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S E M I N A R

Room 119D ZEC

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NOVEL ARCHITECTURE OF AN ALL-DIGITAL TRANSMITTER AND A DISCRETE-TIME RECEIVER FOR WIRELESS APPLICATIONS

by

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Abstract: We present a novel digitally-intensive architecture of a highly-integrated multi-GHz frequency synthesizer, transmitter and receiver implemented in a digital deep submicron CMOS process. The conventional RF frequency synthesizer architecture based on the voltage-controlled oscillator and the phase/frequency detector and charge-pump combination has been replaced with a digitally-controlled oscillator and a time-to-digital converter. The TX architecture is fully digital and takes advantage of the wideband frequency modulation capability of the all-digital PLL. The receiver uses direct RF sampling with discrete-time analog and digital signal processing. Application of the presented ideas has resulted in drastic cost, area and power savings. The ideas have been successfully demonstrated in two commercial Texas Instruments single-chip Bluetooth radios: BRF6100 and BRF6150. They are being extended for more demanding cellular applications and serve as a foundation for a software-defined radio.

Robert Bogdan Staszewski received the BSEE (summa cum laude), MSEE and PhD degrees from the University of Texas at Dallas in 1991, 1992 and2002, respectively. From 1991 to 1995 he was with Alcatel Network Systems in Richardson, TX, working on Sonnet cross-connect systems. He joined Texas Instruments in Dallas, TX, in 1995 where he is currently a Senior Member of Technical Staff. He has been engaged there in advanced CMOS read channel development and then from 1999 in RF CMOS synthesizer design for short distance wireless and cellular phones. His research interests include RF transceivers, frequency synthesizers, high-speed and low-power digital circuits and system implementation in a deep-submicron CMOS process.