

APMP TCTF Activity Report to the 19th CCTF Meeting

September 13-14, 2012, BIPM
Huang-Tien LIN and Chia-Shu LIAO

linht@cht.com.tw

1. Structure of APMP TCTF

1.1 Nov. 2008~ Dec. 2011

- Chair: Dr. Mizuhiko HOSOKAWA (NICT)
Technical secretary: Dr. Yasuhiro KOYAMA (NICT)
- WG on MRA (*Mutual Recognition Arrangement*)
Coordinator: Dr. Hiroyuki ITO (NICT)
- WG on GNSS (*Global Navigation Satellite System*)
Coordinator: Dr. Bruce WARRINGTON (NMIA)
Sub-coordinator: Dr Yasuhisa FUJII (NMIJ)
- WG on TWSTFT (*Two-Way Satellite Time and Frequency Transfer*)
Coordinator: Dr. Hideo MAENO (NICT)
- WG on OFM (*Optical Frequency Metrology*)
Coordinator: Dr. Feng-Lei HONG (NMIJ)

1.2 New Structure of APMP TCTF (after the 2011 APMP General Assembly (GA))

During the 27th General Assembly of APMP (2011 Dec. 7-8), Dr. Huang-Tien LIN of Telecommunication Laboratories, Chunghwa Telecom Co. Ltd., Chinese Taipei has been proposed as the new chair and the proposal was agreed by the members of APMP TCTF. This nomination was approved at the 27th APMP GA. The related Working Groups (WG) were remained till July. 2012, and the current new structure of APMP TCTF is as the following.

- Chair: Dr. Huang-Tien LIN (TL)
- WG on MRA (*Mutual Recognition Arrangement*)
Coordinator: Dr. Wen-Hung TSENG (TL)
- WG on GNSS (*Global Navigation Satellite System*)
Coordinator: Dr. Bruce WARRINGTON (NMIA)
Sub-coordinator: Mr. Jia-Lun Wang (NMIJ)
- WG on TWSTFT (*Two-Way Satellite Time and Frequency Transfer*)
Coordinator: Dr. Miho FUJIEDA (NICT)
Sub-coordinator: Mr. Yi-Jiun Huang, (TL)
- WG on OFM (*Optical Frequency Metrology*)
Coordinator: Dr. Feng-Lei HONG (NMIJ)

2. Activities of WGs in 2009-2012

2.1 WG on MRA

1) Members

Dr. Hiroyuki ITO (NICT, coordinator, 2008- July 2012), Dr. Wen-Hung TSENG (TL, coordinator since Aug. 2012), Dr. Taeg Yong KWON (KRISS), Dr. Xiao Xun GAO (NIM), Dr. Bruce WARRINGTON (NMIA), Dr. Masaki AMEMIYA (NMIJ), Dr. Chia-Shu LIAO (TL)

2) CMC works

(i) Summary of CMC works from Nov. 2009

| Code | NMI | Status | Date |
|--------------------|--|--------------------------------------|-------------------|
| APMP.TF.7.2008 | NIMT, NICT, NMIJ, NIM, TL, KRISS | Published in BIPM KCDB | Nov. 24 2009 |
| AFRIMET. TF.1.2009 | NMISA | Pending after 1st round review | Sept. 01, 2009 |
| APMP.TF.8.2009 | VMI | Published in BIPM KCDB | July 2010 |
| APMP.TF.9.2010 | NPLI (India) | Published in BIPM KCDB | Jun. 18, 2011 |
| APMP.TF.10.2010 | A*STAR (Singapore) | Published in BIPM KCDB | May 17, 2011 |
| EURAMET.TF.7.2010 | NIS (Egypt) | Published in BIPM KCDB | -- |
| EURAMET.TF.8.2011 | INRIM (Italy) | Published in BIPM KCDB | Aug.16, 2011 |
| EURAMET.TF.9.2011 | GUM (Poland) | Published in BIPM KCDB | Aug.16, 2011 |
| SIM.TF.6.2011 | NIST (USA) | Published in BIPM KCDB | Jun.11, 2011 |
| SIM.TF.7.2011 | CENAMEP (Panama) | Inter-regional review in progress | |
| COOMET.TF.5.2011 | KazInMetr (Kazakhstan) | Inter-regional review in progress | |
| COOMET.TF.6.2012 | NSCIM (Ukraine) | Inter-regional review in progress | |
| APMP.TF.11.2012 | NIM (China) | Intra-regional review in progress | |
| APMP.TF.12.2012 | KRISS (South Korea) | Intra-regional review in progress | |

(ii) Developments of guidelines for uncertainty evaluations in CMC

In the 2010 TCTF meeting, a proposal was made by the coordinator of the

working group to develop guidelines for uncertainty evaluations in CMC tables. Such guidelines are expected to become good references for new NMIs to prepare their CMC tables and also expected to establish a standard procedure in the reviewing processes. A set of draft guidelines were developed by the working group members and a technical workshop was held on Nov. 30 to Dec. 02 2011 for discussing these draft guidelines. As the results, a set of initial versions of the guidelines have been published on the APMP TCTF webpage. Comments and suggestions from the NMIs of other RMOs are very welcome.

2.2 WG on TWSTFT

1) Asian Link

- In the Asian-Pacific Rim region, Two Way Satellite Time and Frequency Transfer (TWSTFT) using GE-23 satellite is currently performed mainly by TL in Taiwan and NICT in Japan, after April 2011. The TWSTFT observations and time transfers have been regularly carried out, and the data derived from the observations have been sent to BIPM.

