

TWSTFT Activities in NMIJ, AIST

*National Metrology Institute of Japan
(NMIJ)*

Time keeping at NMIJ

- **Seven Cs atomic clocks (five clocks are reported to BIPM)**
- **Three Hydrogen Masers, two of them are made by Anritsu, one is CH1-75A made by Kvarztz. The CH1-75A were installed in chamber.**
- **UTC(NMIJ) has been generated by using an AOG since June, 2004**
- **The source oscillator for the AOG is one of the Hydrogen Masers since March, 2006**



TWSTFT system at NMIJ

- 1.8 m antenna for JCSAT-1B among Pacific-rim region NMIs
- New earth station with 2.4 m dish antenna for PAS-4



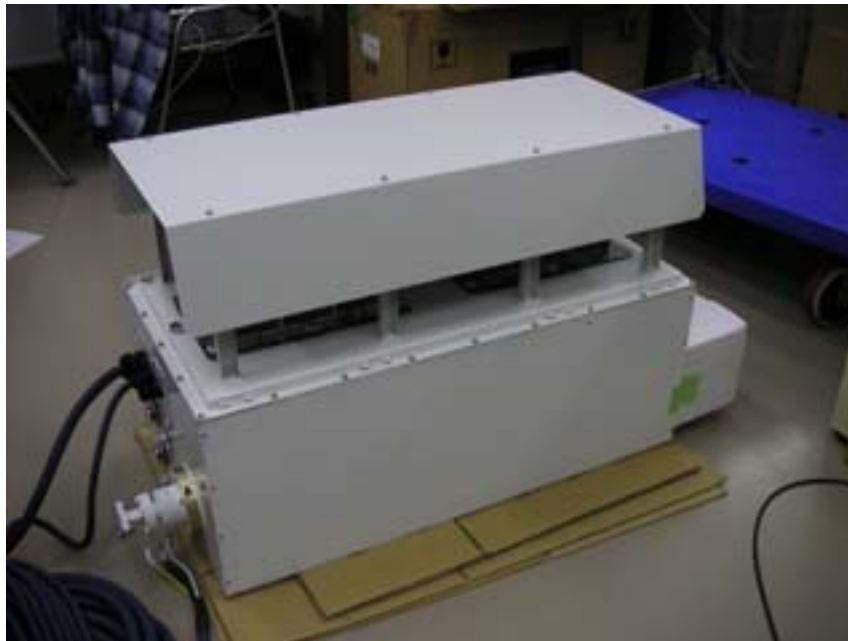
New earth station (1)



A preparative license is due to be received in this month, and UAT will be performed by the end of next month.

New earth station (2)

Temperature controlled box for outdoor unit



Specification

setting range : 20 – 30 °C

setting accuracy : ± 1 °C

Measurement result

setting temperature : 25 °C

± 0.2 °C @ 0 °C

± 0.2 °C @ 20 °C

± 0.5 °C @ 50 °C



Carrier Phase TWSTFT development

TWSTFT using PN code phase

time transfer ~ 0.1 ns
frequency transfer 10^{-10} @1 s

TWSTFT using carrier phase

time transfer ~ 0.1 ps
frequency transfer 10^{-12} @1 s
 $10^{-16} - 10^{-17}$ @1 day

Concept of Carrier-Phase TWSTFT method

The signal carrier phase of bidirectional transmission is used.

resolution	0.1 ~ 1 ps (If a sub-carrier is assumed to be 10GHz, it will measure by the resolution of 1/100 – 1/1000 of the one cycle..)
time transfer Accuracy	< 1ps
frequency transfer Accuracy	< 10 ⁻¹² @1 s

using several PN codes, and it compares simultaneously at many points.

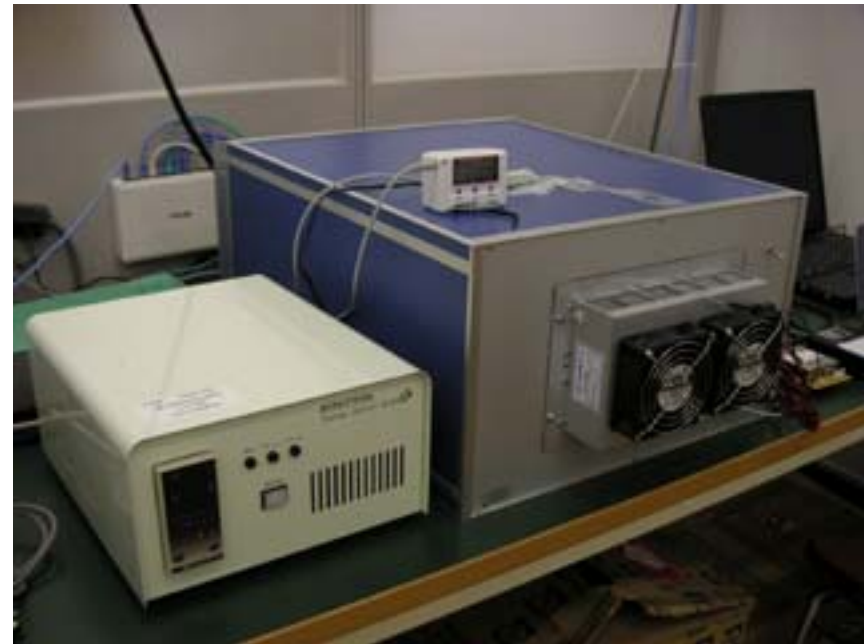
problem to be solved

- ① solving the ambiguity of career phase
- ② correction of ionosphere delay effect caused by the frequency difference between the up-link frequency and the down link one
- ③ compensation of phase fluctuation in the ground station devices caused by mainly temperature variation

Temperature controlled box for calibration system under consideration



Outdoor unit



Indoor unit

the temperature variation effect will be minimized by the highly stable temperature management system in the earth station.