Program

9h00-10h30 Key notes

Taro Eichler (Rohde&Schwarz), Heinz.Westenberger (Rohde&Schwarz), Konstantinos.Chronopoulos (Rohde&Schwarz)

Title: "mm-Wave Channel Sounding for 5G: Fundamentals, Measurement Techniques and Experimental Data Analysis"

Abstract: Successful design and standardization of 5G millimeter-wave communication systems will rely on the profound knowledge of the mobile radio channel. The characterization of the temporal and spatial properties of the radio channel at millimeter-wave frequencies is still very challenging. The aim of channel sounding is to characterize the radio channel by decomposing the radio propagation channel into its individual multipath components. In this talk we will give an overview of advanced measurement and modeling methods and present results from recent measurement campaigns in the 17 GHz and 82 GHz band using state-of-the-art test & measurement instruments. Furthermore, different concepts enabling high-precision time synchronization will be highlighted.

Since 5G communication systems will rely on multi-antenna techniques like beamforming and massive MIMO, the measurement and modeling of spatial channel information is necessary. We will give an outlook on methods to perform spatial channel measurements such as the switched and virtual array method.

Prof. Rahim Tafazolli (University of Surrey)

Title: Latest advances in 5G technologies

Abstract: The talk will cover possible candidate technologies that are being currently developed and trialled in addressing the three challenging use cases defined by 3GPP. These use cases are; Ultra Broadband Mobile, Massive Connectivity and ultra-low latency and reliability. The solutions range; new radio technologies, Radio Access Architectures and Core Network technologies It will also identifies where more research and innovation efforts is required to enable 5G deployment by 2020.

11h-12h30: FANTASTIC-5G Session

Speaker: Frank Schaich (Nokia), Salaheddine Elayoubi (Orange), Martin Schubert (Huawei)

Title: FANTASTIC-5G – An Overview

Abstract: In this talk we present the project FANTASTIC-5G in an overview manner providing a status update after 1 year of project duration. We quickly highlight the key ideas and main technical components being partly detailed in subsequent talks. The considered scenarios are described and put into relation towards 3GPP and NGMN. The talk also includes the impact of the project towards e.g. 3GPP.

Speaker: Hao Lin (Orange), Malte Schellman (Huawei), Xitao Gong (Huawei)

Title: FANTASTIC-5G Waveforms

Abstract: This talk provides an overview on the waveform candidates proposed for novel air interface for 5G in lower frequency bands, which are motivated by the scenarios envisaged for mobile radio communication systems beyond 2020, addressing a multitude of services being provided simultaneously to users and mobile devices accessing a common spectrum band. As the requirements for those services may substantially differ, air interface design should provide more flexibility to appropriately respond to those while ensuring an efficient usage of available system and spectrum resources. This talk elaborates on OFDM-based waveforms with filtering as a key enabler for a flexible air interface, addressing many of the challenges posed for the 5G radio system. Two promising waveform categories, namely subcarrier-wise filtering and subband-wise filtering, are described with respect to their individual characteristics as well as their potential benefits.

Speaker: Klaus Pedersen (Nokia)

Title: Agile 5G Radio Resource Management Design and Related Enablers

Abstract: In this talk we present proposals for an agile 5G multi-service air interface design for operation below 6GHz as studied in the FANTASTIC-5G project. The main focus is on radio resource management (RRM), as well as related enablers such as network-based interference coordination, advanced receivers, and system level integration of massive MIMO. The proposed user-centric RRM framework include support for service-aware scheduling with different transmission time intervals (TTIs) in coherence with the users radio conditions and QoS requirements, as well as non-scheduled access for enabling massive machine connectivity. Support for various connectivity options are addressed as well.

Speaker: Musbah Shaat (CTTC), Thomas Wirth (Fraunhofer HHI)

FANTSTIC-5G Proof-of-Concept: technical components and planned demonstrations

Abstract: The proof-of-concept (PoC) targets to implement key technical components developed within FANTASTIC-5G. A wide range of developed techniques in the project will be demonstrated and compared with the state of the art to illustrate the unique features of FANTASTIC-5G solutions and to validate the feasibility and the superiority of the different components of the foreseen 5G air interface. Post-OFDM waveforms are foreseen as key enablers to several 5G scenarios as it enhances system robustness to different types of impairments, the post-OFDM prototyping PoC is considered in FANTASTIC-5G to implement the algorithms evolved in FANTASTIC-5G for the different waveforms to tackle the open issues like synchronization, channel estimation, equalization, efficient MIMO support and pulse shape adaptation. To that end, development of several post-OFDM based transceivers is intended from algorithm simplification and optimization to on-board validation and demonstration. Additionally, the different post-OFDM waveforms will be evaluated jointly and compared using hardware-in-the-loop approaches and/or transmissions over wireless channel emulator in different scenarios.

