M3A

Terahertz Local Oscillator Sources

T.W. Crowe*, J.L. Hesler, W.L. Bishop, G.S. Schoenthal, and K. Hui
Virginia Diodes, Inc., Charlottesville, VA 22902
* Contact: Crowe (a) VADiodes.com, phone (434)297-3257

***Abstract*—High quality local oscillator sources are required for astronomical receivers throughout the terahertz frequency range. This paper is focused on the development of sources for frequencies greater than 1 THz for use with Hot Electron Bolometric (HEB) mixers, specifically on the Stratospheric Observatory For Infrared Astronomy (SOFIA). One of the great advantages of HEB mixers is their very low LO power requirements, of order one microwatt per pixel (including coupling losses). However, the challenges of achieving even this power level at such high frequency remain significant, and the goals for significant tuning bands to enhance the measurement capability of the receiver are formidable. Also, there is great interest in developing array receivers, which will increase the required power level by a factor of ten.**

VDI's terahertz sources are based on high power amplifiers, typically near 40GHz, and a series of frequency multipliers that translate the power to higher frequency, albeit with very significant losses. For example, three years ago VDI (in collaboration with SRON) presented a 1.3THz source that generated of order 10uW and was electronically tunable over 100GHz of bandwidth. This source used an amp/x2x2x3x3 configuration, where the doublers were high power varactors and the triplers were broadband varistor multipliers. In fact, the triplers were shown to operate with similar performance across the entire waveguide band (1.1-1.7THz) without any tuning whatsoever. These same triplers have been used to generate greater than 30uW, when stronger driver components have been used.

More recently VDI has focused on the 1.9 and 2.7THz bands that are of interest for the German Receiver for Astronomy at Terahertz Frequencies, which is being developed by the Max-Planck-Institut für Radioastronomie (MPIfR) and the Universität zu Köln for use on the SOFIA aircraft. At 1.9 THz VDI has delivered an initial LO chain that generates a few microwatts of power, which is marginally sufficient to pump the receiver when the coupling losses into the dewar are included. In this paper VDI will describe this LO chain and the ongoing efforts to increase the output power by an order of magnitude for use on a future receiver array. The 2.7 THz frequency band is significantly more challenging, owing to the increased inefficiency of Schottky multipliers at the higher frequency. The goal is to generate enough power for a single pixel receiver with significant frequency tuning. To date VDI has demonstrated the required driver module at 300GHz and is presently working on an improved tripler to 900GHz. The final tripler to 2.7THz has been designed and is awaiting fabrication. First results for the new components are expected to be available in time for the conference presentation.