

06. June 2011

1. General Aspects

27 institutes have currently nominated Contact Persons in the Technical Committee Time and Frequency (TC-TF), 17 of whom participated in the 2011 meeting of the TC which was hosted by UME, Turkey. 5 of the institutes have the status of Designated Institutes, and traditionally very actively contributing delegates and three previous TC Chairs (including the period of Euromet) have been representing these institutes. This is quite understandable since the collaboration of timing institutes has always been very strong and productive, last not least because of the well-organized collaboration with the BIPM Time Department. Currently 69 institutes from 52 states world-wide contribute to the realization of International Atomic Time TAI and Coordinated Universal Time UTC. 31 institutes residing in 25 EURAMET member states belong to these, and they have contributed with data from more than 100 commercial atomic clocks and 10 primary clocks during the last 12 months. Among the latter are the most accurate primary clocks ever built. This is a very healthy situation which demonstrates that the European measurement infrastructure in the T+F domain is internationally competitive and recognized and is based on high-quality research. On the other hand, in the TC we have representatives from emerging members and it is not easy to support them in meeting their national requirements in the field, keeping balance with the high level research undertaken in the developed countries. One way of achieving this (hopefully) is the continuation of EURAMET Project work in parallel with the more ambitious EMRP projects.

In addition to the collaboration with BIPM several institutes in Europe conduct research projects with APMP, COOMET, and SIM institutes on a bilateral basis.

2. Projects

The latest status of the projects can be seen on the TC-TF web page. Progress reports have been given on the recent annual meeting and are published in the restricted part of the TC-TF web page.

The work for the following projects is ongoing, or has come to a state of maturity:

1117: Survey of European countries' legal time regulations (MIRS/SIQ).

A booklet containing the findings has been published by EURAMET thanks to the financial sponsorship of MIRS/SIQ. In this booklet the current status of existing national legislation in the EURAMET member countries is compiled. It is additionally documented by which means legal time is disseminated and which organizations are entrusted with this task. Dr. Rado Lapuh from MIRS is to be congratulated for having launched the initiative, for having carried-out the survey among EURAMET members, for having analyzed the replies, and having put all in a nicely readable format. This work complies perfectly with the EURAMET strategic objective to promote the work of its members effectively. The EURAMET Secretariat supported the publication process substantially.

1118: Involvement of the TC-TF in EMRP (MIRS/SIQ).
(see later)

1130: GPS disciplined oscillators, NPL (UK)

The objective is to produce an EURAMET Technical Guide on the use of GPS disciplined oscillators in calibration laboratories, in continuation of previous work of EA.

1146: Time transfer using optical fibers (IPE, CZ);

1152: Studies of GPS receiver performance in dependence on environmental parameters (GUM, PL).

1156: GPSCALEU, performing regional campaigns of GPS (in the future GNSS) receiver characterization. This project was started in 2010 in reaction to Recommendation 2 of CCTF 2009.

3. Comparisons

The Consultative Committee on Time and Frequency has during its session in 2009 clearly expressed that in the T+F domain a single key comparison – today with participation from 69 institutes world-wide – is completely sufficient to guarantee the traceability of all participating national institutes to the international standards – the unit of time (and frequency) and to the epoch (time scale UTC). Thus TC-TF does not see a need to organize key comparison in the field. The GNSS receiver characterization (project 1156) is supporting the work of BIPM as it allows to assign uncertainties to the published values on UTC-UTC(k) where UTC(k) is the local realization of UTC in institute “k”, based on firm grounds. Such exercises have happened in the past on an ad hoc basis, e.g. between ROA (ES) and PTB, and METAS (CH) and PTB. In 2010 ROA organized a ROA – INRIM – PTB campaign, a PTB – NPL campaign took place. PTB in its role as the pivot for all international GNSS time comparisons supporting the work of the BIPM also sees a need to do calibrations of that kind with USNO (late 2010) and NIST (planned for June 2011).

4. CMCs

Preceding the 2011 annual TC-TF meeting, a survey among the members was conducted regarding

- CMCs published?
- CMC entries needing update?
- Number of services offered?
- Number of services actually requested by external customers?

The results are quite interesting: The total number of services offered by all institutes is 19. TC-TF is happy with such a number of a manageable size. 5 institutes still have no CMC tables published. They are encouraged to work on this and support by other TC-TF members has been offered. 7 institutes noted the need to update their CMC entries. The number of services actually requested by external customers varies between “all that have been declared”, particularly in emerging countries, in which no accredited secondary laboratories exist, and less than 25%, e.g. for PTB, where numerous DAkkS laboratories exist in Germany which have an accreditation for offering traceable (mostly) frequency measurements.

The CMC Analysis Working Group is comprised of Anton Niessner (BEV, AU), Kenneth Jaldehag (SP, SE), Peter Whibberley (NPL, UK) and Andreas Bauch (PTB, DE). The review of CMC tables still has played an important role in the work of the TC-TF during the last year. The CMC tables from VSL(NL), GUM(PL), and INRiM(IT) were re-submitted (3 out of 7, see above) and analysis according to the JCRB rules is happening.

