Novel Designs for Submillimeter Subharmonic and Fundamental Schottky Mixers

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Abstract

There is a demand for mixers operating in the submillimeter band between 300 and 1200 GHz for observation of various atomic and molecular lines. For Earth and planetary observations Schottky mixers have adequate sensitivity. Additionally, they have the substantial advantage of working with little or no cooling below room temperature, although their performance does improve at lower temperatures. Near term example missions is a proposal for water detection observations on Mars [1], and measurements of middle atmosphere trace gases and gas dynamics on Venus [2].

To meet these requirements, new mixers have been designed to take advantage of the frameless membrane technology developed at JPL [3]. Two circuit topologies have been used for the subharmonic mixers, one based on previous submillimeter subharmonic mixer designs [4], and the other based on the balanced doubler configuration [5]. These are expected to give single sideband noise temperatures at the diode of about 2500 K, with conversion loss around 13 dB. Single-diode single-ended mixers will also be described, and they are expected to give diode SSB noise temperatures near 1000 K, conversion loss about 8 dB.

[1] Report of the NASA Science Definition Team for the Mars Reconnaissance Orbiter (MRO), available at http://mro.larc.nasa.gov/mro/MRO_SDTreport.pdf, Feb. 2001.

[2] Solar System Exploration Survey, Space Studies Board of the National Research Council, "New Frontiers in the Solar System" available at http://www.nas.edu/ssb/SSE-Survey-Report-Part-1.PDF, July 2002.

[3] S. Martin, B. Nakamura, A. Fung, P. Smith, J. Bruston, A. Maestrini, F. Maiwald, P. Siegel, E. Schlecht, and I. Mehdi, "Fabrication of 200 to 2700 GHz multiplier devices using GaAs and metal membranes, " *2001 MTT-S International Microwave Symposium Digest*, pp. 1641-1644.

[4] E.R. Carlson, M.V. Schneider, and T.F. McMaster, "Subharmonically pumped millimeter-wave mixers," *IEEE. Trans. Microwave Theory Tech.*, vol MTT-26, no. 10, pp. 706-715, Oct. 1978.

[5] E. Schlecht, G. Chattopadhyay, A. Maestrini, A. Fung, S. Martin, D. Pukala, J. Bruston, and I. Mehdi, "200, 400 and 800 GHz Schottky diode 'substrateless' multipliers: design and results", *2001 MTT-S International Microwave Symposium Digest*, pp. 1649-1652.