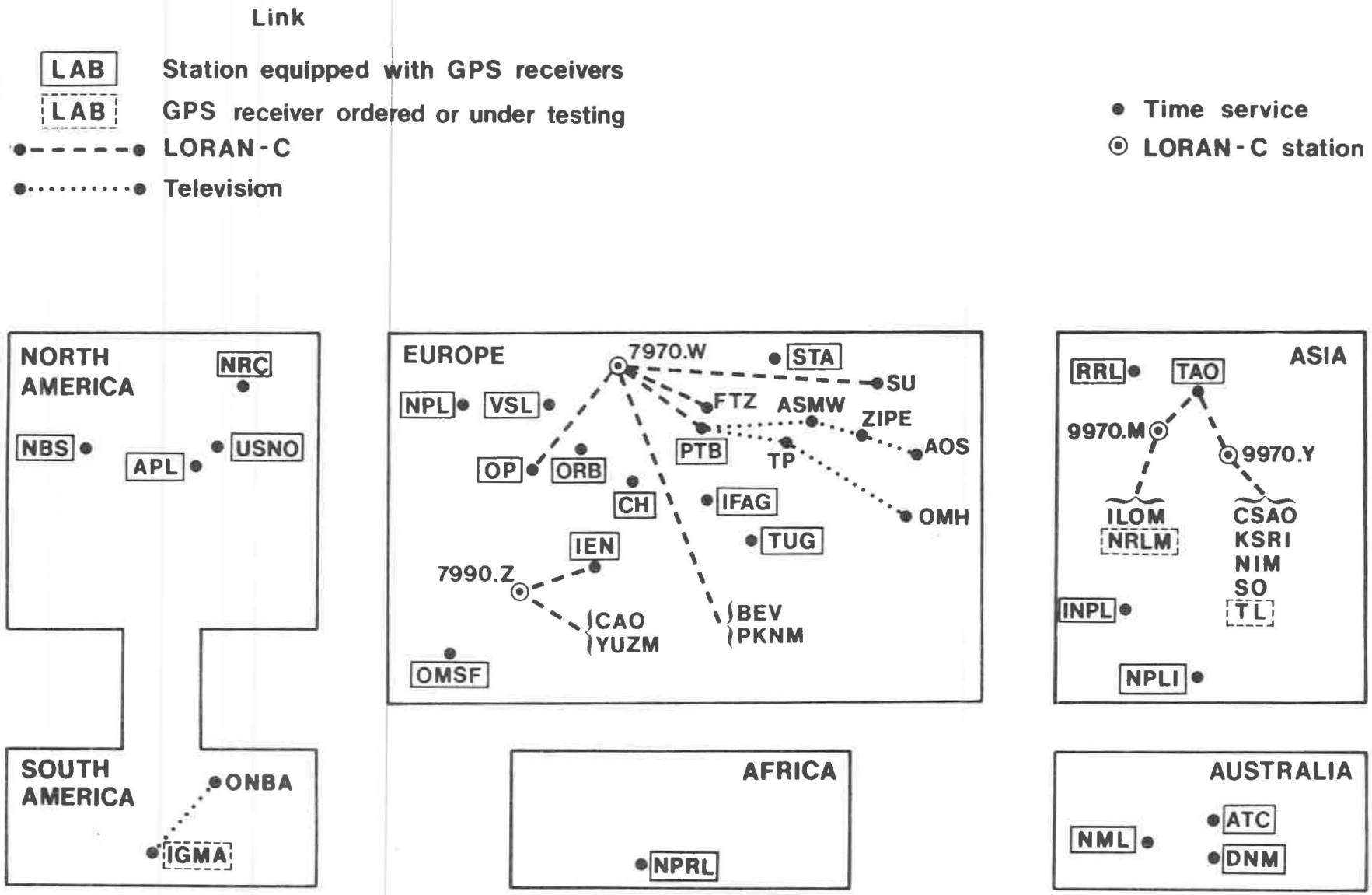


Fig. 4.- Time links used by BIH (31 December 1987)

The link GPS - 7970-W is established through OP or PTB depending on the laboratories.

# PART C

## TIME SIGNAL (1988)

The time signal emissions reported thereafter follow the UTC system, in accordance with the Recommendation 460-4 of the International Radio Consultative Committee (CCIR), unless otherwise stated.

