

# Program

## Session 1: Metasurfaces

Chair: Gerhard Bauch, Hamburg University of Technology

*No Papers*

## Session 2: 5G and Beyond

Chair: Armin Dekorsy, University of Bremen

- 2.1 URLLC for Factory Automation: an Extensive Throughput-Reliability Analysis of D-MIMO.....1**  
Mario Alonzo (University of Cassino and Lazio Meridionale, Italy);  
Paolo Baracca (Nokia Bell Labs, Germany);  
Saeed Reza Khosravirad (Nokia - Bell Labs, Canada);  
Stefano Buzzi (University of Cassino and Lazio Meridionale/CNIT, Italy)
- 2.2 Link-Level Investigations of Hybrid-ARQ schemes for 5G URLLC Scenarios.....7**  
Enrico Dragoni (University of Florence & Nokia Bell Labs, Italy);  
Silvio Mandelli (Nokia Bell Labs, Germany);  
Dania Marabissi (University of Florence, Italy);  
Vahid Aref and Andreas Weber (Nokia Bell Labs, Germany)
- 2.3 Proactive Resource Allocation for the Coexistence of Concurrent Services .....13**  
Fabian Götsch, Jochen Fink, Martin Kasparick (Technische Universität Berlin & Fraunhofer Heinrich Hertz Institute, Germany)

## Session 3: Interference Management

Chair: Anja Klein, Technische Universität Darmstadt

- 3.1 Full-Duplex Relaying: Enabling Dual Connectivity via Impairments-Aware Successive Interference Cancellation .....19**  
Vimal Radhakrishnan, Omid Taghizadeh and Rudolf Mathar (RWTH Aachen University, Germany)
- 3.2 Performance Characterization of Cellular Networks with Pilot-Aided Non-Coherent Joint Transmission .....25**  
Stelios Stefanatos (Freie Universität Berlin, Germany);  
Gerhard Wunder (Freie Universität Berlin & Heisenberg Communications and Information Theory Group, Germany)

## Session 4: mmWave and Massive MIMO

Chair: Eduard Jorswieck, Technische Universität Braunschweig

- 4.1 Structured Channel Covariance Estimation for Dual-Polarized Massive MIMO Arrays .....31**  
Mahdi Barzegar Khalilsarai, Tianyu Yang, Saeid Haghighatshoar and Giuseppe Caire (Technische Universität Berlin, Germany)
- 4.2 Bilinear Precoding for FDD Massive MIMO System with Imperfect Covariance Matrices .....37**  
Donia Ben Amor, Michael Joham and Wolfgang Utschick (Technische Universität München, Germany)
- 4.3 Feedback-Aware Noncoherent Receivers for Massive MIMO Systems.....43**  
George Yammine and Robert F. H. Fischer (Ulm University, Germany)

<b>4.4</b>	<b>Massive MIMO Channel Measurements and Achievable Rates in a Residential Area.....</b>	<b>49</b>
	Marc Gauger, Maximilian Arnold and Stephan ten Brink (University of Stuttgart, Germany)	
<b>4.5</b>	<b>Performance Analysis of Repeater-Aided Millimeter Wave Urban Mobile Communication Networks.....</b>	<b>55</b>
	Armand Nabavi and Stefan Schwarz (TU Wien, Austria)	

## Session 5: Positioning

Chair: Volker Kühn, University of Rostock

<b>5.1</b>	<b>PHY Layer for 5G Radio-Based Precise Positioning in 5GCAR Vulnerable Road User.....</b>	<b>59</b>
	Juergen Otterbach (Nokia Bell Labs, Germany); Thomas Schlitter and Rolf Fuchs (Nokia Bell Labs, Germany); Holger Heimpel (Nokia, Germany); Mike Macdonald (Nokia Bell Labs, USA); Dragan Samardzija (Nokia Bell Labs, USA)	

