

## **A Broadband Downconverter for the K-band Radio Astronomy Receiver on the NASA 70 m Canberra Antenna**

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The 70 m antenna (Tidbinbilla) at the NASA Deep Space Complex in Canberra is equipped with a dual-beam K-band (17 GHz – 27 GHz) radio astronomy system. This antenna is the largest cm-wavelength antenna in the southern hemisphere, the band contains a number of key molecules (H<sub>2</sub>O, NH<sub>3</sub>) and complements ALMA Band 1 (35 GHz – 52 GHz), and the antenna can operate as part of the Australian Long Baseline Array (LBA).

A new broadband downconverter is in development to replace the current downconverter, with the goal of providing more robust and reliable performance. The new implementation will downconvert the entire 17 GHz – 27 GHz band from the dual-beam, dual-polarization receiver, providing four single side-band intermediate frequencies (IF). The four IF signals will be sent to the signal processing center at the base of the antenna with optical fiber units, and then further downconverted using an array of filters, oscillators, and mixers into DC – 1 GHz IF signals for the ROACH2 based digital signal processors.

This development will yield several major improvements. This approach greatly simplifies the signal processing that occurs in the antenna cone, replacing the array of 20 quadrature mixers and quadrature hybrids that produces 40 dual side-band IFs in the current implementation. This scheme moves components of the downconversion process from the antenna cone to the more stable signal processing center at the base of the 70 m antenna and reduces the number of required fiber units from 40 to four. The new downconverter will also provide a single broadband IF signal that will eventually be required for the use of broadband digitizers currently in development at JPL, thus allowing the continued operation of the currently available digital backends while being compatible with future backend developments. We will present the design of the new downconverter and progress on a prototype now being assembled at JPL.