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Live Demonstration: Time and Frequency Standard Based on GPS Receiver

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***Abstract* - Presented standard is intended for use in time and frequency calibration laboratories as a source of UTC-synchronized time scale with high long-term stability or for clock synchronization in distributed systems and sensor networks. Similar device was utilized for measurement published in the report Evaluation of timing GPS receivers for industrial applications [1, 2] for the 12th IMEKO TC10 Workshop.**

1. DESCRIPTION AND TECHNICAL SPECIFICATIONS

Main component of the standard (Fig. 1) is a reliable u-Blox LEA-6T GPS receiver (Fig. 2). The resulting precision of the standard therefore depends primarily on the performance of the receiver [3].

A. Specifications

- external output of 1 PPS signal synchronized with UTC(USNO); adjustable delay in range of $\pm 1 \cdot 10^9$ ns.
- expanded uncertainty (k=2) of 20 ns to UTC
- TTL external frequency output; adjustable in range of 1 Hz to 10 MHz; accuracy better than $2 \cdot 10^{-13}$/day
- external input for 1 PPS signal timestamping; resolution of 1 ns
- standard I/O: USB, RS232 (for control and monitoring from an external computer)

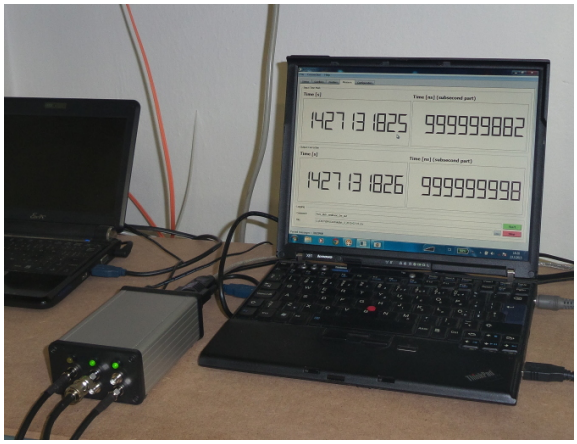

Fig. 1. Time and frequency standard.

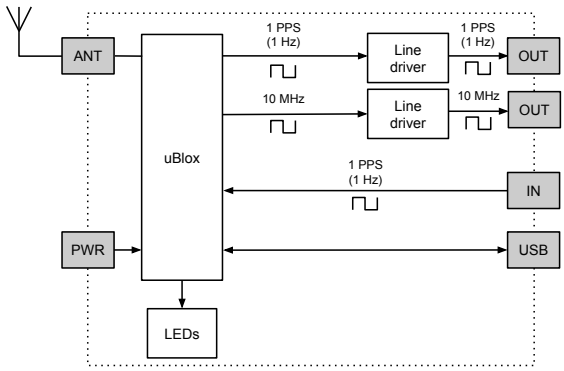

Fig. 2. Block diagram of the time and frequency standard.

2. SOFTWARE EQUIPMENT

Basic software equipment enables control and configuration of the standard on PC, automatic determination of the GPS antenna location, preparation and execution of the measurement. Additional SW provides tools for the post-processing of the measured data (granularity compensation, clock comparison, oscillator calibration).

3. STANDARD UTILIZATION

Time and frequency standard can be used for long-term continuous measurement of the local time scale deviation from the GPS Time. It can provide the measurement either autonomously, using the LEA-6T receivers internal counter, or through an external counter. Fully functional prototypes of the standard were tested in the Laboratory of the National Time and Frequency Standard of the Czech Republic (IPE of the CAS).

REFERENCES

[1] V. Vigner, J. Roztočil, B. Čemusová, Evaluation of timing GPS receivers for industrial applications, Proceedings of the 12th IMEKO TC10 Workshop on Technical Diagnostics. Florence: Universita di Firenze, 2013, ISBN 978-88-903149-8-8.

[2] http://www.imeko.org/publications/tc10-2013/IMEKO-TC10-2013-028.pdf

[3] LEA-6, u-blox 6 GPS Modules, Data Sheet, u-blox AG, 2015, https://www.u-blox.com.