Their maximum departure from the Universal Time UT1 is thus 0.9 second.

## AUTHORITIES RESPONSIBLE FOR THE TIME SIGNAL EMISSIONS

| Signal | Authority |
|---|---|
| **ATA** | National Physical Laboratory<br>Hillside Road<br>New Delhi - 110012, India |
| **BPM** | Shaanxi Astronomical Observatory<br>Academia Sinica<br>P.O. Box 18 - Lintong<br>Shaanxi, China |
| **BSF** | Telecommunication Laboratories<br>Directorate General of Telecommunications<br>Ministry of Communications<br>P.O. Box 71 - Chung-Li<br>32099 Taiwan, R.O.C. |
| **CHU** | National Research Council,<br>Time and Length Standards Section<br>Physics Division (M-36)<br>Ottawa K1A OR6, Ontario, Canada<br>Attn : Dr. J. Vanier |
| **DCF77** | Physikalisch-Technische Bundesanstalt, Lab. Zeiteinheit<br>Bundesallee 100<br>D-3300 Braunschweig<br>Federal Republic of Germany |
| **DGI, Y3S** | Amt für Standardisierung, Messwesen und Warenprüfung<br>Zeit - und Frequenzdienst der DDR<br>Fürstenwalder Damm 388<br>DDR 1162 Berlin |
| **EBC** | Real Instituto y Observatorio de la Armada<br>San Fernando<br>Cadiz, Spain |

| Signal | Authority |
|---|---|
| **HBG** | Service horaire HBG<br>Observatoire Cantonal<br>CH - 2000 Neuchâtel, Suisse |
| **HLA** | Time and Frequency Laboratory<br>Korea Standards Research Institute<br>P. O. Box 3, Taedok Science Town<br>Taejon, Ch'ungnam 300-31<br>Republic of Korea |
| **IAM** | Istituto Superiore delle Poste e delle Telecomunicazioni<br>Ufficio 8°, Rep.2° - Viale Europa 190<br>00144 - Roma, Italy |
| **IBF** | Istituto Elettrotecnico Nazionale Galileo Ferraris<br>Strada delle Cacce, 91<br>10135 - Torino, Italy |
| **JJY, JG2AS** | Standards and Measurements Division<br>Communications Research Laboratory<br>Ministry of Posts and Telecommunications<br>Koganei, Tokyo 184, Japan |
| **LOL** | Director<br>Observatorio Naval<br>Av. Espana 2099<br>1107 - Buenos-Aires, Republica Argentina |
| **MSF** | National Physical Laboratory<br>Electrical Science Division<br>Teddington, Middlesex TW11 OLW<br>United Kingdom |

| Signal | Authority |
|---|---|
| **OLB5, OMA** | 1/ Time information :<br>Astronomický ústav ČSAV, Budečksá 6<br>120 23 Praha 2, Vinohrady, Czechoslovakia.<br>TELEX : 122 486<br><br>2/ Standard frequency information :<br>Ústav radiotechniky a elektroniky ČSAV, Lumumbova 1,<br>182 51 Praha 8, Kobylisy, Czechoslovakia.<br>TELEX : 122 646 |
| **PPE, PPR** | Serviço da hora<br>Observatorio Nacional (CNPq)<br>Rua General Bruce, 586<br>20921 Rio de Janeiro - RJ, Brasil |
| **RBU, RCH, RID,**<br>**RTA, RTZ, RWM,**<br>**UNW3, UPD8, UQC3,**<br>**USB2, UTR3** | Comité d'Etat des Normes<br>Conseil des Ministres de l'URSS<br>Moscou 117049, URSS, Leninski prosp., 9 |
| **TDF** | Centre National d'Etudes des Télécommunications<br>PAB - STC - Etalons de fréquence et de temps<br>196 avenue Henri Ravera - 92220 Bagneux, France |
| **WWV,WWVH**<br>**WWVB** | Time and Frequency Division, 524.00<br>325 Broadway<br>National Bureau of Standards<br>Boulder, Colorado 80303, U.S.A. |
| **YVTO** | Direccion de Hidrografia y Navegacion<br>Observatori Cagigal<br>Apartado Postal No 6745<br>Caracas, Venezuela |
| **Y3S** | See DGI |
| **ZUO** | National Physical Research Laboratory<br>P.O. Box 395 - Pretoria 0001<br>South Africa |

