1.90THz-2.06 THz Schottky Receiver with 4000-6000K DSB Noise Temperature at Room Temperature

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***Abstract*— We report on recent progress made toward highly sensitive room temperature heterodyne receivers at 2THz. Schottky mixer and frequency multiplier devices, designed and fabricated at NASA Jet Propulsion Laboratory, have enabled the demonstration of a room temperature heterodyne receiver sensitive enough to measure the wind velocities, temperature and density in the Earth's thermosphere by observing the emission of the atomic oxygen at 2.06THz.**

***Keywords*—heterodyne, Schottky mixer, THz.**

I. INTRODUCTION

Observing the atomic oxygen line at 2.06 THz in the Earth's 100-200km altitude region with a high spectral-resolution limb-sounder onboard a low Earth orbit satellite can provide global measurements of the neutral winds, temperature and density of the lower thermosphere, which are critical to better understand the underlying mechanisms of the upper atmospheric composition / dynamics/ temperature variability and the role of neutral dynamics on the ionospheric variability. Currently, only heterodyne receivers can provide these measurements with complete local time coverage and desired spatial resolution, precision and accuracy. Before our first reported results [1], only cryogenically cooled Hot-Electron-Bolometer mixers had the necessary sensitivity at 2 THz for such receivers. JPL Schottky technology, however, enables for the first time the construction of a *room-temperature* receiver with sufficient sensitivity to perform these critically needed measurements.

II. RECEIVER DESIGN AND NEW RF RESULTS

The configuration for the 2.06 THz receiver has been presented in [1]. The current version relies on the same Local Oscillator chain which is described in [2], but the sub-harmonic mixer uses a newly fabricated Schottky device that features a bias-able anti-parallel pair of diodes monolithically integrated on a thin GaAs membrane. The design of this mixer (see Fig.1) is rooted on the state-of-the-art 1.2THz sub-harmonic mixer designed for the Submillimeter-Wave-Instrument of the JUpiter ICy moon Explorer [3]. At 2.06THz, a DSB receiver equivalent noise temperature of 6,080K was recorded at room temperature, which is believed to be the best performance of a heterodyne receiver ever reported at this frequency and operating temperature. The mixer is optimally pumped with slightly less than 2mW of LO power and does not require biasing at this pump level. The DSB mixer noise temperature and gain were measured respectively at 5440K and -12.9dB. When operating at 1.92THz the receiver DSB noise temperature reaches a minimum of 4135K with a DSB mixer noise temperature and gain of respectively 3675K and -11.5dB. The measurements were performed in air with a 6cm optical path and 33% humidity at 23°C and with a 5.8-6.5GHz IF filter. Data were corrected for atmospheric attenuation based on version 11.0 of *am*, a program for radiative transfer computations at microwave to submillimeter wavelengths [4]. Raw data for the DSB receiver noise temperature at 2.06THz and 1.92THz are respectively 6322K and 4653K.

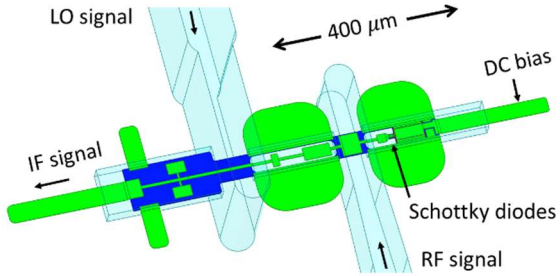

Fig. 1. Schematics of JPL 2.06THz bias-able antiparallel-diode Schottky mixer.

REFERENCES

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