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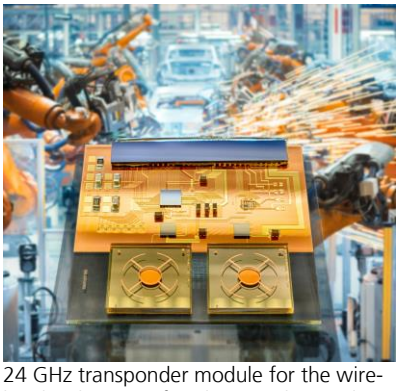
MINIATURIZED 24 GHZ RADAR POSITIONING TRANSPONDER MODULE



24 GHz transponder module for the wireless localization of tools in production lines (copyright Fraunhofer IZM / Volker Mai)

The continuous tracking of tool positions and means of transport is an important factor in terms of efficiency and tracking of safety relevant production steps. The research project Wireless Localization of Systems in Production Lines (NaLoSysPro) developed a miniaturized 24 GHz radar positioning system in order to determine the distance, angle and velocity of objects by signal time-of-flight measurement.

Within the NaLoSysPro consortium Fraunhofer IZM was responsible for the development of a miniaturized 24 GHz transponder module manufactured in thin film multilayer technology.

The miniaturized transponder module consist of a glass wafer substrate, the RF CMOS frontend chip set, SMD passive components and two 24 GHz antennas, one for the RX- and one for the TX-signal path. Due to the good dielectric behavior a borofloat glass wafer substrate is chosen instead of a silicon wafer. The electrical interconnection and signal lines as well as the ground layer are realized with electroplated Cu. These metal layers are separated by Benzocyclobuthene (BCB) dielectric layers. In order to assemble the CMOS chips and the SMD components by soldering onto the transponder substrate, a Cu/Ni/Au pad metallization is used as the top metal layer.

Two 24 GHz thin film antennas are assembled onto the transponder substrate. These antennas are circular polarized patch antennas with capacitive coupled dipoles for broadening of the radiation pattern. The antennas were designed, simulated and finally fabricated using the Fraunhofer IZM wafer level packaging line.
The active CMOS components were designed by the NaLoSysPro project partners and delivered as bare die components. This requires a single chip bumping process which was developed at Fraunhofer IZM.
Finally the CMOS components were assembled in flip chip technology together with the antennas and SMD compnents. A multi-IO flex cable serves as the connection to the backend electronic system.

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