REPORT FROM THE ITU-R WORKING PARTY 7A ON TIME SIGNALS AND FREQUENCY STANDARD EMISSIONS

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Abstract

The Working Party 7A (WP-7A) on "Time Signals and Frequency Standard Missions" is one of the four Working Parties of Study Group 7 "Science Services" (SG 7) of the Radiocommunication Sector of the International Telecommunication Union (ITU-R). The subjects which are addressed in the WP-7A meetings on the basis of input documents as answers to Questions are: (worldwide) Standard frequency and time (T&F) dissemination from terrestrial transmitters and from satellites, including GPS, GLONASS, and Two-Way Satellite T&F transfer, time codes, requirements for high precision time, performance of T&F standards, time scale stability characterization, signal delays in antennas and other circuits, time delay measurements, compensation methods in SDH/SONET systems, etc. The results of the discussions during the meetings are presented, preferably in the form of ITU-R Recommendations to the ITU member states.

Also, for the purpose of communication of the best use and selection of T&F systems to a wide group of users, the writing of handbooks in WP-7A has been started with contributions from internationally recognized specialists. The manuscript of the first handbook has been finished under Dr. R. Sydnor as main editor and D.W. Allan as co-editor. The English version has been prepared for press and is also being translated into French and Spanish.

Several ITU-R Study Group and Working Party meetings were held in Geneva in October 1996. The results of the last WP-7A meeting, held 8 to 16 October 1996, are presented.

ITU-R Working Party 7A Schedule

1996

Publication of accepted Recommendations:
1995 TF Series Fascicle

Oct 8-16 Meeting WP 7A in Geneva

Oct 17-18 Meeting of Study Group 7 in Geneva

Publication TF Handbook Selection & Use Precise T/F Systems
1997
June 2-6 Meeting WP 7A
June Meeting SG 7
Oct Meeting Radiocommunication Assembly
1998 Publication accepted Recommendations:
1997 TF Series Volume

Draft revision of Question ITU-R 1117

Signal Delays in Antennas and other Circuits
and their Calibration for High-Accuracy Time Transfer

* What methods can be recommended and standardized to calibrate delay
introduced by antennas and associated circuits for accurate time transfer
(down to below one nanosecond)

* What parameters influence the delay

* What environmental effects affect delay

* What level of agreement exists between calibrated Two-Way and
GPS/GLONASS Time Transfers

* What standard reference systems would be useful for calibration
purposes
Draft revision to Question ITU-R 2067

Frequency Comparisons of Remotely Located Standards at the $10^{-15}$ Level of Uncertainty

The ITU Radiocommunication Assembly,

Considering

- that the stability of primary and some commercial frequency standards at the $10^{-14}$ level at one day and expected to improve to the $10^{-16}$ level;

- that present time transfer are at best stable to about one nano second and need an integration time of many days to reach a frequency transfer at $10^{-15}$ level;

- that ....;

decides that the following Questions should be studied

*How can frequency be transferred at the $10^{-15}$ level within a day?

*What means of self calibration and self monitoring are needed for these highly reproducible and accurate transfers?

Draft revision of Recommendation ITU-R TF.768-2

Standard Frequencies and Time Signals
(Question ITU-R 1067)

Additions and revisions to the Annex, tables 1 and 2

DCF 77, WWVB, Loran-C, etc.
Additions and revisions to the Annex1, figures and tables

DCF 77, WWVB, IEN/RAI, etc.

The Operational Use of Two-Way Satellite Time and Frequency Transfer employing PN codes.

Addition: File Format for reporting results of a quadratic fit and other parameters.

ANNEX 2.A

DATA LINE:

EXAMPLES

The examples contain actual and fictitious data (especially for calibration).
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* TWUSHO49.913
* FORMAT 01
* LAB USNO
* REV DATE 1995-07-10
* ES USN001 LA: W 38 55 00.000
* REP-FRAME MCSR4
* LINK 04 SAT: IS706
* SAT-NTX: 11922.3750 MHz
* CAL 002 TYPE: GPS
* LOC-MON NO
* MODM MITREX 2500A
* EARTH-STAT LI MJD STTIME NTL TW DRMS SMF ATL RFBDLAY RSIG CI S CALR ESDV.
* LOC REM
USN001 TS01 04 49933 140200 299 0.263265762933 1.529 300 299 0.0000001334100 9.999 002 1 296.350 99999.
USN001 NLP01 04 49933 141000 299 0.260419315503 0.612 299 299 0.0000001334200 9.999 999 0 99999.999 99999.
USN001 VSE01 04 49933 141800 299 0.261451406897 0.387 300 299 0.0000001334200 9.999 999 0 99999.999 99999.
USN001 PEB01 04 49933 143400 299 0.262748501558 1.822 233 232 0.0000001334240 9.999 003 1 449.500 99999.

Draft New Opinion

**Operational Use of Geostationary Direct TV Satellites for Time transfer**

(Question ITU-R 163-1/7)

**Considerings:**

- availability of direct TV satellites
- positioning tolerance +/- 0.1 degree
- common view accuracy 10 ns when satellite position is known good enough

**Opinion:**

* TV satellite operators should make available the satellite coordinates with a resolution for example up to 100 m each 60 minutes. This could be done on an internet site or incorporated in the TV signal
Draft New Opinion

Future Use of the Global Navigation Satellite System (GNSS) for High-Precision Time Transfer
(Questions ITU-R 163-1/7 and 152-1/7)

Considerings:
- satellite navigation signals have been simultaneously used for distribution of time and frequency
- a new enhanced system (GNSS) will be introduced in 1998 to 1999
- time oriented navigation receivers showed uncertainties below 10 ns

Opinion:
* new time-oriented receivers should be studied and developed
* suitable delay calibration methods should be developed to enable uncertainties less than 1 ns

Liaison Statement to ITU-T Study Group 13, Working Party

Cooperation in the study and development of Time Transfer and/or Distribution using overhead capacity in SONET/SDH Networks

Contact Points for WP 7A:
* D.W. Hanson, NIST, Boulder, CO., USA

and:
* T.R. Bartholomew, TASC, Annapolis Junction, MD., USA.
Progress of the TF Series of Handbooks

**Handbook on the Use of Satellite Time and Frequency Dissemination**

editor: J.McA. Steele (UK)

* manuscript planned to circulate December 1996.

**Handbook on the Selection and Use of Precise Frequency and Time Systems**

main editor: R. Sydnor (USA)

* accepted and in press at the ITU, Geneva.