TIME - SIGNALS EMITTED IN THE UTC SYSTEM

| Station | Location<br>Latitude<br>Longitude | Frequency (kHz) | Schedule (UTC) | Form of time signals |
|---|---|---|---|---|
| ATA | Greater Kailash<br>New Delhi<br>India<br>28° 34'N<br>77° 19'E | 5 000<br>10 000<br>15 000 | 12 h 30 m to 3 h 30 m<br>continuous<br>3 h 30 m to 12 h 30 m | Second pulses of 5 cycles of a 1 kHz modulation. Minute pulses of 100 ms duration. (the time signals are advanced by 50 ms on UTC). |
| BPM | Pucheng<br>China<br>35° 0'N<br>109° 31'E | 2 500<br>5 000<br>10 000<br>15 000 | 7 h 30 m to 1 h<br>continuous<br>continuous<br>1 h to 9 h | UTC time signals (the signals are emitted in advance on UTC by 20 ms). Second pulses of 10 ms of 1 kHz modulation. Minute pulses of 300 ms of 1 kHz modulation. From minutes 0 to 10, 15 to 25, 30 to 40, 45 to 55.<br><br>UT1 time signals are emitted from minutes 25 to 29, 55 to 59. |
| BSF | Chung-Li<br>Taiwan<br>ROC<br>24° 57'N<br>121° 9'E | 5 000<br>15 000 | continuous except interruption between minutes 35 and 40 | (a) From min. 5 to 10, 15 to 20, 25 to 30, 45 to 50, 55 to 60, second pulses of 5 ms duration without 1 kHz modulation.<br>(b) From min. 0 to 5, 10 to 15, ..., 50 to 55, second pulses of 5 ms duration with 1 kHz modulation. The 1 kHz modulation is interrupted 40 ms before and after the pulses.<br>(c) Minute pulses are extended to 300 ms.<br>(d) DUT1, CCIR code by lengthening. |
| CHU | Ottawa<br>Canada<br>45° 18'N<br>75° 45'W | 3 300<br>7 335<br>14 670 | continuous | Second pulses of 300 cycles of a 1 kHz modulation, with 29th and 51st to 59th pulses of each minute omitted. Minute pulses are 0.5 s long. Hour pulses are 1.0 s long, with the following 1st to 10th pulses omitted. A bilingual (Fr. Eng.) announcement of time (UTC-5 hours) is made each minute following the 50th second pulse. FSK time code after 10 cycles of 1 kHz on the 31st to 39th seconds. Broadcast is single sideband; upper sideband with carrier reinsert. DUT1 : CCIR code by split pulses. |
| DCF77 | Mainflingen<br>Germany, F.R.<br>50° 1'N<br>9° 0'E | 77.5 | continuous | At the beginning of each second (except the 59th second) the carrier amplitude is reduced to about 25 % for a duration of 0.1 s or 0.2 s. Coded transmission of year, month, day, hour, minute and day of the week in a BCD code from second marker No 21 to No 58 (the second marker durations of 0.1 s or 0.2 s correspond to a binary 0 or a binary 1 respectively). The coded time information is related to legal time of FRG and second markers 17 and 18 indicate if the transmitted time refers to UTC(PTB) + 2 h (summer time) or UTC(PTB) + 1 h. Second marker No 15 is prolonged to 0.2 s, if the reserve antenna is in use.<br><br>To achieve a more accurate time transfer and better use of the frequency spectrum available, an additional pseudo random phase - shift keying of the carrier is superimposed to the AM second markers.<br><br>No transmission of DUT1. |