## Session 6: Situational Awareness and Direction Estimation

Chair: Norbert Görtsz, Vienna University of Technology

<b>6.1</b>	<b>On the Feasibility of Situational Awareness in Millimeter Wave Massive MIMO Systems .....</b>	<b>65</b>
	Rico Mendrik (Hamburg University of Technology, Germany); Henk Wymeersch (Chalmers University of Technology, Sweden); Gerhard Bauch (Hamburg University of Technology, Germany)	
<b>6.2</b>	<b>5GCAR Demonstration: Vulnerable Road User Protection through Positioning with Synchronized Antenna Signal Processing.....</b>	<b>71</b>
	Stephan Saur (Nokia Bell Labs, Germany); Marouan Mizmizi (Politecnico di Milano & None, Italy); Juergen Otterbach, Thomas Schlitter, Rolf Fuchs and Silvio Mandelli (Nokia Bell Labs, Germany)	
<b>6.3</b>	<b>Semi-supervised Localisation utilizing CSI at Large Antenna Array Base Stations .....</b>	<b>76</b>
	Artan Salihu (TU Wien & Christian Doppler Laboratory, Austria); Stefan Schwarz and Markus Rupp (TU Wien, Austria)	
<b>6.4</b>	<b>An MSE Approximation for Grid-Based Maximum Likelihood Direction-of-Arrival Estimators .....</b>	<b>81</b>
	Andreas Barthelme, Johannes Kunz and Wolfgang Utschick (Technische Universität München, Germany)	
<b>6.5</b>	<b>Impact of Phase Center Displacement on Direction-of-Arrival Estimation using Multi-Mode Antennas.....</b>	<b>87</b>
	Sami Alkubti Almasri, Peter A. Hoeher (University of Kiel, Germany)	

## Session 7: Machine Learning 1

Chair: Stephan ten Brink, University of Stuttgart

<b>7.1</b>	<b>Concrete MAP Detection: A Machine Learning Inspired Relaxation .....</b>	<b>91</b>
	Edgar Beck, Carsten Bockelmann and Armin Dekorsy (University of Bremen, Germany)	
<b>7.2</b>	<b>DeEQ: Deep Equalization for Large MIMO Systems.....</b>	<b>96</b>
	Matthias Hummert, Dirk Wübben and Armin Dekorsy (University of Bremen, Germany)	
<b>7.3</b>	<b>Cloud-RAN Fronthaul Rate Reduction via IBM-based Quantization for Multicarrier Systems.....</b>	<b>102</b>
	Johannes Demel, Tobias Monsees, Carsten Bockelmann, Dirk Wübben and Armin Dekorsy (University of Bremen, Germany)	

**Session 8: Machine Learning 2**

Chair: Dirk Wübben, University of Bremen

<b>8.1 Reproducible Evaluation of Neural Network based Channel Estimators and Predictors Using a Generic Dataset .....</b>	<b>108</b>
Nurettin Turan, Wolfgang Utschick (Technische Universität München, Germany)	

**Session 9: Antennas**

Chair: Tobias Weber, University of Rostock

<b>9.1 Universal low-cost Transmitarray Antenna Design at 61 GHz for Beam Steering with different Feed Antennas .....</b>	<b>114</b>
Martin Frank and Fabian Lurz, Robert Weigel (Friedrich-Alexander Universität Erlangen-Nürnberg, Germany); Alexander Koelpin (BTU & Chair for Electronics and Sensor Systems, Germany)	
<b>9.2 Gain of Uniform Rectangular Arrays .....</b>	<b>120</b>
Tobias Laas (Huawei Technologies Duesseldorf GmbH & Technische Universität München, Germany); Josef A. Nossek (Technische Universität München, Germany & Federal University of Ceará, Brazil); Wen Xu (Huawei Technologies Duesseldorf GmbH, Germany)	
<b>9.3 Matching Strategies for Multiantenna Arrays .....</b>	<b>126</b>
Thiago A. de Vasconcelos (Federal University of Ceará, Brazil); André de Almeida (Federal University of Ceará & Wireless Telecom Research Group – GTEL, Brazil); Josef A. Nossek (Technische Universität München, Germany & Federal University of Ceará, Brazil)	
<b>9.4 Performance Simulation of a 5G Hybrid Beamforming Millimeter-Wave System.....</b>	<b>132</b>
Thomas Kühne, Xiaoshen Song and Giuseppe Caire (Technische Universität Berlin, Germany); Kimmo Rasilainen (Chalmers University of Technology, Sweden); Le Thi Huyen, Marco Rossi and Ivan Ndip (Fraunhofer IZM, Germany); Christian Fager (Chalmers University of Technology, Sweden)	
<b>9.5 Polar Quantisation of Uniformly Distributed Signals on the Hypersphere for OMA .....</b>	<b>138</b>
Bernhard Gäde, Ali Bereyhi, Ralf R. Müller (Friedrich-Alexander Universität Erlangen-Nürnberg, Germany)	

