A 1.5 THz hot-electron bolometer mixer operated by a planar diode-based local oscillator

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We describe a 1.5 THz heterodyne receiver based on a superconducting hot-electron bolometer mixer, which is pumped by an all-solid-state local oscillator chain. The bolometer is fabricated from a 3.5 nm-thick niobium nitride film deposited on a quartz substrate with a 200 nm-thick magnesium oxide buffer layer. The bolometer measures 0.15 μm in width and 1.5 μm in length. The chip consisting of the bolometer and mixer circuitry is incorporated in a fixed-tuned waveguide mixer block with a corrugated feed horn. The local oscillator unit comprises of a cascade of four planar doublers following a MMIC-based W-band power amplifier. The local oscillator is coupled to the mixer using a Martin-Puplett interferometer. The local oscillator output power needed for optimal receiver performance is approximately 1 to 2 μW, and the chain is able to provide this power at a number of frequency points between 1.45 and 1.56 THz. By terminating the rf input with room temperature and 77 K loads, a *Y*-factor of 1.11 (DSB) has been measured at a local oscillator frequency of 1.476 THz at 3 GHz intermediate frequency.