

272. Title: Measurement of optical-beat frequency in a photoconductive terahertz-wave generator using microwave higher harmonics

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Abstract: A new method for measuring optical-beat frequencies in the terahertz (THz) region using microwave higher harmonics is presented. A microwave signal was applied to the antenna gap of a photoconductive (PC) device emitting a continuous electromagnetic wave at about 1 THz by the photomixing technique. The microwave higher harmonics with THz frequencies are generated in the PC device owing to the nonlinearity of the biased photoconductance, which is briefly described in this article. Thirteen nearly periodic peaks in the photocurrent were observed when the microwave was swept from 16 to 20 GHz at a power of -48 dBm. The nearly periodic peaks are generated by the homodyne detection of the optical beat with the microwave higher harmonics when the frequency of the harmonics coincides with the optical-beat frequency. Each peak frequency and its peak width were determined by fitting a Gaussian function, and the order of microwave harmonics was determined using a coarse (i.e., lower resolution) measurement of the optical-beat frequency. By applying the Kalman algorithm to the peak frequencies of the higher harmonics and their standard deviations, the optical-beat frequency near 1 THz was estimated to be 1029.81 GHz with the standard deviation of 0.82 GHz. The proposed method is applicable to a conventional THz-wave generator with a photomixer.