

# WORKSHOPS AND SHORT COURSES

Duration: 08:30 to 17:50

Room 252B

WM05

## Millimeter-Wave Technologies for 5G Mobile Networks

### Organisers

Laurent Dussopt, CEA-LETI, France

Frédéric Giancesello, STMicroelectronics, France

### Abstract

Millimeter-waves (mm-wave) are seen as key technology enablers for future 5G wireless mobile networks in order to take advantage of the wide spectrum bands available from 18 GHz up to 95 GHz and even beyond to provide multi-Gbps broadband access to mobile users and high-capacity wireless backhaul links between access points/base-stations. This application field is very active throughout the world for a couple of years with first demonstrations coming up and standardization activities expected to start as soon as 2015 in 3GPP and other standardization bodies; first regulations are expected around 2018 by the ITU-R.

The workshop will include several talks by high-level experts from industry and academia who will present their vision of 5G, the role of mm-wave communications and the main needs/requirement in this domain. The current state of the art and their most recent achievements in such essential fields as RFIC technology and architectures, integration technologies (e.g. system-in-package technologies such as multi-layer organic, ceramic, wafer-level packaging, silicon 3D packaging), integrated and reconfigurable antennas (SiP antennas, beam-steering/beam-switching phased-arrays, lenses) will be presented.

Mobile communications, as a mass market, may be the main driver of mm-wave technology research for the coming years and they will rely on the capability of the R&D community to provide cost-efficient, energy-efficient and high-performance solutions.



### Programme

8:30 - 08:40 Welcome

8:40 - 09:25 5G – Connectivity for 2020 and beyond

*Erik Dahlman*, Ericsson, Stockholm, Sweden

[→ Abstract](#)

9:25 - 10:10 RF system design and integration technologies for mmW back- and front-haul links

*Thomas Zwick*, Karlsruhe Institute of Technology, Germany

[→ Abstract](#)

10:10 - 10:50 Coffee Break

10:50 - 11:35 Low cost mmW antenna: a key enabler for backhaul CMOS/BiCMOS chipset solution up to 120 GHz

*Frédéric Giancesello*, STMicroelectronics, France

[→ Abstract](#)

11:35 - 12:20 Towards the integration of millimeter wave access points in future 5G heterogeneous networks: stakes, challenges, and key enabling technologies

*Cédric Dehos, Alexandre Siligaris*, CEA-LETI, France

[→ Abstract](#)

12:30 - 13:50 Lunch Break

13:50 - 14:40 mm-Wave CMOS: Paving the Path to 5G

*Ali Niknejad*, University of California at Berkeley, USA

[→ Abstract](#)

14:40 - 15:30 Novel trends in integration and packaging technologies for RF and mm-wave front ends

*John Papapolymerou*, Georgia Institute of Technology, USA

[→ Abstract](#)

15:30 - 16:10 Coffee Break

16:10 - 16:55 Integrated antenna solutions for Q-band ultra-throughput wireless communications

*Yan Zhang*, State Key Laboratory of Millimeter Waves, Southeast univ., China

[→ Abstract](#)

16:55 - 17:40 Innovative 60 GHz antenna solution for WigiG and smart eyewear applications

*Cyril Luxey*, University of Nice-Sophia Antipolis, France

[→ Abstract](#)

17:40 - 17:50 Open discussion and concluding remarks

# WORKSHOPS AND SHORT COURSES

## 8:40 - 09:25 5G – Connectivity for 2020 and beyond

*Erik Dahlman, Ericsson, Stockholm, Sweden*

### [Abstract](#)

The aim of this talk is to provide a high-level vision of current developments toward the use of mmW radio technologies in future 5G mobile networks.

## 9:25 - 10:10 RF system design and integration technologies for mmW back- and front-haul links

*Thomas Zwick, Karlsruhe Institute of Technology, Germany*

### [Abstract](#)

This part of the workshop will focus on the RF system design and the implementation for mmW back- and fronthaul links with data rates up to 100Gbps and more. First, the link budget will be presented and analyzed including attenuation effects due to rain. A second block will be dedicated to an evaluation of existing technology options and integration technologies for transceivers above 100GHz. It will be shown that besides the required high-speed semiconductor technologies appropriate and affordable packaging / integration technologies are key for successful products. Based on the available technologies, the link budget and the system requirements the RF system architecture of a transceiver will be discussed. Thereby, it will be shown that the very high bandwidth (several GHz) of the radio signal requires taking the explicit frequency response of the transceiver into account. The major effects of RF frontend imperfections on the signal quality or data rate will be analyzed to establish a new system design approach. The presentation will be based on various 240GHz link experiments with 10-100Gbps transmission rate.