Notes : see p. C-10

| Station | Location<br>Latitude<br>Longitude | Frequency (kHz) | Schedule (UTC) | Form of time signals |
|---|---|---|---|---|
| DGI | Oranienburg<br>Germ.Dem.Rep.<br>52° 48'N<br>13° 24'E | 182 | 5 h 59 m 30 s to<br>6 h 00, 11 h 59 m 30 s<br>to 12 h 00, 17 h 59 m<br>30 s to 18 h 00 | A2 type second pulses of 0.1 s duration for seconds 30-40, 45-50, 55-60.<br>The last pulse is prolonged.<br>(one hour earlier in summer time) |
| EBC | San Fernando<br>Spain<br>36° 28'N<br>6° 12'W | 12 008<br>6 840 | 10 h 00 m to 10 h 25 m<br>10 h 30 m to 10 h 55 m | Second pulses of 0.1 s duration of a 1 kHz modulation.<br>Minute pulses of 0.5 s duration of 1 250 Hz modulation.<br>DUT1, CCIR code, double pulse. Type A3H. |
| HBG | Prangins<br>Switzerland<br>46° 24'N<br>6° 15'E | 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.<br>No transmission of DUT1.<br>Time code and other coded information. |
| HLA | Taedok<br>Science Town<br>Republic of Korea<br>36° 23'N<br>127° 22'E | 5 000 | 1 h to 8 h<br>on Monday to Friday<br>(Except National Holidays in Korea) | Pulses of 9 cycles of 1800 Hz modulation. 59th and 29th second pulses omitted. Hour identified by 0.8 second long 1500 Hz tone. Beginning of each minute identified by 0.8 second long 1800 Hz tone. Voice announcement of hours and minutes each minute following 52nd second pulse. BCD time code given on 100 Hz subcarrier.<br>DUT1 : CCIR code by double pulse. |
| IAM | Rome<br>Italy<br>41° 47'N<br>12° 27'E | 5 000 | 7 h 30 m to 8 h 30 m<br>10 h 30 m to 11 h 30 m<br>Except Sunday and National Holidays | Second pulses of 5 cycles of 1 kHz modulation.<br>Minute pulses of 20 cycles. Voice announcements every 15 m beginning at 0 h 0 m. Time announcement by Morse code beginning at 0 h 5 m.<br>DUT1 : CCIR code by double pulse. |
| IBF | Torino<br>Italy<br>45° 2'N<br>7° 42'E | 5 000 | During 15 m preceding<br>7 h, 9 h, 10 h, 11 h,<br>12 h, 13 h, 14 h, 15h,<br>16 h, 17 h, 18 h.<br>Advanced by 1 hour in summer. | Second pulses of 5 cycles of 1 kHz modulation.<br>These pulses are repeated 7 times at the minute. Voice announcements at the beginning and end of each emission. Time announcement (C.E.T.) by Morse code every ten minutes beginning at 0 h 0 m.<br>DUT1 : CCIR code by double pulse. |
| JG2AS | Sanwa<br>Ibaraki<br>Japan<br>36° 11'N<br>139° 51'E | 40 | continuous, except interruptions during communications. | A1 type second pulses of 0.5 s duration.<br>Second 59 is of 0.1 s.<br>No DUT1 code. |
| JJY | Sanwa<br>Ibaraki<br>Japan<br>36° 11'N<br>139° 51'E | 2 500<br>5 000<br>8 000<br>10 000<br>15 000 | continuous, except interruption between minutes 35 and 39. | Second pulses of 8 cycles of 1 600 Hz modulation<br>Minute pulses are preceded by a 600 Hz modulation.<br>DUT1 : CCIR code by lengthening. |
| LOL1 (1) | Buenos-Aires<br>Argentina<br>34° 37'S<br>58° 21'W | 5 000<br>10 000<br>15 000 | 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 1 000 Hz modulation.<br>Second 59 is omitted. Announcement of hours and minutes every 5 minutes, followed by 3 m of 1 000 Hz or 440 Hz modulation.<br>DUT1 : CCIR code by lengthening. |
| LOL2<br>LOL3 (1) | Buenos-Aires<br>Argentina<br>34° 37'S<br>58° 21'W | 4 856<br>8 030<br>17 180 | 1 h, 13 h, 21 h | A1 second pulses during the 5 minutes preceding the indicated times. Second 29 is omitted. Minute pulses are prolonged.<br>DUT1 : CCIR code by double pulse. |

