A 675 GHz FMCW Radar with Sub-Centimeter Range Resolution

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Remote sensing systems operating in the submillimeter spectrum using heterodyne techniques hold great promise for concealed weapons detection, surveillance, and planetary exploration. Here we describe a novel versatile system at 675 GHz capable of high range-resolution radar operation, broadband coherent active imaging, and high resolution spectroscopic studies.

In this paper we describe the system architecture, performance requirements, and preliminary results of the novel all-solid-state radar system with spectroscopic imaging capability operating at 675 GHz. By using the frequency-modulated continuous-wave (FMCW) technique over a bandwidth of 18 GHz, this submillimeter radar is capable of a range resolution below one centimeter. Using a scanning single-pixel transceiver with a modest aperture size and output power, the radar is capable of generating detailed three-dimensional images of concealed targets at stand-off distances of many meters. Our measurements also suggest that the FMCW range-gating technique can reduce clutter noise when acquiring spectroscopic information of target substances. With anticipated improvements in performance and cost, THz radar technology with 3-D imaging and spectroscopic capability may become an effective tool for a variety of national security, civil, and scientific applications.

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