Advances in High-Power THz Sources

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Solid-state sources based on amplifier-multiplier-chains (AMCs) continue to serve as the source of choice for radio astronomy and atmospheric sensing. As the available output power continues to increase, other applications are also being enabled. These include plasma diagnostics, ESR, DNP-NMR, and radar imaging systems. This paper will review recent developments at VDI that are leading to record power levels as well as more reliable and compact sources.

As an example, Fig. 1 indicates the output power from a ~260 GHz source; roughly 250 mW across a useful band of 10 GHz. This result is made possible through the use of diode multipliers optimized for high power handling, in terms of both electrical and thermal design. Two-way in-phase, power combining is also used for the final two frequency doublers. Significant further improvements are anticipated with higher levels of power combining and/or the cooling of the components (for applications where cooling is feasible). Sources such as these are also useful to drive multiplier into the range well above 1 THz, and data for these higher bands will be presented at the conference.

Figure 2 shows the power from a similar source using broadband components. In this case, roughly 100mW is available across the entire WR10 waveguide band. This performance has been enabled through the use of a newly available amplifier technology. The power available from these broadband sources can also be multiplied to higher frequency, resulting in the results shown in Fig. 3.

The potential for further improvements in this source technology will be summarized at the conference.

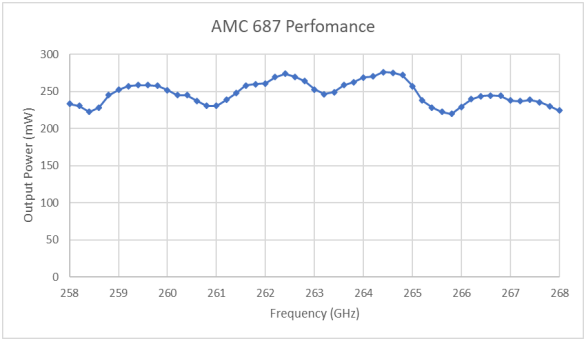

Fig. 1. The measured power of a VDI source. The multiplier bias and amplifier power are optimized at each point. (All power levels measured with PM5 power meter.)

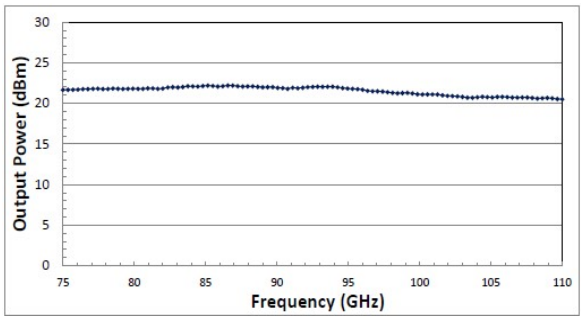

Fig. 2: Power from a broadband (WR10.0) source.

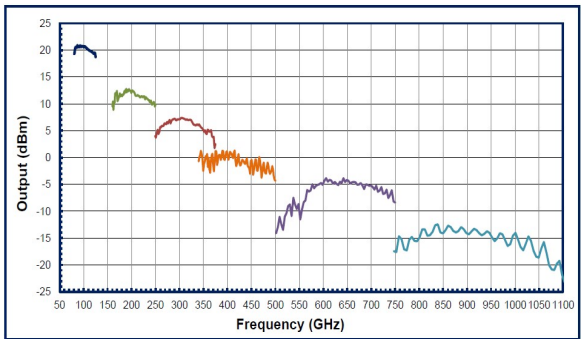

Fig. 3: Power from a broadband modular (reconfigurable) source using a driver module (similar to Fig. 2) and a standard set of frequency multipliers.

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