Dual-Chip Power Combiner using 300 GHz Tripler with Diamond Heat-Spreaders

Choonsup Lee[1*], Lorene Samoska[1], Robert Lin[1], Bertrand Thomas[2], Alain Maestrini[3], Imran Mehdi[1]
1 Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109
2 Radiometer Physics GmbH, Meckenheim, Germany
3 Universite Pierre et Marie Curie-Paris 6, LERMA, Paris, France
* Contact: Choonsup.Lee@jpl.nasa.gov, phone +1-818-393 7140

***Abstract*—Currently several Watts of power in W-band (75-100 GHz) are available attributable to recent advances in GaN-based MMIC power amplifiers. Unfortunately, the current first stage GaAs multiplier in chain driven by W-band amplifier cannot handle that much power because of the elevated temperature problem which limits power handling capability. Therefore, the power handling capability of the first stage multiplier is the limiting factor for more output power at the entire terahertz frequency band in multiplier chain LO sources. Our group had proposed, implemented, and presented 'diamond heat-spreader' on the backside of the multiplier in order to reduce the operating temperature of the multiplier and obtained 100 % increase in power handling capability in the past. In this paper, we have applied the multipliers with diamond heat-spreader to a dual-chip power combiner at 300 GHz to obtain additional doubling of the power handling capability of the multipliers by utilizing the power combining technique.**

Tests of a dual-chip power combiner with diamond heat-spreader in the range of 260-300 GHz band showed that the conversion efficiency remained flat at approximately 8% up to 470 mW input power, with 37 mW of output power. For the same dual-chip power combiner without diamond heat-spreader, the conversion efficiency drops from 12% to 10 % at 200 mW input power due to heating of the diodes, with 23 mW of output power. 200 mW is the highest input power dual-chip without diamond can tolerate while dual-chip with diamond is able to handle 470 mW input power. It is important to note that these frequency multipliers were not originally designed for diamond heat spreaders, and that optimized design tuned for the additional dielectric material loading to the waveguides should operate with higher conversion efficiency. We will present the measurement results of power sweep and frequency sweep.