

# Kashima and Koganei 11-m VLBI Stations

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## Abstract

Two 11-m VLBI antennas at Kashima and Koganei are continuously operated and maintained by the National Institute of Information and Communications Technology (NICT). This brief report summarizes the status of these antennas, the staff, and the activities during 2009.

## 1. Introduction



Figure 1. 11-m VLBI antennas at Kashima (left) and Koganei (right).

Two 11-m VLBI antennas at Kashima and Koganei (Figure 1) used to be stations of the Key Stone Project (KSP) VLBI Network. The network consisted of four VLBI stations at Kashima, Koganei, Miura, and Tateyama (Figure 2). These 11-m antennas and other VLBI facilities at the Miura and Tateyama stations have been transported to the Tomakomai Experimental Forest of the Hokkaido University and to the campus of Gifu University, respectively. As a consequence, two 11-m stations at Kashima and Koganei remain as IVS Network Stations. The KSP was a research and development project of the National Institute of Information and Communications Technology (NICT, formerly Communications Research Laboratory) [1]. After the regular VLBI sessions with the KSP VLBI Network terminated in 2001, the 11-m VLBI stations at Kashima and Koganei have mainly been used for the purposes of technical developments and miscellaneous observations.

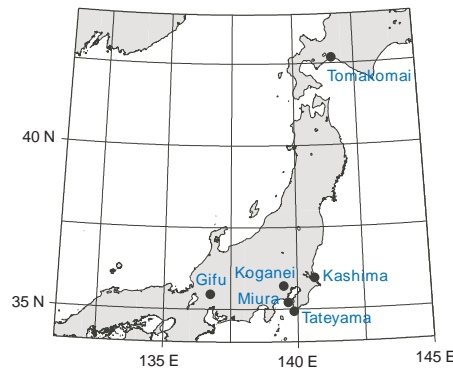


Figure 2. Geographic locations of four KSP VLBI stations and two stations at Tomakomai and Gifu.

## 2. Current Status

The main specifications of these antennas are summarized in Table 1. These antennas can observe S and X-band. Originally, the specifications of these antennas were the same. However, the specifications were changed due to the improvement and the breakdown of the equipment. Also, we changed the phase calibration (P-cal) unit from a 5 MHz to a 1 MHz signal.

Table 1. The specifications of the KSP 11-m antenna

		Kashima	Koganei
Antenna Type		Cassegrain type	
Diameter of the Main Reflector		11-m	
Mount Style		Az El mount	
Latitude		N 35° 57' 20.13"	N 35° 42' 38.01"
Longitude		E 140° 39' 26.90"	E 139° 29' 17.10"
Height of Az/El intersection above sea level		62.4 m	125.4 m
Input Frequency (MHz)	S band	2220 ~ 2370	2100 ~ 2500
	X Low-band	7700 ~ 8200	7700 ~ 8200
	X High band	8180 ~ 8680	8100 ~ 8600
Local Frequency (MHz)	S band	3000	3000
	X Low band	7200	7200
	X High band	7680	7600

In November 2009, we observed the Tsys of the Kashima and Koganei antennas over the entire sky to research the influence of the radio frequency interference (RFI) signals. In X-band, we did not see an RFI signal. However, in S-band, we detected interference from the RFI signal at each station. According to the Japanese radio frequency allocation table, the source of the RFI signal in S-band is thought to be the wireless LAN in Japan. At Kashima, we introduced a narrower band-pass filter (2210 ~ 2380 MHz) to reject the RFI signal. Figure 3 shows the intermediate frequency (IF) spectrum of S-band (left: before replacement of BPF, right: after replacement). It

clearly shows the replacement of the BPF was effective. We are planning to replace the S-band BPF also in Koganei in the near future.

