

NRC-HAA Cryogenic Radio Receiver Development

The Radio Instrumentation Team (RIT) team at NRC Herzberg in Victoria, Canada, is developing a dual linear polarization, cryogenic radio astronomy receiver covering the frequency range of 30.5 to 50.5 GHz for the next generation Very Large Array (ngVLA) project. The specification of this receiver development is aligned with ngVLA Band 5 requirements. This receiver is designed for a noise temperature of less than 25 K over the bandwidth. The proposed receiver uses a vacuum vessel and a two-stage cryopump system for a cryogenic environment which provides 16 K and 70 K stages. The proposed receiver consists of a cryostat with a cooled feed horn, a turnstile OMT plus two integrated noise couplers for noise calibration, two mHEMT MMIC cryogenic low noise amplifiers with noise temperature lower than 14 K, IR filters, and a vacuum window to create a low-loss transmission of electromagnetic fields into the cryostat.

The RIT team is also working on designing and developing various high-efficiency and wideband feed horns, vacuum windows, and OMTs. So far, a compact, low noise octave band OMT, multiple octave band feed horns, and a vacuum window covering the frequency range of 25-50 GHz have been designed. Most of the waveguide components designed and developed for the ngVLA Band 5 and octave band receiver are scalable to higher and lower frequency bands.

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