Session 14 (Focus): Compound Semiconductor and High Speed Devices - Future Technologies Towards Wireless Communications: 5G and Beyond
Tuesday, December 4, 9:00 AM
Continental Ballroom 5
Co- Chairs: K. Makiyama, Fujitsu Laboratories, Ltd.
S-C Shen, Georgia Tech

9:05 AM - 9:30 AM
14.1 Intel 22nm FinFET (22FFL) Process Technology for RF and mmWave Applications and Circuit Design Optimization for FinFET Technology (Invited), *H.-J. Lee, S. Rami, S. Ravikumar, V. Neeli, K. Phoa, B. Sell, and Y. Zhang, Intel Corporation*

Intel 22FFL is a unique FinFET process technology optimized for RF and mmWave applications supporting superior RF performance to planar technologies with both f_t and f_max of NMOS above 300 GHz and 450 GHz respectively. Flicker noise improvement over planar technologies and excellent gain-power efficiency enabling low-power wireless applications are demonstrated.

9:30 AM - 9:55 AM
14.2 GaN HEMTs for 5G Base Station Applications (Invited), *S. Nakajima, Sumitomo Electric Ind., Ltd.*

Many challenges have been overcome in developing highly reliable, cost effective and excellent performance GaN HEMTs. We have focused on GaN HEMT on SiC, and have been shipping commercial GaN HEMTs for the base station market since 2005. The state of the art GaN HEMT has penetrated into the 4G/LTE base station. The efficiency advantage, based on its material properties will also attract 5G power amplifier designers. This paper explains our development history, and overviews the GaN HEMT power amplifiers in the 5G era.

9:55 AM - 10:20 AM
14.3 100-340GHz Systems: Transistors and Applications (Invited), *M.J.W. Rodwell, Y. Fang, J. Rode, J. Wu, B. Markman, S. T. Suran Brunelli, J. Klamkin, M Urteaga*, University of California, Santa Barbara, *Teledyne Scientific Company*

We examine potential 100-340 GHz wireless applications in communications and imaging, and examine the prospects of developing the mm-wave transistors needed to support these applications.

10:20 AM Coffee Break

10:45 AM - 11:10 AM
14.4 Considerations on Design of Highly-Integrated Millimeter-Wave Transceivers in SiGe HBT (Invited), *V. Issakov and S. Trotta, Infineon Technologies AG*

This paper addresses considerations on design of highly-integrated transceivers at mm-wave frequencies. Some aspects are discussed such as SiGe HBT scaling and co-design optimization. A highly-integrated chip operating at V-band for backhaul communication is provided as an example.

11:10 AM - 11:35 AM
14.5 BAW Filters for 5G Bands (Invited), *R. Aigner, G. Fattinger, M. Schaefer, K. Karnati, R. Rothemund, F. Dumont, Qorvo Inc.*

The number of frequency bands requiring BAW filters is expected to grow significantly with the launch of 5G mobile applications. BAW is in particular well suited to address the new radio bands below 6 GHz also referred to as nr-1. RF integration is the only path forward to achieve full connectivity in LTE + 5G wireless due to the complexity of the antenna systems and the resulting coexistence challenges. The article gives an overview and describes recent trends regarding BAW for high frequency bands, wide bandwidth filters, miniaturization and thermal management. Evolution of RF content and the challenges of developing complex RF modules are discussed.

11:35 AM - 12:00 PM

14.6 Tunable Filter Technologies for 5G Communications (Invited), *D. Peroulis, Purdue University*

This paper presents an overview of available technologies for manufacturing three-dimensional front-end tunable filters for 5G systems. Specifically, we discuss three main technologies: a) RF MEMS, b) Printed Circuit Board (PCB), and c) injection molding. The advantages and drawbacks of each technology are discussed along with relevant proof-of-concept demonstrations. Future directions and improvements are also presented.