NRAO-EVLA Wideband Techniques

Steven Durand[1], Rick Perley[1] and Jim Jackson[1]

[1]National Radio Astronomy Observatory, 1003 Lopezville Road, Socorro New Mexico USA 87801, 505.835.7000, sdurand@nrao.edu, rperley@nrao.edu, and jjackson@nrao.edu

Abstract

The National Radio Astronomy Observatory's Very Large Array (VLA), consisting of twenty-seven 25 meter antennas, is one of the world's premier astronomical radio telescopes. A project to expand the sensitivity of the VLA was launched in 2001. The Expanded Very Large Array (EVLA) project required new wideband hardware designs throughout the entire system. The designs are now complete and have been implemented in about half the array.

The EVLA, in contrast with the VLA, is a wideband instrument. The astronomical signals are captured by a suite of new receivers, some a full octave wide, that cover sky frequencies from 1 to50 GHz. The down-converters support wideband signals that parse and convert the receiver signals into eight 2-4 GHz bandpass signals. Each bandpass signal is digitized by a 3-bit sampler for a total of 32 Giga-samples/second or 96 Giga-bits/second.

The sampled digital data are formatted and sent to the correlator via an optical digital transmission system. After formatting, each antenna produces 120 Gbits/second of optical data. The transmission system uses commercial telecom OC192 hardware and an NRAO developed data format. The entire array, upon completion, will produce over 3.2 Tbits/second of data.

This paper discusses the wideband techniques used to receive, down-convert, sample, and transmit the astronomical data to the correlator. Performance data from the receivers, the down-converters, and the data transmission system are presented. The EVLA project is a success in many ways. The new hardware meets or exceeds the scientific requirements published 2001. The wideband techniques used throughout the instrument are, in many cases, applicable to the next generation of radio telescopes.