In contrary to what has been reported as experience in other TCs, the process of the inter-RMO review of CMCs was noticed to happen in an acceptable time. The support of Luis Mussio and Omer Altan of BIPM is greatly appreciated.

During the report period, the Group has been involved in the analysis of 5 CMC tables from all other RMOs and has supported the preparation of a CMC table of NIS (Egypt) which was published as a EURAMET CMC. Unfortunately the latter process has suffered some delay because of controversial statements in the CMC table and unclear responses from the other RMOs on what their objections are.

5. Activities of the Sub-Committees

TC-TF has no sub-committees.

6. Participation in iMERA-Plus and EMRP

One time and frequency iMERA-Plus project is in progress: "Optical Clocks for a future redefinition of the second". PRTs were submitted in reply to the "Industry" call, and

- New generation of frequency standards for industry (NPL, LNE-SYRTE, MIKES, PTB, industries)

was selected as SRT. The 2011 call "SI Broader Scope" appeared to be much more appropriate, and the following PRTs were submitted:

- High-accuracy optical clocks with trapped ions (PTB, MIKES, QUEST, Universities, ESA)
- Time and frequency dissemination services through optical telecommunication networks (Univ. Amsterdam, BEV, IPE, METAS, MIKES, SP, VSL)
- Using optical fibre links for frequency and time comparison and dissemination of reference frequencies (PTB, GUM, INRIM, IPE, LNE-SYRTE, NPL, SMD)

As a matter of fact, the proposed topics emerged from consultation among the partners without much involvement of the TC-TF, but two are related to an ongoing research project. For the 2012 calls a more formal involvement of the TC-TF was agreed upon.

7. Meetings

The 2011 TC-TF annual plenary meeting took place in Gebze Kocaeli, Turkey, on 7-8 April 2011, hosted by TÜBİTAK UME. An interesting visit of the institute took place on the second day, closing the meeting. The 2012 meeting will be held in Gothenburg, Sweden, during the day preceding the European Frequency and Time Forum held in the same week. SP will organize the meeting and will also organize lab tours in conjunction with both events.

8. Issues

Also in the field of time and frequency some countries/ institutes are actively involved in the EURAMET Focus Group Facilitating National Metrology Infrastructure Development, either as experts and lecturers, or as participants to training and knowledge transfer. The availability of suitable didactical material for training was questioned. The Technical Guide to be produced in Project 1130 was considered as good and helpful in this context. The availability of technical

guides, calibration guides and work procedures inside the various countries which could be helpful for developing members will be surveyed. In case that one could build on existing material the process of writing new documents of this kind would be easier.

9. Strategic Planning

The emergence of microwave and optical frequency standards with accuracies close to or better than those of caesium primary frequency standards has led to the concept of secondary representations of the second. The recent improvement in optical frequency standards is surpassing many expectations. Over the past several years, optical standards based on cold atoms and cold trapped ions have benefited significantly from the advent of the self-referenced femtosecond comb. The comb measurement of optical frequencies is in many cases limited by the Cs microwave standard itself, providing the measurement reference. In optical frequency ratio measurements, optical frequency standards demonstrated to provide reproducibility better than that of primary standards, raising the prospect of an optical redefinition of the second in the future. These developments imply strong requirements on time and frequency transfer techniques, which are not satisfied by the satellite-based methods currently in common use. The CCTF Working Group on Coordination of the Development of Advanced Time and Frequency Transfer Techniques (WGATFT) has announced to organize a workshop in late June 2011 on such matters whose results shall serve as a basis for further work in support of preparations for future improvements of the SI second and of time scales. For many years the TC-TF has had projects aimed at improving the quality of time and frequency transfer. Two current projects dealing with GNSS-based time transfer (see above) are well suited to support those needs. The improvement of time transfer through telecommunication satellites had been a EUROMET topic for many years, but due to a lack of stable resources little research is currently undertaken. Thus it is even more important to exploit the possibilities of optical-fiber based transfer of optical standard frequencies and modulated timing signals (project 1146). A few TC-TF members are reportedly involved in the currently most elaborate time transfer experiments, Time Transfer through Laser Link (T2L2, operational today) and the ACES Microwave link (to be flown on the ISS in 2015).

10. Outlook 2011-2012

The following specific objectives are firmly scheduled for the coming year:

- Continuing practical work in response to Recommendation 2 of CCTF 2009 in the frame of project 1156,
- Developing guidelines for conducting GNSS receiver characterization together with experts from BIPM and other RMOs,
- Closing the work on project 1130 and publishing a Technical Guide, otherwise the project can be blamed as a never ending story.
- Stimulating discussions within the TC-TF on knowledge transfer among countries as well as knowledge transfer and education of lower-level calibration laboratories.

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