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Broadband Schottky Receivers for Atmospheric Studies

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***Abstract*—Microwave limb sounding of the Earth's atmosphere is well developed as a means to gain greater understanding of atmospheric chemistry; particularly with regard to ozone depletion and greenhouse warming. More recently scientists have considered long-duration missions to study the atmospheres of other planets, particularly Venus and Mars, as well as the atmospheres of the major moons of the gas giant planets. Of particular interest is the proposed Vesper mission to Venus which would use heterodyne receivers in the frequency band from about 440-590GHz. Schottky receivers are ideal for such a mission because they achieve the required sensitivity without any need for cooling and can be easily tuned across very significant frequency bands. Through a NASA SBIR project (Contract NNX09CA57C), VDI is developing an improved mixer technology that would be optimal for Vesper and other similar missions. Specifically, VDI is striving to simplify the Vesper receiver through the development Schottky receivers that can be tuned across the entire waveguide band without any mechanical or bias adjustments. For Vesper VDI proposes the use of a subharmonically pumped mixer that operates in the WR-1.9 waveguide band (400-600GHz). This mixer requires no bias and the Phase 1 study has shown that excellent sensitivity (Tmix ~ 1,000-2,000K, DSB) can be achieved across a very broad frequency band with only 1-2mW of LO power. In Phase 2 VDI will co-design the mixer and LO multipliers to achieve a receiver system that allows tuning of the LO frequency across the required Vesper band with no adjustments other than the frequency of the input oscillator, while maintaining the sensitivity noted above and potentially reducing the required LO power level. The presentation will review that performance of this mixer design, with emphasis on the work being done to achieve full waveguide band performance and discussion of the development of the LO oscillator chain.**