THE CUBESAT RADIOMETER RADIO FREQUENCY INTERFERENCE TECHNOLOGY VALIDATION (CUBERRT) MISSION

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The CubeSat Radiometer Radio Frequency Interference Technology Validation (CubeRRT) mission was developed to demonstrate radio frequency interference (RFI) detection and mitigation technologies for future microwave radiometer remote sensing missions. CubeRRT is a 6U CubeSat that deployed on July 13th, 2018 from the International Space Station and performs observations of Earth brightness temperatures in 1 GHz channels tunable from 6-40 GHz to demonstrate on-board real-time RFI processing. At present, CubeRRT is continuing bus and payload commissioning activities.

Passive remote sensing measurements below 40 GHz can be significantly impacted by RFI that causes degraded geophysical retrievals, including soil moisture, atmospheric water vapor, sea surface temperature, sea surface winds, and many others. As RFI sources continue to expand over larger areas and occupy additional spectrum, it is increasingly difficult to perform radiometry without an RFI filtering capability. RFI processing on the ground for such systems is not possible because the data volumes needed to convey sufficient information are prohibitive for downlink. Real-time on-board RFI processing is therefore an important technology needed for future missions.

To address this challenge, CubeRRT was designed to demonstrate on-board, real-time RFI processing from 6-40 GHz over one year in orbit. The CubeRRT payload consists of three subsystems: a wideband antenna subsystem, a tunable analog radiometer subsystem, and a digital backend processor performing real-time RFI detection and filtering. The enabling CubeRRT technology is a digital Field-Programmable Gate Array-based spectrometer with a bandwidth of 1 GHz that is capable of implementing kurtosis and cross-frequency RFI detection methods in real-time on board the spacecraft.

The presentation will review CubeRRT's design and associated RFI detection and filtering approaches. Pre-launch test and characterization activities will also be described, along with information on the current mission progress and status. The implications of CubeRRT's results for future Earth observing microwave radiometer missions will also be described.