



Frequency Transfer with New Broadband VLBI. –NMIJ-NICT Test Experiment –

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1 Introduction

High precision distant frequency transfer techniques are desired to compare the advanced atomic frequency standards (AFS), which are newly developed by metrological research institutes in the world. Fiber-link frequency transfer is the technique of current highest accuracy, although distance of comparison is limited by fiber-link. Two-way satellite time and frequency transfer (TWSTFT) is the technique used for high precision time and frequency transfer. Its drawbacks are dependency on geographical availability of satellite and running cost including transponder of satellite, radio signal transmission license. Space geodetic techniques such as Global Navigation Satellite Systems (GNSS) and Very Long Baseline Interferometry (VLBI) observations are passive method as the next choices for time and frequency transfer. VLBI observation determines the spatial coordinates of the station and clock difference simultaneously. The analysis is theoretically based on inertial reference frame using natural radio source fixed in celestial sphere. These features have advantages of VLBI in the aspect of long term stability of comparison than the other space techniques which uses artificial signal sources. We have developed a broadband VLBI system named GALA-V[1], which is designed for advanced delay precision with observing board observation frequency range (3-14GHz).

2 Frequency Transfer with GALA-V System between NMIJ-NICT

Two transportable broadband VLBI stations and large diameter high sensitivity antenna are used as a minimum set of GALA-V system for frequency transfer. Domestic performance test has been conducted with two small (2.4m diameter) broadband VLBI stations named MBL1 installed at National Metrology Institute of Japan (NMIJ), and MBL2 installed at headquarters of NICT (Koganei). Time series of UTC(NICT) and UTC(NMIJ) are compared by the GALA-V VLBI and by using GPS, in parallel. Two types of GPS analysis PPP and IPPP[2] were used in the comparison. Frequency comparison between VLBI and GPS(IPP) shows smaller difference than GPS(PPP)-GPS(IPP). This result shows potential of high accuracy frequency transfer by VLBI technique.

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References

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