2) Asian-European Link

- TWSTFT experiments between Asian and European Institutes have been conducted since July 2005. NICT, TL, PTB in Germany, NTSC in China, NIM in China, VNIIFTRI in Russia, and NPLI in India are currently joining this network using AM-2 satellite since October 2010. KRISS in Korea and AOS in Poland are planning to join this link in near future.

3) Asian-Hawaii-USA Link

- TWSTFT link between NICT and USNO in USA was first established in July 2010 using a relay station at Kokee Park Geophysical Observatory (KPGO) in Kauai Island, Hawaii and two satellites of GE-23 and AMC-1. TL has also joined the link since April 2012.

4) Other Activities

- The 19th meeting of the CCTF WG on TWSTFT was held at NMIJ on September 12-13, 2011. 23 specialists from 13 institutes attended the meeting to report and discuss about recent activities on TWSTFT.

2.3 WG on OFM

1) Main subjects of the WG:

- a) Optical comb research activities
- b) Optical clock research activities
- c) Microwave and optical frequency dissemination using optical fibers
- d) Optical combs and CCL-K11

2) Activities:

- a) Information exchange on optical clocks and combs.
- b) Attending the BIPM workshop on Development of Advanced Time and Frequency Transfer Techniques

2.3 WG on GNSS

1) Development of GPS time-transfer comparison protocol

- Some progress has been made in developing a standard protocol for GPS time-transfer comparisons, despite limited resources. This work was proposed at the last CCTF meeting, with support from BIPM, but we have not so far had significant input from BIPM or other European colleagues.
- Several APMP laboratories participated in a pilot international comparison for PPP time-transfer organized by BIPM in 2010–2011. The WG is currently considering how the protocol might be extended to support this method of time-transfer.

2) Circulation of calibrated receivers to improve Type B uncertainty in *Circular T*

- Both the single-frequency system developed at NMIJ, with funding from APEC TILF, and the dual-frequency system developed at NMIA, with funding from TL, are waiting for the protocol to be completed before beginning their next comparison rounds.

3) Other activities

- NMIA has continued to host a regional archive of time-transfer data in CGGTTS format.
- Several APMP laboratories have continued to operate geodetic monitoring nodes supplying data to the global IGS network.
- The experience of WG members is available to assist with estimation of uncertainties for GPS time-transfer, for example for remote calibration and the preparation of associated CMCs.
- The discussion on the guideline of remote calibration service in time and frequency field was made at the TCTF workshop held at NICT.

- APMP TCTF will hold a GPS receiver calibration exercise during the 2012 APMP TCTF meeting in New Zealand. This will be a good start of the next comparison rounds in the future.

3. Training and Conferences in the T&F research field

1) NICT Time and Frequency Training Program 2009

NICT offered a training program from October 15, 2009 to October 23, 2009. A call for applications was sent to full member NMIs and associate member NMIs of APMP. Twelve people from nine institutes, NIM (China), NTSC (China), KazInMetr (Kazakhstan), KIM-LIPI (Indonesia), NIMT (Thailand), NISIT (Papua New Guinea), MUSSD (Sri Lanka), MUSSD (Sri Lanka), NSCL (Syria), NML-ITDI (Philippines) and NMC (Singapore) attended the program.

During the training program, lectures and hands-on seminars using actually used hardware in NICT were offered to improve practical skills to operate time keeping, international time and frequency transfer, dissemination, and calibration of the standards. In the afternoon of the last day, a round table discussion was organized and the report titled “Requirements and Recommendations for National Time and Frequency Laboratories” was made as an output of the training program.

2) AP-RASC'10 in Toyama, Japan

The Asia Pacific Radio Science Conference 2010 was held for 5 days from September 22, 2010 at Toyama International Conference Center, Toyama, Japan. The conference is a regional scientific conference organized by the International Union of Radio Science (URSI) every three years and this was the fourth conference of the series. Five sessions were designated as the joint sessions of ATF2010 (Asia Pacific Time and Frequency Workshop). About 580 researchers participated from 29 economies in total. Within the total number of 519 submitted papers, 46 papers related with the time and frequency metrology were presented in the five ATF joint sessions.

3) 2011 URSI GASS

General Assembly and Scientific Symposium (GASS) of International Union of Radio Science (URSI) was held in Istanbul, Turkey from August 12 to August 20, 2011. In total, 1108 researchers from 55 economies participated and 1319 papers were presented. Time and Frequency Metrology is covered in the Commission A of URSI and three sessions (Time Scale, Optical Frequency Metrology, Pulsar Timing and Time Transfer) were organized.

Beijing, China was selected as the venue of the next GASS of URSI to be held in 2014.

4) 2011 APMP TCTF Technical Workshop on Guidelines for CMC

A technical workshop to discuss and develop guidelines to evaluate uncertainties to be used in CMC tables was held as written in 2.1(iv) at the Koganei campus of NICT in Tokyo, Japan from November 30 to December 2, 2011 previous to the 27th General Assembly of APMP. Members of the TCTF Working Group on MRA and other experts participated in the workshop and a set of guidelines has been developed for typical calibration services in the field of time and frequency.

5) 2013 ATF Workshop and the 20th meeting of the CCTF WG on TWSTFT Meeting

2013 ATF Workshop will be hosted, as the joint sessions of commission-A of the 2013 Asia-Pacific Radio Science Conference (AP-RASC'13 Conference), on September 3-7, 2013 in Taipei, Taiwan. The session topics include:

- Calibration and dissemination in electromagnetic metrology
- Microwave frequency standards
- Time and frequency transfer
- Optical frequency standards
- Optical frequency measurement
- Other topics of commission A

The 20th meeting of the CCTF WG on TWSTFT will be held, on September 6-7, 2013, in the last two days of AP-RASC'13 conference.