

# Final Report on EUROMET (EURAMET) Project No. 529

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*“Comparison of the GPS time scale locally generated by NBS type receivers using a travelling standard”*

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GPS time and frequency transfer is among the most useful tools for comparison of remote clocks and represents the basis for the contributions of timing laboratories to the realization of International Atomic Time (TAI). It is one of the most accurate techniques in this field, and the performance achieved has improved considerably since the Euromet Project 529 was initiated. In the recent years in particular the capabilities to do frequency transfer were improved by using the Precise Point Positioning (PPP) evaluation of GPS carrier phase observables. However, to provide accurate time transfer by means of a GPS link, it is necessary to carry out calibrations periodically to verify the long term stability of the equipment. This is an ongoing task, based on code-based data analysis. Given the limited scope of this project and its reference to outdated equipment, it can be considered as finished.

Generally there are two types of calibration procedures: absolute and differential ones. The latter procedure was used in 2004 when a TTR6-AOA GPS receiver from ROA was circulated in a calibration campaign between selected European laboratories that contribute with their data to the computation of TAI. After visiting three European sites the receiver came back to ROA, where an unexpected delay change of more than 6 ns was detected in the closure measurement, indicating the well-known limitations of the equipment that was used [1].

For the purpose of link calibrations, the Bureau International des Poids et Mesures (BIPM) has performed a number of differential calibrations for GPS receivers of different types, the complete history of which is now available on the BIPM's web pages at <http://www.bipm.org/jsp/en/TimeCalibrations.jsp>. Differential time corrections for GPS time equipment are published in *Rapports BIPM* which are accessible from the same URL.

[1] J. Palacio, F. J. Galindo, H. Esteban, et al. EUROMET project 529: “Results of the 2004 GPS receiver calibration campaign,” Proceedings of the 20<sup>th</sup> EFTF, pp. 567-571, 2006.