Reliability and Reproducibility of Discrete Schottky Diodes-Based Sources up to 370 GHz

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Abstract— We present a set of two different THz sources covering the 275-360 GHz frequency range average output power of 14-15 dBm. This power is obtained without any power combining technique allowing a significant reduction in the complexity of the source and the number of components. The presented sources are based on ACST high power frequency doublers covering the 135-185 GHz and 270-370 GHz frequency ranges based on novel Schottky-varactor discrete diode structures and assembly process. These varactor diodes integrate a CVD-diamond substrate to increase the thermal dissipation capabilities and provide higher power handling capabilities to the doubler chip. The first source presented in this work cover the frequency band proposed for the submillimeter wave instrument (SWI) in the ESA's mission JUICE-SWI, and it demonstrates high reproducibility and reliability. The D and G-band doublers can safely handle up to 600 mW input power to provide 160-180 mW output power. However, the D-band doubler (135-160 GHz) doubler has demonstrated 250 mW output power using 1 W input power without failure. The Y-band doublers can safely handle up to 140 mW input power to provide 30-40 mW output power. An overview of the experimental results compared to simulated predictions are discussed here.

1. RESULTS

Nowadays the market volumes for submm-wave sources and receivers are very limited. Moreover, specification requirements may vary from one particular application to another. Under these conditions, the use of discrete diode structures for frequency multipliers and mixers is of significant advantages in comparison to monolithically-integrated MMIC diode circuits, concerning flexibility and price. The experimental results of two different manufactured THz sources are plotted in Fig. 1. The first source operates in the 275-315 GHz frequency range, and it consists of an active multiplication chain (AMC) to reach E-band (60-90 GHz) and two multiplication stages at 135-160 GHz and 270-320 GHz. The second source is a scaled version of the first one to operate in the 315-360 GHz frequency range. The second source consists of an AMC to reach E-band and two multiplication stages at 155-185 GHz and 310-370 GHz. Commercial 71-76 GHz and 81-86 GHz high power amplifiers are used in source one and two, respectively, to build up the setups. The maximum power achieved by these sources is between 14-16 dBm with >15 % bandwidth. These sources are defined using discrete Schottky diodes without any power combined technique in the multiplication chain. These discrete diodes-based sources provide state-of-the-art performance previously defined only by MMIC sources [1].

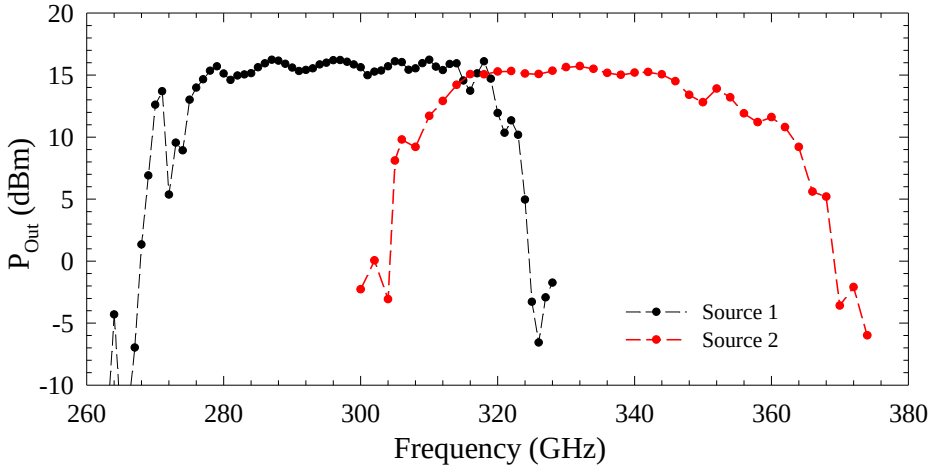

Fig. 1. Output power provided by two different THz sources developed at ACST.

[1] D. Moro-Melgar, O. Cojocari, and I. Oprea. "High Power High-Efficiency 270-320 GHz Source Based on Discrete Schottky Diodes." In *2018 15th European Radar Conference (EuRAD)*, pp. 337-340. IEEE, 2018.