Broadcast and multicast transmissions are expected to have high importance in 5G networks as it reduces drastically the network load by delivering the same content to a group of end users. The developed techniques in the project to enable multicast transmissions to different multicast groups by the use of MIMO techniques but, at the same time, provide a common broadcast layer to all users will be demonstrated using a software defined radio platform.

This talk aims at presenting the planned demonstrations in FANTASTIC-5G and describing the basic technical components of the different PoCs. It is worth mentioning that several FANTASTIC-5G PoCs are presented in the FANTASTIC-5G booth.

14h00-15h30: mmMagic Session

Speaker: Wilhelm Keusgen (HHI Fraunhofer)

Title: 6–100 GHz Channel Modeling for 5G: Outcomes and Perspective of mmMAGIC

Abstract: Standardization of 5G has been kicked off by the work of channel modeling for the frequency spectrum above 6 GHz. One of the key ambitions of mmMAGIC is to develop a unified statistical channel model for link- and system-level simulations that is valid over the entire frequency range from 6 to 100 GHz. It will build on the outcomes of the 3GPP modeling activities, but aims to go beyond. In this context, extensive radio channel measurement campaigns at several locations in Europe have been performed in multiple frequency bands in order to provide a reliable basis for model extension and parameterization. This talk presents recent measurement results and key aspects of the model development.

Speaker: Ali Zaidi (Ericsson, EAB)

Title: Waveforms, channel codes, and retransmission schemes for above 6 GHz communication

Abstract: mmMAGIC aims to develop radio interface for above 6 GHz communication. Communication above 6 GHz (especially, mm-wave) is characterized by large bandwidths, massive MIMO, harsh propagation conditions, severe RF impairments, and extreme data rate requirements. In this talk, we provide an overview of waveform and channel coding candidates, as well as novel retransmission schemes that are being investigated in mmMAGIC. The candidate waveforms and channel codes are assessed for relevant performance measures and their applications are discussed in different scenarios. To ensure fast and reliable retransmissions, novel HARQ protocols and methods for retransmissions with partial decoding are considered

Speaker: Yinan Qi and Maziar Nekovee (Samsung R&D Institute UK)

Title: Coordinated Initial Access in Millimetre Wave Standalone Networks

Abstract: In this paper, the main challenges and requirements of initial access (IA) in millimetre wave networks are identified and the latest solutions are reviewed. Moreover, a novel coordinated IA scheme for clustered millimeter wave small cells (mmSCs) is proposed for the fifth generation mobile communication networks (5G). This solution is a method for efficient and fast initial access for ultra-dense millimeter wave standalone networks without presence of overlaid legacy networks operating on lower frequency. In contrast to the current full beam sweep scheme, where time consuming exhaustive searching is employed, the mmSCs within one cluster will perform the IA procedure in a coordinated manner based on the power delay profile (PDP) measurement reports shared with each other via the backhaul links and thereby avoiding the full beam sweep. The proposed scheme significantly reduces the initial access time, enhances the access robustness and reduces the cost and complexity of the mobile terminals.

Speaker: Yaning Zou (Dresden University of Technology)

Title: Flexible hybrid beamforming design for communication above 6GHz with large antenna arrays

Abstract: One critical aspect for the envisioned air interface design in mmMagic project is to develop beamforming techniques that can combat unfavourable mmwave channel propagation conditions with reasonable implementation complexity and cost. In this presentation, TU Dresden shows some recent results on developing a flexible hybrid beamforming design architecture that can be applied in various transmission scenarios. The target is then to provide tailored design with given KPIs and meanwhile robust against sudden change in the propagation environment, e.g., signal blockage. As multiple RF chains will be needed in hybrid beamforming, RF impairments should also be taken into account for cost and energy efficient implementations.

