

Bachelor Thesis Task in the Electrical and Information Engineering Program

Topic: Realization of a Transfer Substrate THz Measurement Setup for Characterizing RTD Oscillators

Task:

Powerful oscillators and sensitive detectors are needed in the sub-THz and THz range of 0.1 – 1 THz. This frequency spectrum is particularly well-suited for security applications, such as 3D imaging of dangerous objects hidden under clothing, as THz waves are not strongly absorbed by clothing. Another potential application of this frequency spectrum lies in communication technology, where high data rates can be achieved in wireless point-to-point transmission at these high frequencies.

In the framework of this bachelor thesis, a measurement concept for characterizing RTD oscillators will be implemented and analyzed. The oscillators manufactured in this field with slot antennas exhibit a radiation pattern directed towards the substrate. The measurement concept aims to carry out measurements with the help of focusing high-resistivity float-zone (HRFZ) silicon lenses, which allow for collimated free-space radiation directed downward. For the necessary precise alignment to the center of these lenses, a so-called transfer substrate approach will be chosen. This involves modifying an existing free-space measurement setup accordingly.

To establish the transfer substrate process, RTD oscillators will be bonded onto a suitable transfer substrate using a micro-assembly machine (Fineplacer) and optical adhesives. Using electromagnetic (EM) simulations, the choice of transfer substrate material will be investigated to further characterize the measurement setup.

With the implemented measurement setup, the output powers of the available RTD oscillators will then be measured. Initially, a Schottky barrier detector (measurement without frequency information) will be used, followed later by a phase-noise analyzer with harmonic mixers. First, the measurement setup will need to be characterized with the SBD or mixer. The acquisition of output spectra in the frequency ranges of 220-330 GHz and 330-500 GHz of the oscillators represents the ultimate goal of this task.