



Australian Government
National Measurement Institute

WG on GNSS Report



APMP Technical Committee on Time and Frequency
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Mission:

- To support time and frequency applications of Global Navigation Satellite Systems (GNSS) in APMP

Objectives:

- Support research into GNSS time and frequency transfer
- Coordinate GNSS time and frequency comparisons within APMP
- Develop support for new GNSS techniques and applications

- Coordinator: Bruce Warrington (NMIA)
- Sub-coordinators: Michito Imae and Yasuhisa Fujii (NMIJ)

Action Plan 2010–

1. Comparisons supporting GNSS time and frequency transfer

- Continue to coordinate the comparison of GPS receiver delays by circulating a dual-frequency GPS receiver system among APMP economies (with thanks to TL)
- Reduce the time between comparison visits by circulating an additional single-frequency GPS receiver system (with thanks to NMIJ and APEC TILF)
- Extend the dual-frequency comparison to support additional evaluations, for example to separate receiver delays at L1 and L2 frequencies in support of P3 or PPP carrier-phase time transfer
- Work towards establishing formal recognition of APMP GNSS comparison campaigns, for example as regional Supplementary Comparisons within the CIPM MRA framework

Comparisons: work in progress

i. Develop a formal protocol for the intercomparison

- APMP TCTF and WG GNSS previously identified the importance of a formal protocol, to ensure recognition of results (for example, to support reduction of u_B for laboratories contributing to TAI)
- At CCTF 2009, Dr Felicitas Arias noted that ongoing characterization of GNSS receiver delays is necessary for the preparation of TAI and the dissemination of UTC. A proposal has been prepared to involve the regional metrology organisations more actively in supporting these campaigns, and was discussed by the CCTF (CCTF/09-39)
- A working group was formed to prepare a draft protocol, including representatives from BIPM, PTB (Andreas Bauch) and NMIA (Bruce Warrington). However, this working group has made limited progress.
- If anyone else would like to assist with preparation or review of this protocol, please let the WG GNSS know.

Comparisons: work in progress

ii. Current program of APMP receiver intercomparisons

- Dual-frequency system completed three main rounds throughout the region and a side visit to NMISA in South Africa.
- We intend to prepare final results in accordance with the comparison protocol, to support formal recognition of comparisons completed so far. This increases the preparation work required, and we regret the extended delay which is partly due to limited resources.
- **If any laboratory would like details of their comparisons immediately, please contact Bruce Warrington directly.**
- Multichannel single-frequency receiver prepared at NMIJ, supported by APEC TILF, to support more frequent comparison at L1.
- We intend to prepare the next rounds of the comparison in accordance with the formal protocol. **Laboratories interested in participating should contact Bruce Warrington, Michito Imae or Yasuhisa Fujii.**

Comparisons: work planned to do

iii. Extend comparison to dual-frequency (P3 and PPP)

- Currently calculate and report L1 C/A code delay only. Delay values also available in principle for both P/L1 and P/L2, to support P3 (code) time transfer for geodetic dual-frequency receivers
- A number of APMP laboratories have purchased and are currently operating geodetic GNSS receivers
- At CCTF, BIPM reported that PPP links will be included in the calculation of TAI. A BIPM calibration campaign to characterize delays of selected receivers is currently in progress, including NIM, NTSC, A*STAR, NMIA and TCC (Chile)
- The WG intend to monitor the protocol and performance of this campaign, and work closely with BIPM to consider further regional campaigns to complement these results

The WG would greatly appreciate opinions from participating laboratories about the relative priority of these different modes of comparison within APMP.

Action Plan 2010–

2. Survey the use of GNSS time and frequency transfer for remote calibration in APMP
 - provide an opportunity to discuss related issues such as the estimation of uncertainty, the use of GPSDO (or GNSS disciplined oscillators), and accreditation of calibration services
 - report back to the APMP TCTF summarising information which may be useful to economies operating or developing remote calibration facilities
 - consider guidelines for harmonization of remote calibration services, and for the assessment of these services for CMCs under the CIPM MRA

Discussion from sub-WG on remote calibration this afternoon (with thanks to Michito Imae)

The WG is especially grateful for the leadership of Michito Imae of NMIJ in this work, and seeks suggestions from laboratories for future survey topics.

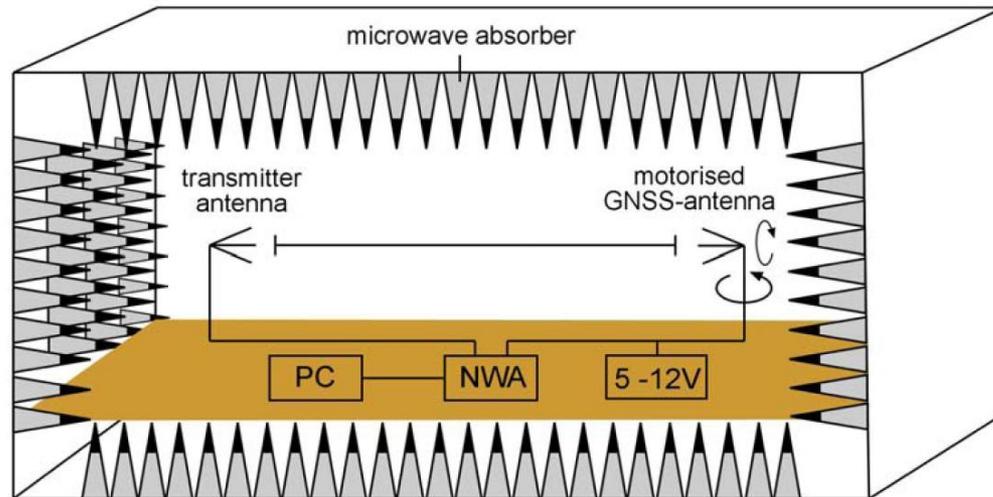
Action Plan 2010–

3. Support research and development of GNSS time and frequency transfer techniques
 - Question: NMIA currently download CCTF data from a number of APMP institutes, make this available by FTP, and report common-view GPS transfer results for selected laboratories. Is this still of use?
 - Question: Is there a need to extend or change this work to support RINEX data and PPP transfer results? How might this be achieved within available resources?
4. Provide opportunities for coordinated discussion on the impact of new satellite-based systems on GNSS time and frequency transfer in the APMP region

Action Plan 2010–

5. Develop support for other GNSS applications relevant to time and frequency as appropriate

One possibility has arisen recently at NMIA: characterizing phase and gain maps for geodetic antennas using anechoic chamber measurements (in partnership with Geoscience Australia)



from Zeimetz and Kuhlmann, 2006

If these studies are of interest to other APMP laboratories, please let the WG know.

Action Plan 2010–

If you or your laboratory:

- have a need to complete another comparison with a travelling APMP receiver
- would be willing to help coordinate a comparison round
- would be willing to help develop a comparison protocol
- have other specific issues you would like to the WG to discuss

Please let Bruce Warrington (NMIA) or Michito Imae (NMIJ) or Yasuhisa Fujii (NMIJ) know.

If you are able to assist with any of the work of the WG this would be particularly appreciated, as it will allow us to devote more resources to the Action Plan.



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