Date: July, 29 , 2009

Dear Dr. Arias, BIPM,

Attached is the report on the frequency measurement by NMIJ-F1, a cesium atomic fountain frequency standard of NMIJ, during **MJD 55009-55039.** The uncertainty evaluation was the same as that in the last publication.

Shinya Yanagimachi
Akifumi Takamizawa
Takeshi Ikegami

National Metrology Institute of Japan (NMIJ)
Time and Frequency Division
Time Standards Section
AIST Tsukuba Central 3, Tsukuba-Shi, Ibaraki-Ken 305-8563, Japan

Frequency comparison between H-Maser(405002) and Cs Fountain(NMIJ-F1) during MJD 55009-55039

The frequency of our Hydrogen maser HM(Clock # 405002) have been measured using NMIJ-F1 during MJD 55009-55039 (30 days). The results are shown in tables 1.

Table 1. Results of the comparison in $1\text{x}10^{-15}$ unit.

Period	**55009-55039**
Measurement ratio	99.8%
Y(NMIJ-F1)-Y(Maser 405002)	-199.5
u_A	0.7
u_B	3.9
$u_{link/lab}$	0.3

1. Type A uncertainty u_A

The frequency stability $\sigma_y(\tau)$ is $1\times10^{-12}\ \tau^{-1/2}$. This equation has been used for the estimation of type A uncertainty on the basis of white FM noise. The measurement uncertainty is 0.7×10^{-15}.

2. Uncertainty of the link in the laboratory $u_{link/lab}$

The uncertainty of the link in the laboratory, $u_{link/lab}$, is written as,

$$u_{link/lab} = \sqrt{u_{dead\ time}{}^2 + u_{link/maser}{}^2} \qquad (1)$$

where $u_{link/maser}$ is the uncertainty due to the phase noise of the synthesis chain between the fountain and HM, $u_{dead\ time}$ is the uncertainty due to the operational dead time of the fountain. ($u_{link/maser}$, $u_{dead\ time}$) are evaluated to be $(2\times10^{-16}, 2\times10^{-16})$.

3. Type B uncertainty u_B

The value of type B uncertainty is the same as the last publication, as is shown in table 2.

Table 2: Frequency biases and uncertainties in NMIJ-F1 during the period MJD 55009-55039 in 1×10^{-15} unit.

Source of uncertainty	Bias	Uncertainty
2nd order Zeeman	174.9	0.5
Blackbody radiation	-18.0	1.4
Gravitation	1.6	0.1
Cold collisions	0.0	3.3
Distributed cavity phase	0.0	1.2
Microwave power dependence	0.0	0.7
Total	158.5	3.9