Time and Frequency Information in Telecommunications Systems
Standardized By Federal Standard 1002A

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During the last two decades there has been a dramatic shift of timekeeping from national observatories to national standards laboratories. This is a result of the shift in the basis for the definition of the second from astronomical observations to well-defined transitions in atoms.

The world operates on a single time system, Coordinated Universal Time (UTC). UTC is the average of the best clocks throughout the world. The time scales of the National Institute of Standards and Technology (NIST) and the U.S. Naval Observatory (USNO) are steered to the international UTC time scale maintained by the Bureau International des Poids et Mesures (BIPM) in Paris, France. NIST and USNO also maintain atomic clocks which contribute to the UTC average. The values of UTC promulgated by NIST and USNO are used by the United States Federal government to obtain standard values of time.

The Federal Standard entitled, Time and Frequency Information in Telecommunication Systems, establishes the requirements for telecommunications facilities and systems of the Federal government for obtaining UTC coordinated time and frequency reference information based on national time scales maintained by NIST and USNO. This standard is reproduced herein.

1.1. Purpose. The purpose of this standard is to facilitate interoperability between telecommunication facilities and systems of the Federal Government by standardizing time and frequency reference information.

1.2. Application. This standard shall be used by all Federal agencies where interoperability between Federal Government telecommunication facilities and systems is dependent on time or frequency reference information.

2. REFERENCED DOCUMENTS. The current issues of the following documents form a part of this standard to the extent specified herein:

2.1. General Services Administration, Information Resources Management:


2.1.2. Federal ADP and Telecommunications Standards Index, GPO Stock Number 722-008-0000-6

2.2. Institute of Electrical and Electronics Engineers (IEEE):

2.2.1. IEEE Std. 1139-1988, IEEE Standard Definitions of Physical Quantities for Fundamental Frequency and Time Metrology

2.3. National Institute of Standards and Technology (NIST), U.S. Department of Commerce:

2.3.1. NIST Technical Note 1337, 1990, Characterization of Clocks and Oscillators

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2.3.2. NIST Special Publication 559 (Revised 1990),
Time and Frequency Users Manual
2.3.3. NIST Special Publication 432 (Revised 1990),
NIST Time and Frequency Services
(Application for copies of documents should be
addressed to: Superintendent of Documents,
U.S. Government Printing Office, Washington,
DC 20402-0001.)

2.4. U.S. Naval Observatory (USNO):
2.4.1. U.S. Naval Observatory Time Service Announcements:
Series 4  Daily Time Differences
Series 14  Time Service General Announcements
2.4.2. The real-time Automatic Data Information Systems
(ADS)  (Application for copies of documents and information on accessing ADS should be addressed
to: Superintendent, U.S. Naval Observatory,
Washington, DC 20390.)

2.5. Department of Defense (DoD):
2.5.1. DoD Directive 5160.51, 14 June 1985
2.5.2. SECNAV Instruction 4120.20, 4 February 1986
2.5.3. DCA Instruction 330-50-2, 3 October 1990
(Application for copies of documents should be
addressed to: Standardization Order Desk,
Bldg. 4D, 700 Robbins Avenue, Philadelphia,
PA, 19111-5094.)

2.6. International Radio Consultative Committee (CCIR):
2.6.2. Recommendation 460-4 of the CCIR, 1990, Standard-Frequency and Time-Signal Emissions
2.6.3. Recommendation 685 of the CCIR, 1990, International Synchronization of UTC Time Scales
(Application for copies of documents should be
addressed to: International Telecommunications
Union (ITU), General Secretariat—Sales Section,
Place des Nations, CH1211 Geneva 20, Switzerland.)

3. DEFINITIONS. As used in this standard, definitions of terms shall be in agreement with their usage in IEEE Standard 1139-1988; NIST Technical Note 1337; USNO Time Service Announcements, and DoD Directive 5160.51.

4. GENERAL STATEMENT OF REQUIREMENTS. The time and frequency reference information utilized in applicable Federal Government telecommunication facilities and systems shall be referenced to the existing standards of time and frequency maintained by the National Institute of Standards and Technology and the U.S. Naval Observatory. The respective time scales are known as UTC(NIST) and UTC(USNO). For purposes of this standard, the values of UTC promulgated by NIST and USNO will be used to obtain standard values of time and frequency with the selection being directed by the considerations described in the following paragraphs.

The time scales of NIST and USNO are steered to the international UTC maintained by the Bureau International des Poids et Mesures (BIPM). Therefore, for all non-DoD activities, UTC(NIST) and UTC(USNO) are equivalent at their point of origin to one microsecond in time. The one-microsecond tolerance is in accord with Recommendation 685 of CCIR. The equivalence can be extended beyond one microsecond by obtaining appropriate corrections from the agency, NIST or USNO, maintaining the time scale of interest. The selection of the appropriate source for non-DoD agencies is at the discretion of the individual agency, efficiency and cost of access being factors to be considered. The frequencies derived from the two time scales at their points of origin are equivalent to the frequency of the international UTC to one part in 10\(^{13}\).

UTC(USNO) or any source traceable to UTC(USNO) serve as reference for all DoD networks in accordance with MIL-STD-188-115 and DoD Directive 5160.51. That directive cites the National Bureau of Standards (now renamed the National Institute of Standards and Technology) as a secondary reference for DoD activities.

