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Millimeter-wave and terahertz spectroscopy for the detection of ionized air and chemical vapor BENJAMIN GRABER, US. Naval Research Laboratory/Temple University, RONGJIA TAO, Temple University, DONG HO WU, US. Naval Research Laboratory —
Our previous work has demonstrated that the time domain terahertz spectroscopy (TDTS) of chemical vapor or ionized air produces characteristic spectrum from which one can identify chemicals or an ionization source, such as nuclear isotopes. While the average power of TDTS is only less than micro-Watts, the peak power of terahertz pulse can exceed kilo-Watts. When terahertz pulse is concentrated within a small area this large peak power produces a very large electric field, exceeding several kV/m. We investigate the field strength dependence of TDTS to see how it affects the detection capability of TDTS for chemical vapor and ionized air when the peak power is varied over the range from a few mW to kW. At the same time we performed similar experiments using a CW millimeter-wave spectroscopy over the frequency range from 75 GHz to 110 GHz and the power strength range from a few micro-Watts to several mW. We will present the details of our experimental results and discuss the merits of both systems for accuracy and long range detection of vapors. We will also examine some theory to understand the data.

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