



Schottky Heterodyne Receivers With Full Waveguide Bandwidth

New receivers are designed for high-resolution spectroscopic studies.

Goddard Space Flight Center, Greenbelt, Maryland

Compact THz receivers with broad bandwidth and low noise have been developed for the frequency range from 100 GHz to 1 THz. These receivers meet the requirements for high-resolution spectroscopic studies of planetary atmospheres (including the Earth's) from spacecraft, as well as airborne and balloon platforms. The ongoing research is significant not only for the development of Schottky mixers, but also for the creation of a receiver system, including the LO chain.

The new receivers meet the goals of high sensitivity, compact size, low total power requirement, and operation across complete waveguide bands. The exceptional performance makes these receivers ideal for the broader range of scientific and commercial applications. These include the extension of sophisticated test and measurement equipment to 1 THz and the development of low-cost imaging systems for security applications and industrial process monitoring. As a particular example, a WR-1.9SHM

(400–600 GHz) has been developed (see Figure 1), with state-of-the-art noise temperature ranging from 1,000–1,800 K (DSB) over the full waveguide band. Also, a Vector Network Analyzer extender has been developed (see Figure 2) for the WR1.5 waveguide band (500–750 GHz) with 100-dB dynamic range.

This work was done by Jeffrey Hesler and Thomas Crowe of Virginia Diodes, Inc. for Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15798-1

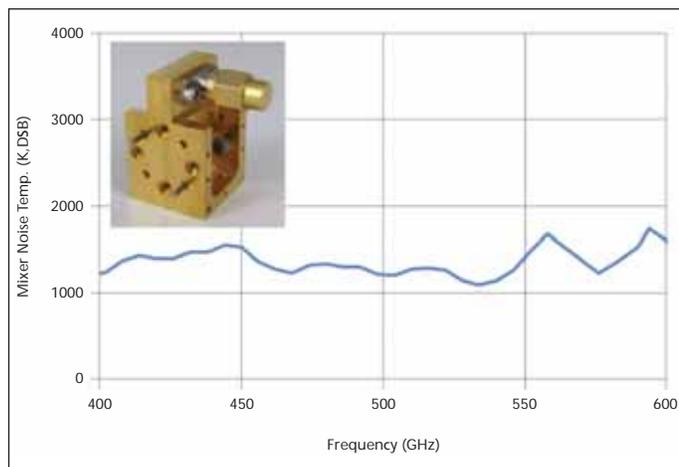


Figure 1. Measured Performance of a WR-1.9 (400–600 GHz) subharmonic mixer (shown in inset).

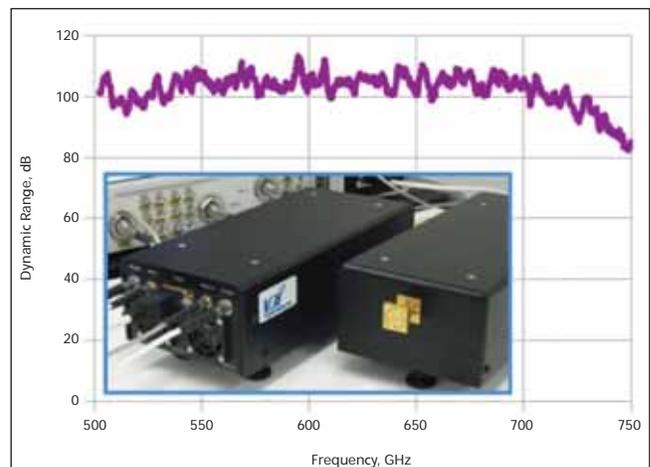


Figure 2. Measured Dynamic Range of a VDI WR-1.5 (500–750 GHz) VNA frequency extender module.

Carbon Nanofiber-Based, High-Frequency, High-Q, Miniaturized Mechanical Resonators

These miniature resonators can be used in portable electronics, communications systems, and other wireless systems.

NASA's Jet Propulsion Laboratory, Pasadena, California

High Q resonators are a critical component of stable, low-noise communication systems, radar, and precise timing applications such as atomic clocks. In electronic resonators based on Si integrated circuits, resistive losses increase as a result of the continued reduction in device dimensions, which decreases their Q values. On the other hand, due to the

mechanical construct of bulk acoustic wave (BAW) and surface acoustic wave (SAW) resonators, such loss mechanisms are absent, enabling higher Q-values for both BAW and SAW resonators compared to their electronic counterparts. The other advantages of mechanical resonators are their inherently higher radiation tolerance, a factor that makes them

attractive for NASA's extreme environment planetary missions, for example to the Jovian environments where the radiation doses are at hostile levels. Despite these advantages, both BAW and SAW resonators suffer from low resonant frequencies and they are also physically large, which precludes their integration into miniaturized electronic systems.