Pilot Comparison of Time Interval Measurements with High Speed Oscilloscopes – initial results

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In this paper we present the initial results of the pilot comparison of time interval measurements with high speed oscilloscopes being the part of the EURAMET Project #1288, coordinated by MIRS/SIQ. This comparison is aimed to better characterise the developed by AGH and GUM electronic based Time Interval Generator (TIGen) as a time interval standard for a new Inter-Laboratory Comparison planned as a Supplementary Comparison in the KCDB.

So far, the obtained results for TIGen confirm the stability of generated time intervals at the single picoseconds level, but the absolute values of the generated time intervals have not yet been compared between different institutes. At the same time, high speed oscilloscopes are considered to be ones of the most accurate instruments for precise measurements of short time intervals. So, this pilot comparison is also able to verify and confirm the metrological quality of TIGen as well as additionally to verify and confirm the metrological equivalence of high speed oscilloscopes for absolute time interval measurements.

Relatively small group of participants in this comparison includes some NMIs or DIs (SIQ, UME, SASO) and research institutes operating in time and frequency domain (AGH, NIT) and were limited to close the comparison in a few months. GUM is responsible for coordinating the schedule, collecting and analysing the comparison data and preparing the report.

The previous experience with a cable delay measurements within the EUROMET Project #828 showed that a cable delay is not well-defined measured quantity and its value is significantly dependent on the shape of signals used for cable delay measurements and the selected trigger levels. For the cable delay of about 175 ns (the cable length of about 35 m), the values of obtained results (estimates) were scattered within the range of about ± 1 ns.

In this comparison, the results are matched very well and contained within the range less than ± 10 ps around each measured value of time interval – up to about 12 μs, if the oscilloscope were synchronized to the external reference frequency. At the conference we plan to show some details of the used time interval standard and the applied methods as well as discuss the obtained agreed results in a poster form. A such investigations are very important for precise time interval measurements, especially at calibration of different methods of precise time transfer.

References

[1] Technical protocol of the EUROMET supplementary comparison TF.TI-K1 ”Comparison of time interval (cable delay) measurement”, BEV, 2005 (EURAMET Project #828)