» 122 GHz Miniature Radar «

CW/FMCW Radar for Unmanned Aerial Vehicles

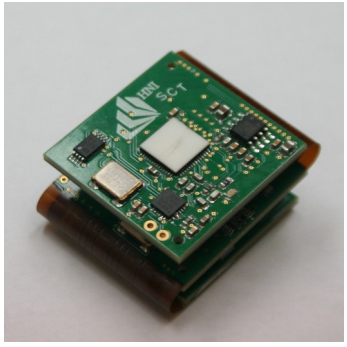
122GHz Radar Project

The collaboration between Heinz Nixdorf Institute and industrial and academic partners in Germany for the creation of a small sensor for Unmanned Aerial Vehicles lead to the implementation of a miniaturized radar system operating at 122 GHz. Partners in this collaboration are IHP Microelectronics, Siliconradar GmbH, Karlsruhe Institute for Technology, PKTEC GmbH and Airrobot GmbH. The project is funded by Bundesministerium für Wirtschaft und Energie (BMWi) in the ZIM program.

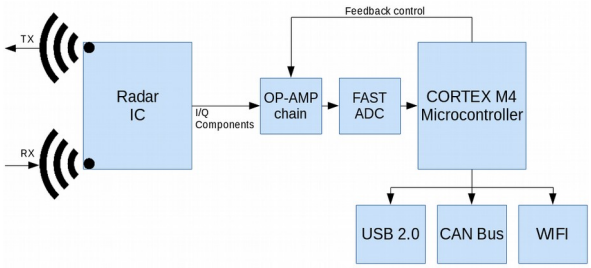
Hexacopter by Airrobot GmbH

Radar System

The complete system is designed using FLEX-PCB technology in order to achieve a small from factor for the sensor. This leads to a total size of **30mmx30mm** for the complete radar system.
The PCB board for the radar signal processing is equipped with fast ADCs in order to acquire the quadrature components from the radar chip, an analog amplification/filtering chain to pre-process the input signal and a micro controller core for calculation. In order to eliminate the necessity for external signal processing through a connected PC the system is equipped with a **CORTEX M4** micro controller. This unit not only auto calibrates the bias for the signal acquisition chain but also performs on-board post-processing such as **FFT** and filtering. The system also includes external communication ports such as **CAN Bus**, **USB 2.0**, and **WIFI**, allowing the possibility for the creation of an array of radars system**.**



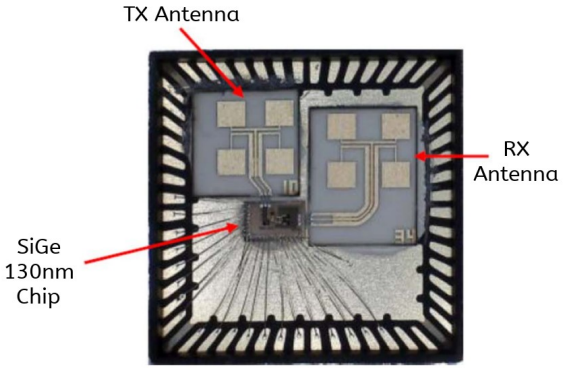
Rigid-FLEX PCB for the 122GHz Radar System



Block Diagram for the 122GHz Radar System

Radar Chip

The core of the system is a 8mmx8mm chip developed in **130nm SiGe BiCMOS** technology using in package antennas. The chip is able to operate in Continuous Wave (**CW**) and Frequency Modulated Continuous Wave (**FMCW**) mode at a center frequency of 122 GHz, allowing measurements of multiple targets velocity and distance. The use of such a high operating frequency allows for small antennas to be integrated in a QFN package leading to a reduction of the total size of the device.



122GHz Radar Integrated Circuit

Applications

Measurements of distance can be operated at a maximum distance up to 10m and with a precision under one millimeter. The low power dissipation of the system, the small form factor and weight of the device and the versatility of the external connection make this device a good solution for sensor fusion systems, sensor arrays for automotive and aerial applications.

System and Circuit Technology
Prof. Dr.-Ing. Christoph Scheytt

Contact:
Federico Nava (navaf@hni.upb.de)