## 10:50 - 11:35 Low cost mmW antenna: a key enabler for backhaul CMOS/BiCMOS chipset solution up to 120 GHz

*Frédéric Giancesello, STMicroelectronics, France*

### [Abstract](#)

This presentation will review the state-of-the-art and main achievements of the author's company in the domain of System-in-Package integration technologies for mmW transceiver modules (HTCC, Fan-Out Wafer-Level-Packaging, Si interposer, BGA, etc.).

## 11:35 - 12:20 Towards the integration of millimeter wave access points in future 5G heterogeneous networks: stakes, challenges, and key enabling technologies

*Cédric Dehos, Alexandre Siligaris, CEA-LETI, France*

### [Abstract](#)

This presentation will review the state-of-the-art and main achievements of the author's lab in the domain of RFIC transceivers, based on silicon technologies, for mmW high data rate communications from 60 GHz up to 300 GHz.

## 13:50 - 14:40 mm-Wave CMOS: Paving the Path to 5G

*Ali Niknejad, University of California at Berkeley, USA*

### [Abstract](#)

Wireless connectivity has become a cornerstone of our information society. The need for mobile access to data has led to an explosion in wireless devices, networks, and communication bands. It's clear that the current wireless data demand will quickly outpace our current wireless infrastructure, requiring serious consideration of how to scale up the wireless Internet. In this talk we will propose an xG network architecture that has the capability scale by taking advantage of spatial diversity and beam forming, massive MIMO, and higher frequency bands anchored by a hierarchical wireless mesh network. xG is a truly wireless Internet that can shrink and grow based on the appearance of new devices and terminals by utilizing devices as part of the infrastructure itself. In the talk emphasis is placed on the design of xG handsets and base stations and the design challenges including cost, multi-band and broadband operation, linearity and co-existence, and transmitter power and data rate scalability. Some

example integrated circuit designs that could potentially support xG functionality will be highlighted in this and the following talks.

## 14:40 - 15:30 Novel trends in integration and packaging technologies for RF and mm-wave front ends

*John Papapolymerou, Georgia Tech, USA*

### [Abstract](#)

This talk will present recent innovative trends in RF and mm-wave packaging technologies. More specifically, designs and examples from the System-on-Package approach using multilayer organic and thin glass technologies from 2-170 GHz will be presented.

## 16:10 - 16:55 Integrated antenna solutions for Q-band ultra-throughput wireless communications

*Yan Zhang, State Key Laboratory of Millimeter Waves, Southeast Univ., China*

### [Abstract](#)

In this talk, the research progress of integrated antennas for millimeter wave (mmW) ultra-throughput wireless communication network will be briefly reviewed. The newly released Q-band spectrum (40.5-50.2GHz) by Chinese government is assigned to support ultra-high data rate wireless business for both long- and short-range scenarios, and accordingly a related standard of IEEE 802.11aj has been established which is very promising for 5G communication system. To meet the requirement of high gain antenna for long-range case, reflectarray and transmitarray have been developed and exemplified in Q band. A new type of integration design of folded reflectarray and transmitarray antennas have been proposed, and planar feeds are adopted instead of conventional bulky feeds, e.g. horn antenna or open waveguide. For indoor environment, accessing antennas and terminal antennas have been developed for versatile applications. All these antennas are adopted with integrated concept and fabricated by standard PCB process, which provide integration antenna solutions for Q-band ultra-throughput wireless communication system.

## 16:55 - 17:40 Innovative 60 GHz antenna solution for Wigig and smart eyewear applications

*Cyril Luxey, University of Nice-Sophia Antipolis, France*

### [Abstract](#)

This talk will present the state-of-the-art and main achievements of the author's lab in the domain of mmW integrated antennas (60 to 150 GHz) with solutions addressing both short-range (low-gain, high integration) and long-range (high-gain, use of dielectric lenses) mmW communications.