# APMP TCTF Report to the 20th Meeting of the CCTF

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## Structure of the APMP TCTF 2012-2015

Between the previous CCTF meeting and September 2014, the TCTF had the following structure:

*Chair*: Dr Huang-Tien Lin (TL)

*WG on the Mutual Recognition Agreement (MRA)*

Co-ordinator: Dr Wen-Hung Tseng (TL)

*WG on Global Navigation Satellite Systems (GNSS)*

Co-ordinator: Dr Bruce Warrington/ Dr Michael Wouters (NMIA)
Sub-coordinator: Mr Jia-Lun Wang (TL)

*WG on Two-way Satellite Time and Frequency Transfer (TWSTFT)*

Co-ordinator: Dr Miho Fujieda (NICT)
Sub-coordinator: Mr Yi-Jiun Huang (TL)
Sub-coordinator: Dr Hideo Maeno (NICT)

*Joint TCL/TCTF WG on Optical Frequency Metrology (OFM)*

Co-ordinator: Dr Feng-Lei Hong (NMIJ)

Dr Lin completed his term as TCTF Chair in September 2014, and was succeeded by Dr Michael Wouters, NMI Australia for a three year term.

The current (2015) structure of the TCTF is:

*Chair*: Dr Michael Wouters (NMIA)

*WG on the Mutual Recognition Agreement (MRA)*

Co-ordinator: Mr Louis Marais (NMIA)

*WG on Global Navigation Satellite Systems (GNSS)*

Co-ordinator: Dr Michael Wouters (NMIA)
Sub-coordinator: Mr Jia-Lun Wang (TL)

*WG on Two-way Satellite Time and Frequency Transfer (TWSTFT)*

Co-ordinator: Dr Miho Fujieda (NICT)

Sub-coordinator: Mr Yi-Jiun Huang (TL)

Sub-coordinator: Dr Hideo Maeno (NICT)

*Joint TCL/TCTF WG on Optical Frequency Metrology (OFM)*

Co-ordinator: Dr Feng-Lei Hong (NMIJ)

# Activities of the Working Groups 2012-2015

## WG on MRA

The following intra- and inter-regional CMCs reviews were conducted:

| Code | NMI | Status | Date |
|---|---|---|---|
| APMP.TF.11.2012 | NIM (China) | Published in KCDB | 2013-02-08 |
| APMP.TF.12.2012 | KRISS (Korea) | Published in KCDB | 2013-03-13 |
| COOMET.TF.6.2012 | NSCIM (Ukraine) | Published in KCDB | 2013-02-21 |
| SIM.TF.8.2013 | INDECOPI (Peru) | n/a | n/a |
| SIM.TF.9.2013 (resubmission of SIM.TF.8.2013) | INDECOPI (Peru) | Published in KCDB | 2014-06-17 |
| SIM.TF.11.2014 | ICE-LMVE (Costa Rica) | Published in KCDB | 2014-12-08 |
| SIM.TF.10.2014 | INM (Colombia) | Published in KCDB | 2015-02-10 |
| SIM.TF.12.2014 | INTI (Argentina) | Published in KCDB | 2015-03-10 |
| COOMET.TF.7.2014 | KazInMetr (Kazakhstan) | Published in KCDB | 2015-03-13 |
| APMP.TF.13.2014 | TL (Chinese Taipei) | Published in KCDB | 2015-03-13 |
| APMP.TF.14.2014 | NICT (Japan) | Intra-RMO review | In progress |
| APMP.TF.15.2015 | NIMT (Thailand) | Intra-RMO review | In progress |

The WG MRA also maintains a set of guidelines for the calculation of CMC uncertainties, developed as a result of a 2011 workshop. These are intended as a guide for NMIs submitting CMCs for the first time. The guidelines are freely available from the TCTF website.

## WG on GNSS

The first calibration of Group 2 receivers is currently being organized. This campaign is being piloted by NIM and will use a purpose-built system designed by NIM. The details of the campaign will be finalised later this month.

An APMP Technical Committee Initiative proposed through the TCTF was funded to develop a low-cost GNSS time-transfer system to enable development of time-dissemination services. The system's hardware design and software will be openly available. This project is a collaboration between NMIA, NPLI, NIMT and SIRIM.

### WG on TWSTFT

Three TWSTFT links are currently maintained: within Japan; between Asia and Hawaii (USNO); and between Asia and Europe. The Asia-Europe link has been affected by changes to the orbit of the satellite in use, AM2, and the launch failure of an intended successor satellite. Alternatives to AM2 have been investigated.

Research in the WG includes: link calibration; the use of dual pseudo-random noise codes; software-defined receivers; and the use of carrier-phase.

### WG on OFM

A workshop on calibration of $I_2$-stabilized HeNe lasers was held jointly with the Technical Committee for Length between 28th July, 2014 and 1 August, 2014. The workshop was hosted by NIMT and involved 22 participants. It was aimed at NMIs from developing countries.

Research in the WG includes: optical clocks; optical frequency combs; and dissemination of microwave and optical frequency standards over optical fibre.

## Training and conferences 2012-2015

### Workshop on GPS receiver calibration

A half-day workshop on GNSS receiver calibration was organized by TL and held in conjunction with the APMP 2012 meeting in Wellington, NZ. The workshop was funded by the APMP through its Technical Committee Initiative program. Presentations were made on topics such as 'link calibration' and several laboratories detailed their experiences . The workshop concluded with a practical exercise using a travelling system designed by TL.

### APMP-MEDEA Workshop on participating in UTC

A workshop on "Participating in UTC" was held in Beijing, China, 5th to 6th November 2014 and hosted by NIM. The workshop was funded by the APMP-MEDEA (Metrology-Enabling Developing Economies in Asia, a PTB-funded project) program and was aimed at developing NMIs who were currently participating in UTC or were establishing the capability to do so in the near future. Eight participants from 6 NMIs were funded to attend. Topics presented ranged from the requirements for participating in UTC to cable delay measurement techniques.

Presentations from this workshop are available from the TCTF web pages.

### ATF Workshops

The 2013 Asia-Pacific Workshop on Time and Frequency was held as a joint session with the 2013 Asia-Pacific Radio Science Conference. About 60 papers were presented in 9 sessions.

The 2014 IEEE FCS meeting was held in Taipei with the ATF 2014 as a technical co-sponsor. Of the 177 papers accepted, 109 were from APMP laboratories.

The 2015 Asia-Pacific Workshop on Time and Frequency will be held in Beijing on the 31st October, 2015, in conjunction with the 2015 meeting of the APMP. Funding has generously been made available by NICT and NIM to allow participation by those NMIs who would not usually be able to

present. The Chair of the Organizing Committee is Dr Y. Koyama (NICT). The proceedings of this workshop will be available from the TCTF web pages.