DIGITAL BACK END FOR PERFORMING HIGH RESOLUTION SPECTROMETRY IN CORRELATION RADIOMETERS

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ABSTRACT

In correlation radiometry, the cross spectral density or coherence between the two channels is measured and this is proportional to the difference in brightness temperatures observed at the two input ports. The statistical properties of cross spectra is studied to understand how temporal and frequency domain kurtosis techniques can be applied on cross spectra or coherence function for RFI detection and mitigation. The CU Lobe Differencing Correlation Radiometer (LDCR), an L-band radiometer designed and built by Center for Environmental Technology at CU as a payload for a lightweight small UAS (sUAS) enabling high resolution (~15 m) soil moisture mapping is used for this study. In its current build - LDCR RevB - a digital backend which simultaneously samples both channels at 80 MS/s using a field programmable gate array (FPGA) is implemented to enable RFI detection and mitigation over the 1.400 -1.427GHz RAS/EESS band at a resolution of 20 kHz. The hardware architecture and digital data processing scheme incorporated in LDCR RevB sensor is discussed. The data from bench top tests and initial flight over the test site at Irrigation Research Foundation (IRF) at Yuma, CO is analyzed and the deviation from the expected performance is explained. The architecture of the next revision of the sensor LDCR Rev C building upon the lessons learnt from RevB sensor is also presented.