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Title:Demonstration of a room temperature 2.48-2.75 THz coherent spectroscopy source
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Abstract:We report the first demonstration of a continuous wave coherent source covering 2.48-2.75 THz, with greater than 10 instantaneous tuning bandwidth and having 1-14 uW of output power at room temperature. This source is based on a 91.8-101.8 GHz synthesizer followed by a power amplifier and three cascaded frequency triplers. It demonstrates for the first time that purely electronic solid-state sources can generate a useful amount of power in a region of the electromagnetic spectrum where lasers (solid state or gas) were previously the only available coherent sources. The bandwidth, agility, and operability of this THz source have enabled wideband, high resolution spectroscopic measurements of water, methanol, and carbon monoxide with a resolution and signal-to-noise ratio unmatched by any other existing system, providing new insight in the physics of these molecules. Furthermore, the power and optical beam quality are high enough to observe the Lamb-dip effect in water. The source frequency has an absolute accuracy better than 1 part in 1012 and the spectrometer achieves sub-Doppler frequency resolution better than 1 part in 108. The harmonic purity is better than 25 dB. This source can serve as a coherent signal for absorption spectroscopy, a local oscillator for a variety of heterodyne systems and can be used as a method for precision control of more powerful but much less frequency agile quantum mechanical terahertz sources.
Number of references:57