Notes : see p. c-10

| Station | Location<br>Latitude<br>Latitude | Frequency (kHz) | Schedule (UTC) | Form of time signals |
|---|---|---|---|---|
| MSF | Rugby<br>United Kingdom<br>52° 22'N<br>1° 11'W | 60 | continuous except for an interruption for maintenance 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. BCD NRZ code, 100 bits/s (month, day of month, hour, minute), during minute interruption. BCD PWM code, 1 bit/s (year, month, day of month, day of week, hour, minute) from seconds 17 to 59 in each minute.<br>DUT1 : CCIR code by double pulse. |
| OLB5 | Liblice<br>Czechoslovakia<br>50° 4'N<br>14° 53'E | 3 170 | continuous except from 9 h to 14 h on the first Wednesday of every month | A1 type, second pulses.<br><br>No transmission of DUT1. |
| OMA<br>(2) | Liblice<br>Czechoslovakia<br>50° 4'N<br>14° 53'E | 50 | continuous (from 6 h to 12 h on the first Wednesday in each month, emitted from Podebrady with reduced power) | 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.<br><br>Phase coded announcement of date, UT and local civil time. No DUT1 code. |
| OMA | Liblice<br>Czechoslovakia<br>50° 4'N<br>14° 53'E | 2 500 | continuous except from 9 h to 14 h on the first Wednesday of every month | Pulses of 100 cycles of 1 kHz modulation (prolonged for the minutes)<br>No DUT1 code. |
| PPE | Rio-de-Janeiro<br>Brasil<br>22° 54'S<br>43° 13'W | 8 721 | 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 times. The minute ticks are longer.<br>DUT1 : CCIR code by double pulse. |
| PPR | Rio-de-Janeiro<br>Brasil<br>22° 59'S<br>43° 11'W | 435<br>4 244<br>8 634<br>13 105<br>17 194.4<br>22 603 | 1 h 30 m, 14 h 30 m, 21 h 30 m | Second ticks, of A1 type, during the five minutes preceding the indicated times.<br>The minute ticks are longer. |
| RBU<br>(3) | Moscow<br>USSR<br>55° 48'N<br>38° 18'E | 66 2/3 | continuous | DXXXW type signals. The time of day in hours, minutes and seconds is transmitted in BCD code. |
| RCH<br>(3) | Tashkent<br>USSR<br>41° 19'N<br>69° 15'E | <br>2 500<br><br>5 000<br><br>10 000 | between minutes 0 and 10, 30 and 40<br>0 h to 3 h 40 m<br>5 h to 23 h 40 m<br>0 h to 3 h 40 m<br>14 h to 23 h 40 m<br>5 h to 13 h 10 m | A1X type second pulses. The pulses at the beginning of the minute are prolonged to 0.5 s. |
| RID<br>(3) | Irkutsk<br>USSR<br>52° 26'N<br>104° 2'E | 5 004<br>10 004<br>15 004 | The station simultaneously operates on three frequencies between minutes 20 and 30, 50 and 60 | A1X type second pulses. The pulses at the beginning of the minute are prolonged to 0.5 s. |

