The Status of KVN(Korean VLBI Network) phase compensation system development

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Abstract

KVN is a millimeter VLBI network which is comprised of three 21m radio telescopes. 22/43/86/129 GHz receivers are installed in each telescope for 4 bands simultaneous multi-frequency observation. Three cable-cal systems will be installed in KVN telescopes until Feb. 2012. The cable-cal system has been developed with collaboration of KRIS(Korea Research Institute of Standards and Science). KVN cable-cal system disseminates 1.4 GHz signal from H-maser room to receiver cabin using fiber optic Tx/Rx. The phase stability of remote signal in receiver cabin will be shown. And KVN is developing a new P-cal signal generator for calibrating 4 band receivers. This generator has to transmit signals from 21 GHz to 130 GHz using 200 MHz reference for calibrating 4 band receivers. As a feeder, we are considering ultra- wide bandwidth double-ridge pyramid horn. 1 mm coaxial to double-ridge waveguide adaptor was simulated and manufactured. Commercial comb generator is considered for signal generation.

1. Goals

1. To calibrate the instrumental phase delay of 22/43/86/129 GHz receivers which have independent local oscillator.

2. KVN Receiver System including phase compensation system

KVN is constructing 4 band simultaneous observation system for millimeter VLBI. Cable calibration systems using fiber optic transmitter/receiver are under installation for distributing the H-maser reference signal to antenna vertex room. Phase calibration generator is under development using commercial comb generator and wideband double-ridged feeder for calibrating quasi-optics and independent local oscillators of 4 band receivers.

2.1. The Status of KVN(Korean VLBI Network) phase compensation system development

KVN P-cal Signal Generator

1. Phase calibration signal generation concept

KVN need P-cal signal generator with output power from 21 GHz to 130 GHz. The P-cal signal is to calibrate local oscillators and signal paths for 4 band receiver and quasi-optics. IF bandwidth is 500 MHz. Therefore we 200 MHz reference which more than one comb signal is inside the each IF band.

2. Wideband coax to double-ridged w/g adaptor design

We are considering P-cal signal generation using commercial comb generator or harmonic

3. Commercial comb generation output

Commercial comb generator make sufficient output power in case of high reference signal. At 2 GHz, if we use lower reference signal, 200 MHz, output power cannot be sufficient for 130 GHz phase calibration signal. We are preparing to measure the output power of comb generator using 200 MHz reference.

Summary & Further Work

1. Fiber optic frequency transmission system (cable calibration system or round trip system) was developed for KVN: Allan standard deviation: 3E-16 @ 1000 s
2. Remote signal monitoring method was suggested and confirmed by using measuring round trip signal and phase signal.
3. 20-130 GHz broad band P-cal signal generator is needed for KVN instrumental phase calibration. Therefore KVN is considering wideband coaxial to w/g feed and commercial comb generator.