THz Schottky Diode MMICs for Astronomy and the Physics of the Atmosphere

L.Gatilova[1&2], J.Treuttel[1], F. Yang[1&3], T. Vacelet[1], C. Goldstein[4], Y.Jin[2], A. Maestrini[1&5]

[1]*Observatoire de Paris - LERMA,*
[2]*CNRS - Laboratoire de Photonique et de Nanostructures,*
[3]*University of South West, Nanjing, China*
[4]*Centre National d'Etudes Spatiales,*
[5]*Université Pierre et Marie Curie – Paris 6*

Among different technologies available to build THz and sub-THz devices for radio-astronomy, Schottky diodes play a crucial role. In particular planar Schottky diodes on thin GaAs membrane remain key elements of submillimetre-wave mixers and frequency multipliers dedicated to the instrumentation for astrophysics, planetology, the science of the atmosphere and experimental physics.

We report on a 310-360 GHz frequency doubler that LERMA has designed as a demonstrator for the local oscillator of the Submillimeter Wave instrument on JUICE (JUpiter ICy moons Explorer - ESA). This multiplier features 4 anodes in a balanced configuration monolithically integrated on a 59m-thick GaAs membrane circuit connected to a split waveguide-block by metallic beam-leads. The LERMA-LPN circuits have been tested at RF with a 20-45 mW source provided by Radiometer Physics GmbH (RPG). A conversion efficiency of about 15-22% has been measured in the 310-360 GHz band, in very good agreement with simulations. A lifetime test is underway at LERMA since mid-December 2013. After more than 3 weeks of continuous operations at 45mW input, the circuit shows no sign of aging. The design and fabrication process of LERMA-LPN 310-360 GHz frequency doubler will be presented at the conference.

In addition, LERMA-LPN discrete anti-parallel diodes have been tested at RF by RPG on a 448 GHz and a 664 GHz sub-harmonic mixer and with an IF LNA in the 0.5-9 GHz band. The following table shows the measured results [1].

RF Frequency	T_mixer_DSB	G_mixer_DSB	P_LO
448 GHz	~1200K	~ -8dB	1.2 mW
664 GHz	~1550K	~-8dB	2.3 mW

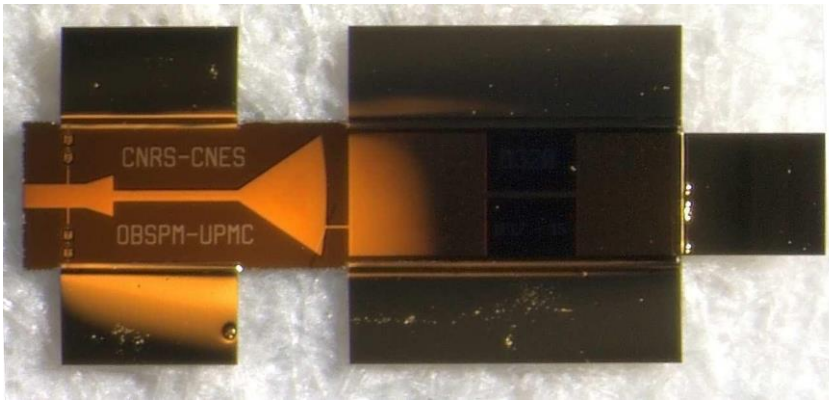

Fig. 1. LERMA-LPN GaAs Schottky diode based 320-340 GHz frequency doubler MMIC circuit.

References

1. Bertrand Thomas, Radiometer Physics GmbH., private conversation, December 2013