Room temperature terahertz heterodyne detection using unipolar nanodiodes

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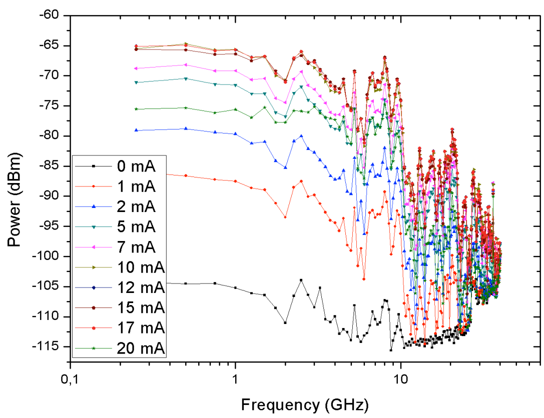
Terahertz (THz) communication is envisioned as a key technology to deal with the dramatic increase of data traffic due to a change in the way today's society creates, shares and consumes information. Presently, there is no compact, affordable and integrated THz demodulator that is suitable for high-data-rate communications at room temperature. Schottky-barrier diodes, well established now, offer high-sensitivity and up to several 10'GHz detection bandwidth but suffer of medium/high output impedance, thus limiting its compatibility with integrated circuits such as demodulation circuits. One solution consists to use the heterodyne scheme to achieve THz-communication link.
In this presentation, we propose to investigate the performances of unipolar nanodiodes mixers for communications in the heterodyne scheme.



IF power versus its frequency for different values of the applied current. The RF frequency is 280 GHz and the LO varies between 280 and 320 GHz.

Unipolar nanodiodes have been used as mixers for heterodyne detection of two THz incoming radiations at room temperature; the resulting signal has been transposed into a measurable GHz IF-signal. In this first implementation, the IF signal has been tuned between 0 GHz and 40 GHz with a dynamic range of 70 dB combining the advantages of a large IF-bandwith simultaneously with reasonable conversion losses.

As the concept of Unipolar nanodiodes doesn't present intrinsic limitation to operate at higher frequencies, once proper scaling is optimized to this application, the planar geometry and the ease of fabrication of those nanodiodes makes them as highly competitive in the prospect of new generation of room temperature terahertz mixers.