Developments of K5/VSI System for Geodetic VLBI Observations

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As one of the technology development centers of the International VLBI Service for Geodesy and Astrometry (IVS), National Institute of Information and Communications Technology (NICT) has been developing VLBI observation systems and data processing systems. In 1999, we started to develop K5 VLBI system, which consists of the PC-based data acquisition terminals and software based correlation processing programs. In contrast to the previous K4 VLBI system developed with the specially designed high speed cassette tape recording system, the K5 VLBI system is designed with the commodity products such as personal computers, hard disks, and network components. This strategy has been quite successful to develop highly flexible and high performance observation systems and data processing systems for VLBI. As the data acquisition terminals of the K5 system, we have developed two independent series of systems. One is the K5/VSSP system series and the other is the K5/VSI system. The concept of the K5/VSSP and K5/VSSP32 systems is to develop AD sampling units interfaced to the commodity PC systems by using the PCI expansion bus (VSSP) and USB2.0 interface (VSSP32). Each AD sampling unit can support up to four analog inputs, and therefore, four units are used to record signals from 16 full channels of baseband converter units in the case of usual geodetic VLBI observations. On the other hand, K5/VSI series are realized by high speed AD sampler units and the units are interfaced with the commodity Linux PC system with the VSI-H (VLBI Standard Interface - Hardware specifications). VSI-H was proposed to define standard interface for the high speed data transfer between data input modules, data transfer modules, and data output modules to improve the compatibility between next generation VLBI observing systems and the correlator systems. To input the data stream from the VSI-H data input modules, a special board called PC-VSI board has been developed. The board is installed to the PCI expansion bus slot of Linux PC system and can support high speed data transfer and recording up to 2Gbps with a single unit. Three data sampler units, ADS1000, ADS2000, and ADS3000, have been developed to support various sampling modes. ADS1000 can sample one baseband channel at the sampling rate of 1024Msps. ADS2000 can sample 16 baseband channels at the sampling rate of 64Msps suitable for observations using the bandwidth synthesis method. ADS3000 can sample wide range of baseband frequency band up to 1024MHz with the sampling rate of 2048Msps. A high speed FPGA (Field Programmable Gate Array) chip is equipped inside the unit and it can be used to process the input data stream for digital filtering and digital baseband conversion processing. By developing specialized program for the FPGA chip, ADS3000 has a potential to support various observing modes without hardware baseband converters.