

APMP TCTF Report to the 21st Meeting of the CCTF

June 8th to 9th, 2017, BIPM

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Structure of the APMP TCTF 2015-2017

The current (2017) structure of the TCTF is:

Chair: Dr Michael Wouters (NMIA)

Chair Elect: Dr Aimin Zhang (NIM)

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) [co-ordinator after Nov 2016]

WG on Test and Calibration (TC)

Co-ordinator: Dr Ahmad Sahar bin Omar (NMIM)

Sub-coordinator: Mr Stephen Quigg (NMIA)

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

Co-ordinator: Dr Kazumoto Hosaka (NMIJ)

Meetings of the TCTF

The TCTF meets annually, in conjunction with the APMP General Assembly. Our previous meetings were:

- 2015 2nd to 3rd November, Beijing, hosted by NIM
- 2016 14th to 15th November, Da Nang Vietnam, hosted by VMI

Reports on these meeting and individual laboratory presentations are available from the TCTF website: http://www.apmpweb.org/fms/general.php?tc_id=TF

The next meeting will be hosted by NPLI in the last week of November, 2017.

Activities of the Working Groups 2015-2017

Working Group on MRA

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

Code	NMI	Status	Date
APMP.TF.14.2014	NICT (Japan)	Published in KCDB	2016-10-15
APMP.TF.15.2015	NIMT (Thailand)	Published in KCDB	2016-09-02
APMP.TF.16.2016	SG (Singapore)	Published in KCDB	2016-10-12
EURAMET.TF.10.2016	IMBIH (Bosnia)	Published in KCDB	2016-09-07
APMP.TF.17.2017	RCM-LIPI (Indonesia)	In progress	
AFRIMETS.TF.2.2016	DEFNAT (Tunisia)	Published in KCDB	2017-04-25

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

http://www.apmpweb.org/fms/guidelines3.php?tc_id=TF

Working Group on GNSS

Three calibrations of G2 receivers have been completed: **1015-2016** (BIRM, organized by NIM); **0418-2016** (NTSC organized by NIM); and **1013-2017** (NIMT, NMLS-SIRIM and VMI, organized by TL). A report on the latter campaign is currently being prepared. A further campaign by NICT is anticipated in the latter half of 2017.

An APMP Technical Committee Initiative proposed through the TCTF was funded in 2015 to develop a low-cost GNSS time-transfer system to enable development of time-dissemination services and this is now almost completed. The system's hardware design and software will be openly available with the software already available via www.openttp.org. The initiative is a collaboration between NMIA, NPLI, NIMT and SIRIM.

Working Group on TWSTFT

Research in the WG includes: link calibration; the use of dual pseudo-random noise codes; software-defined receivers; and the use of carrier-phase. Reports can be found on the TCTF website.

WG on OFM

Research in the WG includes: optical clocks; optical frequency combs; and dissemination of microwave and optical frequency standards over optical fibre. Reports can be found on the TCTF website.

WG on Test and Calibration

This is a new working group focusing on practical test and calibration issues and addressing the interests of NMIs in developing economies. A stopwatch calibration comparison is currently being organized since this is a common activity in many working laboratories.

Training and conferences 2015-2017

APMP-MEDEA training course on GNSS time-transfer and calibration techniques

A kickoff workshop on GNSS time-transfer and receiver calibration techniques was held in Taipei from 27th to 29th September, 2016 and hosted by TL. 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. Sixteen participants from 13 NMIs were funded to attend, along with three presenters from NIM, NICT and NMIA. The workshop consisted of lectures and practical demonstrations using the time-transfer systems that are being used within the APMP for GNSS receiver calibrations.

The workshop has been followed up with a limited GNSS receiver calibration campaign: three NMIs whose receivers have never been calibrated were visited. There will also be on-site visits to several NMIs and a concluding workshop later this year.

ATF Workshops

The 2015 Asia-Pacific Workshop on Time and Frequency was held in Beijing on the 31st October, 2015, in conjunction with the 2015 meeting of the APMP. Funding was generously made available by NICT and NIM to allow participation by several NMIs who would not usually be able to present. Presentations made at this workshop are available on the TCTF web pages.

The 2016 Asia-Pacific Workshop on Time and Frequency was held as joint sessions with AP-RASC2016 in Seoul, South Korea.