Characterisation of the TELIS autocorrelator spectrometer

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Abstract

The balloon borne cryogenic heterodyne spectrometer TELIS allows limb sounding of the Earth's atmosphere within the submillimeter and far-infrared spectral range. The instrument was developed by a consortium of major European institutes that includes the Space Research Organisation of the Netherlands (SRON), the Rutherford Appleton Laboratory (RAL) in the United Kingdom and the Deutsche Zentrum für Luft- und Raumfahrt (DLR) in Germany (lead institute). TELIS offers three channels (450-650 GHz, 499-503 GHz, 1.79 – 1.870 THz) and utilises state-of-the-art superconducting heterodyne technology [1].

As a spectrometer a 3-level autocorrelator with complex I-Q-sampling technique is used. It offers the advantage of low energy consumption, being light weight and has a resolution better than 2.5 MHz. A similar spectrometer without I-Q-technique has been successfully used on the ODIN satellite [2].

During gas cell characterization measurements of the TELIS autocorrelator spectrometer however, discrepancies occurred between measured and expected spectra. To investigate and quantify the observed errors, the TELIS autocorrelator spectrometer was referenced against a well known FFT spectrometer [3] in simultaneous measurements. In order to generate well controlled input signals, a 50 Ohm load plunged into temperature stable slush-baths ranging from 77 K to 273 K has been used. The obtained input signal was split, processed and simultaneously fed into both spectrometer inputs for spectral intercomparison. We will show and discuss the obtained experimental results for radiometric characterisation of the TELIS autocorrelator spectrometer.

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