Submitted *to the 14th Cornell University Conf.*, August 1993

# FABRICATION AND CHARACTERIZATION OF PLANAR INTEGRATED SCHOTTKY DEVICES FOR VERY HIGH FREQUENCY MIXERS

I. Mehdi and P.H. Siegel
Jet Propulsion laboratory,
California Institute of Technology, Pasadena, CA 91109

Many millimeter-wave mixers and frequency multipliers today still employ a whisker contacted Schottky diode as the nonlinear device. in order to reduce the risk and assembly cost associated with these critical receiver components for NASA's present and future space missions, the authors have been investigating more reliable, easy-to-handle, planar integrated diode structures. For applications at or above 600 GHz, the discrete diode is integrated with additional mixer circuitry in a hybrid GaAs-on-quartz package to increase flexibility and simplify assembly.

We have recently designed and tested a 215 GHz subharmonically pumped waveguide mixer using discrete planar antiparallel-pair devices fabricated with the surface channel technology developed at the University of Virginia. Our best measured result with these devices are at 205 GHz where we obtained a single sideband noise temperature of 1590 K and a conversion loss of 8.7 dB. This performance is slightly better than that of the best whisker-contacted diodes in a similar subharmonic mixer mount and demonstrates that, at least up to 200 GHz, planar diode technology is competitive with the whisker-contacted honeycomb diode structure. For higher frequency operation the discrete diode approach becomes untenable as the smallest handleable package size becomes a significant fraction of a wavelength.

This paper will focus on the fabrication technique that we have developed to integrate the discrete planar GaAs diodes with additional mixer filter circuitry fabricated on fused quartz, Preliminary results from utilizing this approach to fabricate a 640 GHz planar diode mixer will be presented. A new vertical diode structure for stepping to frequencies above 600 GHz will also be proposed and its advantages, based upon computer simulations, will be discussed.