Development of a 2 THz Solid-state Radiometer for Atmospheric Sounding

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Both the interstellar medium and planetary atmospheres are incredibly rich in molecular species with spectral rotational and vibrational signatures that lie in the 1-10 THz frequency range. The atomic oxygen (OI) emission at 2.06 THz (145.525 um) is one of the two brightest emission lines in the terrestrial thermosphere and has been observed from balloon, sounding rocket and orbital platforms [1].

Schottky diode front-end receivers have been demonstrated up to 2.5 THz [2] with a CO2-pumped methanol gas laser local oscillator source. However, recent developments in Schottky multiplier sources show that sufficient power can be obtained at 1 THz to drive a 2 THz sub-harmonic mixer. This makes possible the development of a 2-THz all solid state front-end heterodyne receiver that can be deployed on CubeSat or similar miniature platforms.

Firstly, we will present preliminary development of the 2THz front-end receiver, with a first circuit iteration that features a balanced sub-harmonic mixer similar to previous studies [3], along with a noise temperature measurement system. Secondly, we will discuss further circuit development for a second iteration, including a novel bias-able sub-harmonic mixer. This mixer features an anti-parallel pair of diodes that favors a better trade-off between available power and line losses, and was partially addressed in [4].

References