Explanatory Note: Users are cautioned that in referring to these two time scales, the user assumes responsibility for propagation errors associated with transferring time and frequency to the user site. These are outside the control of NIST and USNO. Guidance on proper use of signals provided by NIST can be obtained from NIST Technical Note 559 (Revised 1990). Additional information on the USNO may be obtained by accessing the USNO real time Automated Data Information System (ADS). Some of the systems used for accessing the two time scales are described in NIST Special Publication 432 (Revised 1990), ADS System and, USNO Series 14 Time Service General Announcements. UTC(USNO) and UTC(NIST) operate under general definitions spelled out by Recommendation 460-4 of the CCIR.

5. CHANGES. When a Federal agency considers that this standard does not provide for its essential needs, a statement citing specific requirements shall be sent in duplicate to the General Services Administration, Policy and Regulation Division (KMF), Washington, DC 20405, in accordance with the provisions of Federal Information Resource Management Regulation 41 CFR 201-20.303. The General Services Administration will determine the appropriate action to be taken and will notify the agency.

Federal departments and agencies are encouraged to submit updates and corrections to this standard, which will be considered for the next revision of this standard. In view of the special nature of this standard, records of coordination with all affected Federal agencies are maintained by the preparing activity.
PREPARING ACTIVITY:
Office of the Manager
National Communications System
Office of Technology and Standards
Washington, DC 20305-2010

MILITARY INTERESTS:
Military Coordinating Activity
DCA-DC
Review Activities
Army — CR
Navy — AS, OM
Air Force — 02, 17
USMC — MC
NSA — NS
Custodians
Army — SC
Navy — EC
Air Force — 90

Robert T. Adair (Senior Member, IEEE) received the B.S. and M.S. degrees in electrical engineering from the University of Colorado, Boulder, in 1961 and 1966, respectively.

In 1958 he joined the National Bureau of Standards (NBS—now the National Institute of Standards and Technology—NIST) where he worked on: RF voltage calibration systems, led the RF and Microwave Attenuation and Phase Shift Calibration Lab, Cryogenic Electronics, and a Navy Underwater Acoustics project until 1977. He was employed by the United Nations Development Program to set up an RF standards laboratory for the Singapore Government during late 1977 and early 1978 after which he returned to NBS to work on the development of the six-port automatic network analyzer (ANA). He took a leave of absence from NBS from 1979 to 1981 to serve as a Hospital Engineer in the Peace Corps on Pohnpe Island in the Pacific. From 1981 through 1987 he worked at NBS on a WR-10 (94-96 GHz) millimeter wave six-port ANA, RF test procedures for the Army Test, Measurement, and Diagnostics Equipment Modernization program, the Army CECOM ATE RF Measurements Assessment Program, the Air Force F15 Avionics ATE RF Measurements Assessment Program, documenting Microwave Metrology systems, and impedance standards development for the RF and microwave six-port ANA’s. Since 1987 he has been with the National Telecommunications and Information Administration where he has worked on Fiber Optic, Radio, and Satellite telecommunications systems. He has served as the Advanced Networks Analysis Group Chief since late 1987.

Mr. Adair is a member of ARRL, Eta Kappa Nu, and chairman of the Federal Telecommunications Standards Committee (FTSC) HF Radio Sub委员会. He has served on several IEEE subcommittees and conference committees. He has received a number of Department of Commerce awards for Sustained Superior Performance as well as several commendations from other agencies and the private sector. He received the Department of Commerce Silver Medal Award for Meritorious Federal Service. He was selected as an honored member of Who’s Who in U.S. Executives for 1990.

Michael D. Meister (Member, IEEE) received the B.S. degree in electrical engineering from the University of Wyoming, Laramie, in 1987. He is currently pursuing the M.S. degree in electrical engineering.

In 1990 he joined the National Telecommunications and Information Administration’s (NTIA), Institute for Telecommunication Sciences (ITS). Prior to joining ITS he was with Northern Telecom and Network Systems Engineering, Inc., in the design and implementation of telecommunication systems. His primary areas of interest include data communications, computer networks, and fiber-optic technologies. He is an active participant in two Telecommunication Industry Association, Telecommunication Standards Working Groups. He is also student branch counselor for the Denver Section IEEE.

Mr. Bodson was Chairman from 1976 to 1977, the Vice Chairman from 1975 to 1976, was engaged in Research and Development, and Systems Engineering. He served on various IEEE committees and boards including the Standards Board from 1987 to present, the Executive Committee from 1985 to 1986 and in 1988, Vice President-Region 7 Activities from 1985 to 1986, and Region 2 Director from 1983 to 1984. He served on various IEEE committees and boards including the Standards Board from 1987 to present, the Executive Committee from 1985 to 1986 and in 1988, the Founders Medal from 1988 to 1990, the Bell Medal from 1978 to 1980, the Educational Activities Board in 1984, the Finance Committee from 1985 to 1986 and from 1988 to 1989, and the Regional Activities Board from 1978 to 1986. Also, he was the Region 2 Chairman from 1983 to 1984, the Vice Chairman from 1981 to 1982, and the Secretary-Treasurer from 1979 to 1980. In the Washington Section he was Chairman from 1976 to 1977, the Vice Chairman from 1975 to 1976, the Secretary from 1974 to 1975, the Treasurer from 1973 to 1974, the Communications Chapter Chairman from 1972 to 1973, the Vice Chairman from 1971 to 1972, and the Secretary-Treasurer from 1970 to 1972. He was Guest Editor for the IEEE Transactions on Vehicular Technology. He is a member of the Communications and Vehicular Technology Societies. He was on the Board of Directors for the EASCON Conference from 1972 to 1975 and the Finance Chairman for the OCEANS’76 Conference in 1976.

Mr. Bodson is a registered Professional Engineer in the District of Columbia and the Commonwealth of Virginia and is certified by the National Council of Examiners for Engineering and Surveying.