16h00-17h30: Flex5Gware Session

Speaker: Miquel Payaró (CTTC)

Title: Flex5Gware's initial results on 5G hardware platforms

Abstract: In very broad and generic terms, the Flex5Gware vision for 5G HW platforms is that they will undergo a process towards i) improving their energy and spectrum efficiency (the latter includes the increase of the operated radio frequency bandwidth via mmWave-band usage and aggregation of spectrum at frequencies below 6 GHz) and ii) improving their modularity and flexibility (which implies increased reconfigurability and scalability). In this talk, we present an overview of the different results that have been obtained in the Flex5Gware project towards achieving this vision. In particular, the following technology areas will be considered: RF front-ends and antennas, mixed-signal technologies, digital front-ends and HW/SW function split. To endow this workshop with more detailed technical insight, four in-depth presentations will follow on the progress achieved in each one of these areas.

Speaker: Dieter Ferling (Nokia)

Title: Multiband base station transceivers up to 6 GHz

Abstract: The request for more powerful mobile systems, enabling high mobile data rate and throughput in areas of different size and user density, is addressed by concepts for base station transceivers promoting concurrent multiband operation in radio bands below 6 GHz. Solutions to reduce the hardware complexity are elaborated for broadband or multiband capability by including data and frequency conversion, amplification and filtering. Digital to analogue converters providing RF sampling will allow soon for direct RF signal generation of multiple signal carriers up to 6 GHz and obviate the need for additional frequency conversion. Analogue to digital converters show a more restricted performance, currently up to around 4 GHz. A multiband power amplifier is a further essential component in a multiband RF chain. Supporting radio bands around 2.6, 2.8 and 3.5 GHz, it allows for a three band transmitter design. Filters showing two resonator frequencies per cavity enable components with reduced number of cavities, leading to significant volume reduction for dual band filters. These components allow for multiband transceiver design operating between 2.5 and 3.6 GHz.

Speaker: Sylvie Mayrargue (CEA)

Title: Flexible In-band Full-Duplex transceivers based on a modified MIMO RF architecture

Abstract: In-band full-duplex transceivers are considered for future generations of cellular network systems. We propose to evaluate the performance of in-band full-duplex transceivers using a modified architecture based on hardware available for multiple-input multiple-output transceivers. A hybrid self-interference cancellation technique using an auxiliary transmitter is therefore introduced. Performance is evaluated using simulation models and is confirmed by hardware experimentation. The main limiting factors of the proposed architecture are analyzed and improvements to the architecture are then suggested.

Speaker: Vassilis Foteinos (Wings ICT Solutions)

Title: Dynamic reconfiguration of future 5G HW/SW systems

Abstract: The advanced 5G network infrastructure needs to be highly flexible in order to meet identified but dynamic, as well as unforeseen diverse requirements imposed by new cutting-edge applications (augmented reality, connected cars, tactile Internet, etc.). Dynamic reconfiguration of future 5G HW/SW systems could be an answer to this challenge, as it allows system's adaptation to the very demanding and changing contexts of operation, guaranteeing Quality of Service (QoS) and Quality of Experience (QoE). This presentation deals with this issue and describes a solution that is based on a context-aware, cognitive and dynamic HW/SW partitioning mechanism for 5G network elements and devices. The mechanism exploits knowledge (e.g. prediction of a hotspot) derived by network and sensor measurements and decides upon the HW or SW execution of functions (e.g. LTE, 3GPP based PHY/MAC functions) in order to fulfill and maintain the application goals. This solution leads to high flexibility, configurability, performance and energy efficiency.

Speaker: Nikolaos Bartzoudis (CTTC)

Title: Partitioning and distributing communication stack functions of 5G wireless hotspots

Abstract: Following the topic of the previous talk, in this case we present a flexible 5G networking architecture, where the HW accelerated (HWA) and SW communication stack functions can be reconfigured to optimize a certain utility function relevant in wireless hotspots like, e.g., reducing its energy footprint. Observe that a similar partitioning of the eNB protocol stack, either at stack-level or algorithm-level has also been proposed by the small cell forum. The network flexibility is achieved i) by switching from a given network configuration to another featuring a different partitioning of its underlying SW and HWA communication stack functions and ii) by modifying specific wireless communication parameters or a functional set of physical-layer blocks.