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Calibration and Performance Of The Juno Microwave Radiometer In Jupiter Orbit

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The NASA Juno mission was launched from Kennedy Space Center on August 5th, 2011. Juno is a New Frontiers mission to study Jupiter and carries as one of its payloads a six-frequency microwave radiometer to retrieve the water vapor abundance in the Jovian atmosphere, down to at least 100 bars. The Juno Microwave Radiometer (MWR) operates from 600 MHz to 22 GHz and was designed and built at the Jet Propulsion Laboratory. The MWR radiometer system consists of a MMIC-based receiver for each channel that includes a PIN-diode Dicke switch and three noise diodes distributed along the front end for receiver calibration. The receivers and electronics are housed inside the Juno payload vault, which provides radiation shielding for the Juno payloads. The antenna system consists of patch-array antennas at 600 MHz and 1.2 GHz, slotted waveguide antennas at 2.5, 5.5 and 10 GHz and a feed horn at 22 GHz, providing 20-degree beams at the lowest two frequencies and 12-degree beams at the others.

Since launch, MWR has operated nearly continually over the five year cruise. During this time, the Juno spacecraft is spinning on the sky providing the MWR with an excellent calibration source. Furthermore, the spacecraft sun angle and distance have varied, offering a wide range of instrument thermal states to further constrain the calibration. An approach was developed to optimally use the pre-launch and post-launch data to find a calibration solution which minimizes the errors with respect to the pre-launch calibration targets, the post-launch cold sky data and the component level loss/reflection measurements. The extended cruise data allow traceability from the pre-launch measurements to the science observations. In addition, a special data set was taken at apojove during the capture orbits to validate the antenna patterns in-flight using Jupiter as a source. An assessment of the radiometer calibration performance during the first science orbits will be presented. Both the absolute and relative performance will be shown. The relative calibration is assessed by evaluating the temporal stability over the pass and the forward looking and aft looking observations of the same point in the atmosphere.