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

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The CubeSat Radiometer Radio Frequency Interference Technology Validation (CubeRRT) mission is a 6U CubeSat that deployed on July 13th, 2018 from the International Space Station. CubeRRT 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.

CubeRRT's on-board RFI processor uses measurements of both the signal power and kurtosis in 128 frequency subchannels to perform RFI detection using kurtosis and cross-frequency techniques. The kurtosis algorithm flags frequency subchannels whose estimated kurtosis deviates from the value expected for thermal noise by a specified number of standard deviations. The cross-frequency algorithm is designed to flag sub-channels having power levels that are inconsistent with thermal noise expectations given the power measurements of other frequency sub-channels. This is accomplished by flagging subchannels whose power exceeds the median power of all subchannels by a specified number of standard deviations.

Because CubeRRT's RFI processing is performed on "raw" data aboard the spacecraft and not on calibrated power measurements, power variations among frequency sub-channels caused by the instrument passband shape influence the performance of the cross frequency algorithm. CubeRRT's cross-frequency algorithm addresses this issue using two "spectrum flattening" approaches. In the first, spectra acquired from CubeRRT's antenna measurements are divided by those from CubeRRT's internal reference load before proceeding to the cross-frequency processor. This step removes passband variations common to the antenna and reference load states. In the second, a fixed set of "flattening constants" (which vary with the RF center frequency) is multiplied by the measured frequency spectrum before flagging is performed. These approaches can also be combined so that the constant scale factors applied represent expectations for the shape of the antenna over reference spectrum.

The presentation will review CubeRRT's kurtosis and cross-frequency algorithms. Pre-launch test and characterization of algorithm performance will also be described, along with information on the current mission progress and status. The implications of CubeRRT's algorithms for future Earth observing microwave radiometer missions will also be described.