Notes : see p. c-10

| Station | Location<br>Latitude<br>Longitude | Frequency (kHz) | Schedule (UTC) | Form of time signals |
|---|---|---|---|---|
| RTA<br>(3) | Novosibirsk<br>USSR<br>55° 4'N<br>82° 58'E | 10 000<br>15 000 | between minutes 0 and 10, 30 and 40, 0 h to 5 h 10 m, 14 h to 23 h 40 m, 6 h 30 m to 13 h 10 m | A1X type second pulses. The pulses at the beginning of the minute are prolonged to 0.5 s. |
| RWM<br>(3) | Moscow<br>USSR<br>55° 48'N<br>38° 18'E | 4 996<br>9 996<br>14 996 | The station simultaneously operates on three frequencies between 10 and 20, 40 and 50 | A1X type second pulses. The pulses at the beginning of the minute are prolonged to 0.5 s. |
| RTZ<br>(3) | Irkutsk<br>USSR<br>52° 26'N<br>104° 2'E | 50 | between minutes 0 and 5<br><br>0 h to 20 h 05 m<br>22 h to 23 h 05 m<br>in winter<br><br>0 h to 19 h 05 m<br>21 h to 23 h 05 m<br>in summer | A1X type second pulses. The pulses at the beginning of the minute are prolonged to 0.5 s. |
| TDF | Allouis<br>France<br>47° 10'N<br>2° 12'E | 162 | continuous except every Tuesday from 1 h to 5 h | Phase modulation of the carrier by + and - 1 radian in 0.1 s every second except the 59th second of each minute. This modulation is doubled to indicate binary 1. The numbers of the minute, hour, day of the month, day of the week, month and year are transmitted each minute from the 21st to the 58th second, in accordance with the French legal time scale. In addition a binary 1 at the 17th second indicates that the local time is 2 hours ahead of UTC(summer time), a binary 1 at the 18th second indicates when the local time is one hour ahead of UTC(winter time) ; a binary 1 at the 14th second indicates that the current day is a public holiday (Christmas, 14 July, etc...); a binary 1 at the 13th second indicates that the current day is a day before a public holiday. |
| UNW3 | Molodechno<br>USSR<br>54° 26'N<br>26° 48'E | 25 | 7 h 43 m to 7 h 52 m<br>19 h 43 m to 19 h 52 m<br>in winter<br><br>7 h 43 m to 7 h 52 m<br>20 h 43 m to 20 h 52 m<br>in summer | A1N type 0.1 second pulses of 0.025 s duration.<br>Second pulses are prolonged to 0.1 s.<br>10 second pulses are prolonged to 1 s and minute pulses are prolonged to 10 s.<br>No transmission of DUT1 code. |
| UPD8 | Arkhangelsk<br>USSR<br>64° 24'N<br>41° 32'E | 25 | 8 h 43 m to 8 h 52 m<br>11 h 43 m to 11 h 52 m | A1N type 0.1 second pulses of 0.025 s duration.<br>Second pulses are prolonged to 0.1 s.<br>10 second pulses are prolonged to 1 s and minute pulses are prolonged to 10 s.<br>No transmission of DUT1 code. |
| UQC3 | Chabarovsk<br>USSR<br>48° 30'N<br>134° 51'E | 25 | 0 h 43 m to 0 h 52 m<br>6 h 43 m to 6 h 52 m<br>17 h 43 m to 17 h 52 m<br>in winter<br><br>2 h 43 m to 2 h 52 m<br>6 h 43 m to 6 h 52 m<br>18 h 43 m to 18 h 52 m<br>in summer | A1N type 0.1 second pulses of 0.025 s duration.<br>Second pulses are prolonged to 0.1 s.<br>10 second pulses are prolonged to 1 s and minute pulses are prolonged to 10 s.<br>No transmission of DUT1 code. |

Notes : see p. C-10

| Station | Location<br>Latitude<br>Longitude | Frequency (kHz) | Schedule (UTC) | Form of time signals |
|---|---|---|---|---|
| USB2 | Frunze<br>USSR<br>43° 04'N<br>73° 39'E | 25 | 4 h 43 m to 4 h 52 m<br>9 h 43 m to 9 h 52 m<br>21 h 43 m to 21 h 52 m<br>in winter<br><br>4 h 43 m to 4 h 52 m<br>10 h 43 m to 10 h 52 m<br>22 h 43 m to 22 h 52 m<br>in summer | A1N type 0.1 second pulses of 0.025 s duration.<br>Second pulses are prolonged to 0.1 s.<br>10 second pulses are prolonged to 1 s and minute pulses are prolonged to 10 s.<br>No transmission of DUT1 code. |
| UTR3 | Gorki<br>USSR<br>56° 11'N<br>43° 58'E | 25 | 5 h 43 m to 5 h 52 m<br>13 h 43 m to 13 h 52 m<br>18 h 43 m to 18 h 52 m<br>in winter<br><br>7 h 43 m to 7 h 52 m<br>14 h 43 m to 14 h 52 m<br>19 h 43 m to 19 h 52 m<br>in summer | A1N type 0.1 second pulses of 0.025 s duration.<br>Second pulses are prolonged to 0.1 s<br>10 second pulses are prolonged to 1 s and minute pulses are prolonged to 10 s.<br>No transmission of DUT1 code. |
| WWV | Fort-Collins, CO<br>USA<br>40° 41'N<br>105° 2'W | 2 500<br>5 000<br>10 000<br>15 000<br>20 000 | continuous | Pulses of 5 cycles of 1 kHz modulation. 59th and 29th second pulses omitted. Hour is identified by 0.8 second long 1 500 Hz tone. beginning of each minute identified by 0.8 second long 1 000 Hz tone. DUT1 : CCIR code by double pulse. BCD time code given on 100 Hz subcarrier, includes DUT1 correction. |
| WWVB | Fort-Collins, CO<br>USA<br>40° 40'N<br>105° 3'W | 60 | continuous | Second pulses given by reduction of the amplitude of the carrier. Coded announcement of the date, time, correction to obtain UT1, daylight savings time in effect and leap year. No CCIR code. |
| WWVH | Kauai, HI<br>USA<br>21° 59'N<br>159° 46'W | 2 500<br>5 000<br>10 000<br>15 000 | continuous | Pulses of 6 cycles of 1 200 Hz modulation. 59th and 29th second pulses omitted. Hour identified by 0.8 second long 1 500 Hz tone. Beginning of each minute identified by 0.8 second long 1 200 Hz tone.<br>DUT1 : CCIR code by double pulse.<br>BCD time code given on 100 Hz subcarrier, includes DUT1 correction. |
| YVTO (4) | Caracas<br>Venezuela<br>10° 30'N<br>66° 56'W | 6 100 | continuous | Second pulses of 1 kHz modulation with 0.1 s duration. The minute is identified by a 800 Hz tone and a 0.5 s duration. Second 30 is omitted. Between seconds 40 and 50 of each minute, voice announcement of the identification of the station. Between seconds 52 and 57 of each minute, voice announcement of hour, minute and second. |
| Y3S (5) | Nauen<br>Germ. Dem. Rep.<br>52° 39'N<br>12° 55'E | 4 525 | continuous except from 8 h 15 m to 9 h 45 m for maintenance if necessary | A1 type second pulses of 0.1 s duration.<br>Minute pulses prolonged to 0.5 s.<br>DUT1 : CCIR code by double pulse. |
| ZUO | Olifantsfontein<br>South Africa<br>25° 58'S<br>28° 14'E | 2 500<br>5 000 | 18 h to 4 h<br>continuous | Pulses of 5 cycles of 1 kHz modulation.<br>Second 0 is prolonged. |
| ZUO | Johannesburg<br>South Africa<br>26° 11'S<br>28° 4'E | 100 000 | continuous | Pulses of 5 cycles of 1 kHz modulation.<br>Second 0 is prolonged. |