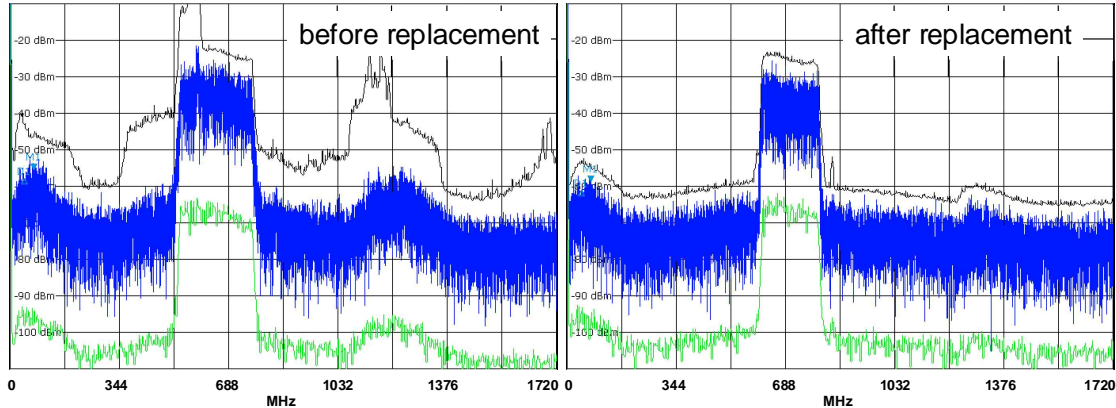


Figure 3. The spectrum of the IF in S-band (left: before replacement of BPF, right: after replacement).

### 3. Activities in 2009

Since 2007, we have been performing special purpose geodetic VLBI experiments between the Kashima (11-m or 34-m) and Koganei (11-m) stations to evaluate the capability of geodetic VLBI for precise time and frequency transfer and comparison. In 2009, the experiments for this purpose were performed in June, August, October, and December. Each time, S/X-band geodetic VLBI observations were performed continuously from 1 to 3 days [2].

For technical developments, the baselines between the Kashima and Koganei stations have also been used in experiments for many purposes—for example, e-VLBI observations, geodetic observations using the MARBLE (Multiple Antenna Radio-interferometry of Baseline Length Evaluation) system, etc. For the results of these experiments, please see the reports from NICT in the “Analysis Centers” and “Technology Development Centers” sections in this volume.

Apart from the VLBI sessions, the Space Environment Group of NICT started to use the 11-m antenna at Koganei to download data from the STEREO spacecraft. Two STEREO spacecraft were launched by NASA in October 2006 to investigate the solar terrestrial environment and to provide 3D images of the Sun and solar storms. The Koganei 11-m antenna is therefore operated every day even if there are no VLBI sessions to perform.

### 4. Staff Members

The 11-m antenna stations at Kashima and Koganei are operated and maintained by the Space-Time Standards Group at Kashima Space Research Center, NICT. The staff members of the group are listed in Table 2. The operation and maintenance of the 11-m VLBI station at Koganei is also greatly supported by the Space-Time Standards Group, the Space Environment Group, and the Space Communications Group at the Koganei Headquarters of NICT. We are especially thankful to Jun Amagai and Tadahiro Gotoh for their support.

Table 2. Staff members of Space-Time Standards Group, KSRC, NICT

Name	Main Responsibilities
KOYAMA Yasuhiro	Administration
KAWAI Eiji	Antenna Systems
ICHIKAWA Ryuichi	Meteorological Sensors, IGS Receivers
AMAGAI Jun	Antenna System and Timing Systems at Koganei 11-m station
SEKIDO Mamoru	Field System, Calibration and Frequency Standard Systems
HASEGAWA Shingo	System Engineer

## 5. Future Plans

In 2010, we plan to continue precise time transfer VLBI experiments and e-VLBI developments. In addition to the VLBI observations and developments, the data downlink from two STEREO spacecraft will be continued. Additionally, we especially are planning to set up the following things to improve the antenna's condition for the precise time and frequency transfer VLBI experiments:

- at the Koganei 11-m station
  - link to the Hydrogen maser coherent with UTC (NICT) by optical fiber
  - repair the temperature control room of KSP Hydrogen maser
  - change the band-pass filter of S-band
- at the Kashima 11-m station
  - set up the precise temperature control room at observation room
  - set up the transportable two-way satellite time and frequency transfer (TWSTFT) system

## References

- [1] Special issue for the Key Stone Project, J. Commun. Res. Lab., Vol. 46, No. 1, March 1999
- [2] Takiguchi, H., Y. Koyama, R. Ichikawa, T. Gotoh, A. Ishii, and T. Hobiger, Comparison Study of VLBI and GPS Carrier Phase Frequency Transfer -Part II-, IVS NICT-TDC News, No. 30, 26-29, 2009.