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INTRODUCTION

At the Technical University Graz (TUG) commercial cesium frequency standards were used to generate UTC(TUG). Because of the small ensemble of clocks UTC(TUG) was simply generated by one clock. Since the end of 1992 this clock was a high performance HP5071A. For the contribution to TAI time comparisons were carried out using GPS CV links and from July 1999 on the TUG/PTB TWSTFT link has been included in the computation of TAI with the GPS link between PTB and TUG kept as back-up.

Due to unsolvable problems concerning the basic funding the work of the time laboratory was discontinued by the end of June 2000. Up to this date work was carried out in the fields of two-way satellite time and frequency transfer (TWSTFT), GPS time transfer, and time distribution via telephone, but from 1998 on the originally planned work had already to be reduced until the complete termination in 2000.

TWO-WAY SATELLITE TIME AND FREQUENCY TRANSFER

From the very beginning the TUG participated in the TWSTFT work using INTELSAT satellites to link European and US laboratories. After an initial evaluation by the BIPM the link between the PTB and the TUG was the first to be included in the computation of TAI starting with July 1999 [1,2].

The TUG operated two fully automated TWSTFT stations both equipped with SATRE modems and Satellite Simulators (SATSIMS) of de Jong-type for delay monitoring purposes. One station was designed as a portable station and could therefore be used for delay calibrations of remote stations. The first and due to the above mentioned reasons last calibration trip was carried out in 1998 to calibrate the TUG/PTB link [3].

In 1998 and 1999 common-clock experiments were carried out whenever satellite time was available to verify the delay variations measured by means of the SATSIMS. Final encouraging results after having overcome some problems arising from signal reflections were presented at the 8th Meeting of the WG on TWSTFT, October 2000 [4]. Further experiments to study specific reasons of measured residual delay variations could unfortunately not longer be performed.

Furthermore the PC-software-package developed for the processing of TWSTFT data and related data was extensively used to process all available TWSTFT data in parallel with the calculations done at the BIPM.

GPS TIME TRANSFER

Two single-frequency C/A code GPS-receivers were operated in a fully air-conditioned environment. One of the receivers is an original NBS receiver on loan from NIST. The GPS data which were regularly reported were collected by this receiver. The other receiver is an STI TTS-502B not longer supported by the manufacturer. Both receivers were connected to the same clock to study the behaviour of the differential delay of the receivers.

Using the software update we gratefully received from NIST the NIST receiver managed the GPS week and Y2K rollover without problems. The STI receiver could also be kept in operation because the software to communicate with the receiver and to read and preprocess the data had been developed at the TUG and could therefore be modified to overcome the GPS week rollover problems. For all software written at the time laboratory a Y2K problem did not exist.

The participation in the performance evaluation carried out by the PTB of a low-cost GPS receiver designed and manufactured in Germany by comparing it with GPS CV and TWSTFT measurements [5] had also to be terminated.

TIME DISTRIBUTION VIA TELEPHONE

The time distribution service offered free-of-charge by the TUG via telephone modems makig use of the European Telephone Time Code Format had also to be discontinued. The interest in such a service was again demonstrated by the large number of calls around the Y2K rollover. In addition to the twelve European countries (Austria, Belgium, England, Germany, Italy, Poland, Portugal, Rumania, Spain, Sweden, Switzerland, The Netherlands and Turkey) now distributing time using the European Code Malaysia has just implemented such a service using also the European Code.

REFERENCES

[1] Azoubib, J. and W. Lewandowski: 1st BIPM TWSTT Monthly Report, BIPM, May 1999.

[2] Azoubib, J. and W. Lewandowski: 7th BIPM TWSTT Monthly Report, BIPM, November 1999.

[3] Kirchner, D., H. Reßler, P. Hetzel, A. Söring, and W. Lewandowski: Calibration of Three European TWSTFT Stations Using a Portable Station and Comparison of TWSTFT and GPS Common-View Results, Proc. 30thPTTI, pp. 365-375, 1998.

[4] CCTF Working Group on Two-Way Satellite Time and Frequency Transfer, Report of the 8th meeting, October 2000.

[5] Hetzel, P., D. Kirchner, T. Polevka and H. Ressler: SATMIX Time Scale Comparisons Using a Single-Channel Fat-Sequencing GPS Receiver with Carrier Phase Smoothing,Proc. 31st PTTI, pp. 383-391, 1999.

[1,2] and [4] are available via the BIPM homepage.