Notes : see p. C-10

## NOTES ON THE CHARACTERISTICS OF THE SIGNALS

(1) No recent information on these time signals.

(2) OMA, 50 kHz

a. The main transmitter in Liblice radiates approx. 7 kW and the stand-by transmitter in Podebrady (50° 9'N, 15° 9'E) approx. 50 W.

b. The details of the time code were published in Nomenclature des stations de radiorepérage et des stations effectuant des services spéciaux - Liste VI, Volume I, édition 7 de U.I.T. in Geneva in July 1980.

(3) The radiostations of the USSR emit DUT1 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 21th an 24th second so that dUT1 = + 0.02 s x p. Negative values of dUT1 are transmitted by the marking of q second markers within the range between the 31th and the 34th second, so that dUT1 = -0.02 s x q.

(4) YVTO. The frequency may change to 5000 kHz during 1988.

(5) 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 doubling a number (p) of consecutive seconds markers from second marker 21 to second 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 doubling a number (q) of consecutive seconds markers following the minute marker from second marker 31 to second marker (30 + q) inclusive ; (q) being an integer from 1 to 5 inclusive.

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

The second 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.

## UNCERTAINTY OF THE CARRIER FREQUENCY

The carriers of the following time signals are standard frequencies.

| Station | Relative uncertainty of the carrier frequency in $10^{-10}$ |
|---|---|
| ATA | 0.1 |
| BPM | 0.1 |
| BSF | 0.2 |
| CHU | 0.05 |
| DCF77 | 0.005 |
| EBC | 0.1 |
| HBG | 0.005 |
| HLA | 0.1 |
| IAM | 0.5 |
| IBF | 0.1 |
| JJY, JG2AS | 0.1 |
| LOL1 | 0.1 |
| MSF | 0.02 |
| OMA (all frequencies) | 0.5 |
| RBU, RTZ | 0.05 |
| RCH, RID, RTA, RWM | 0.5 |
| TDF | 0.02 |
| UNW3, UPD8, UQC3, USB2, UTR3 | 0.05 |
| WWV | 0.1 |
| WWVB | 0.1 |
| WWVH | 0.1 |
| ZUO | 0.1 |

## TIME OF EMISSION OF THE TIME SIGNALS IN THE UTC SYSTEM, IN 1987

The following deviations of the time of emission of the time signals, from UTC, have been reported to the BIH, or observed.

| | |
|---|---|
| ATA | UTC-ATA = -0.0500 s |
| BPM | UTC-BPM = -0.0200 s |
| OLB5 | UTC-OLB5= 0.0008 s |