

The Radiometer Atmospheric CubeSat Experiment Payload Pre-Flight Integration and Test Results

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The Jet Propulsion Laboratory (JPL) is developing the Radiometer Atmospheric CubeSat Experiment (RACE), a water vapor radiometer integrated on a 3U CubeSat platform. RACE will measure 2 channels of the 183 GHz water vapor line utilizing 35 nm Indium Phosphide (InP) high electron mobility transistors (HEMT) for the low noise amplifiers (LNA) and a novel amplifier based internal calibration subsystem. The 3U spacecraft will be provided by the University of Texas at Austin's Satellite Design Laboratory.

The radiometer utilizes a direct detect topology to reduce power draw. The front end RF system to the detector output only requires ~20 mW of power. The complete payload electronics draws ~1 W, with the majority of power utilized for payload command and data handling (C&DH). Internal calibration consists of a coupled amplifier based noise-source and a Dicke switch to a matched load. During operations on orbit, cold sky and other vicarious scenes will also be utilized for calibration.

The integrated system noise figure has been measured to be approximately 10.5 dB, driven primarily by the performance of the Dicke switch. The typical noise figure of the LNAs is 4.5 dB. Across the expected temperature range, the gain of the system changes by 0.06 dB/K. The LNA noise source adds 50-300 K depending on the channel and temperature. Characterization tests are ongoing.

RACE was selected for launch by the NASA CubeSat Launch Initiative (CSLI) in 2012 and is expected to be launched in Q2 2014.