Universität Stuttgart

Institut für Robuste Leistungshalbleitersysteme
Prof. Dr.-Ing. Ingmar Kallfass
Pfaffenwaldring 47
70569 Stuttgart

Institut für Robuste Leistungshalbleitersysteme

Robert Bosch Zentrum für Leistungselektronik
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Synchronous detection for ultra-wide band communication systems operating at E-band carrier frequencies with high data rates.

Mr. Aleksey Dyskin
Technion – Israel Institute of Technology
Institute of Robust Power Semiconductor Systems (ILH), University of Stuttgart

Abstract:

The demand for reliable high speed communication services has been increased with the fast development of modern communication techniques. These techniques support, complement and replace the existing wired solutions, handling ever increasing amounts of data. To enable a high data rate communication, the product of spectrum efficiency (in units of bits/sec/Hz) and channel bandwidth (in units of Hz) should be high enough. At microwave frequencies the available bandwidth is relatively low so the spectrum efficiency should be very high. This leads to complex and sophisticated circuitry and higher-order modulations, and hence in high power consumption and cost.

A possible solution to relax the complexity of the circuitry and the digital processing effort is by decreasing the spectrum efficiency and increasing the bandwidth accordingly. Wireless communication systems that operate at frequencies of 71-86, 240 and 300 GHz can address this issue. However despite the dramatically decreased spectrum efficiency, the increasing high-speed data rates resulting from the wide bandwidth become a very challenging issue to process. Analog-to-digital converter and digital signal processor implementation is seen as a major limitation due to their high power consumption and cost. This can be addressed by performing a carrier phase and frequency synchronization of the received signal in the analog domain with relatively low additional hardware effort and power.

In this research we present a modulation-independent carrier recovery technique. The technique uses a feed-forward controlled leakage transmission carrier, which is transmitted together with the modulated data. The integrated receiver, designed for BPSK modulation, was implemented in a SiGe 0.13um heterojunction bipolar transistor process by IHP. The receiver was tested with an E-band BPSK signal of 640 Mbps.

Short Bio:

Aleksey Dyskin received the BSc and MSc degrees in Electrical Engineering from the Technion – Israel Institute of Technology in 2008 and 2013, respectively. Since 2014 he is pursuing the PhD degree in the joint PhD program of the Technion and the University of Stuttgart, Germany. His research interests include RF and millimeterwave integrated circuits, broadband communications systems and circuit theory.

Between 2007–2010 he worked at Intel as an RFIC engineer. From 2010 to 2014 he worked at Rafael as a senior RFIC engineer. Additionally, Aleksey has been teaching various IC courses at the Electrical Engineering Department of the Technion for over a decade.