**Session 10: Compressed Sensing and Coarse Quantization**

Chair: Wolfgang Utschick, Technische Universität München

<b>10.1 Zero-Crossing Precoding with MMSE Criterion for Channels with 1-Bit Quantization and Oversampling .....</b>	<b>144</b>
Diana M. V. Melo, Lukas T. N. Landau (Pontifical Catholic University of Rio de Janeiro, Brazil); Rodrigo C. de Lamare (Pontifical Catholic University of Rio de Janeiro & University of York, Brazil)	
<b>10.2 Coarse Quantization-Aware Block Diagonalization Algorithms for Multiple-Antenna Systems with Low-Resolution Signals.....</b>	<b>150</b>
Silvio Fernando Bernardes, Pinto (Pontifical Catholic University of Rio de Janeiro, Brazil); Rodrigo C. de Lamare (Pontifical Catholic University of Rio de Janeiro & University of York, Brazil)	
<b>10.3 Sparse Measurement Matrices for Compressed-Sensing Recovery by Bayesian Approximate Message Passing.....</b>	<b>156</b>
Norbert Goertz, Stefan Birgmeier (TU Wien, Austria)	
<b>10.4 On the Invariance of Recovery Algorithms for Compressed Sensing based on Expectation-Consistent Approximate Inference .....</b>	<b>162</b>
Carmen Sippel, Robert F. H. Fischer (Ulm University, Germany)	

**Session 11: Beamforming and Precoding**

Chair: Sebastian Stern, Ulm University

<b>11.1 Optimal and Suboptimal MMSE Precoding for Multiuser MIMO Systems Using Constant Envelope Signals with Phase Quantization at the Transmitter and PSK Modulation .....</b>	<b>168</b>
Erico Lopes, Lukas T. N. Landau (Pontifical Catholic University of Rio de Janeiro, Brazil)	
<b>11.2 Fast Beam Alignment through Simultaneous Beam Steering and Power Spectrum Estimation Using a Frequency Scanning Array.....</b>	<b>174</b>
Christoph Jans, Xiaohang Song, Wolfgang Rave, Gerhard P. Fettweis (Technische Universität Dresden, Germany)	
<b>11.3 Statistical Power Allocation for Downlink Two-User Power-Domain MIMO-NOMA with Excess Degrees of Freedom .....</b>	<b>180</b>
Aravindh Krishnamoorthy, Robert Schober (Friedrich-Alexander Universität Erlangen-Nürnberg, Germany)	
<b>11.4 Robust Submodular RRH Selection for Joint Multicast Downlink Transmission.....</b>	<b>186</b>
Jochen Fink, Martin Kasparick, Slawomir Stanczak (Technische Universität Berlin & Fraunhofer Heinrich Hertz Institute, Germany)	
<b>11.5 Codes over Gaussian Integers for Spatial Modulation .....</b>	<b>192</b>
Daniel Rohweder (University of Applied Sciences, Konstanz, Germany); Sergo Shavgulidze (Georgian Technical University, Georgia); Juergen Freudenberger (University of Applied Sciences, Konstanz & Institute for System Dynamics (ISD), Germany)	

**Poster Session P1****P1-1**

<b>Multi-Connectivity Management for Mobile Ultra-Reliable Low-Latency Communications.....</b>	<b>198</b>
Ali Haider Mahdi (Technische Universität Dresden, Germany); Tom Hößler (Technische Universität Dresden & Barkhausen Institut, Germany & Barkhausen Institut) Germany; Lucas Scheuvens, Norman Franchi, Gerhard P. Fettweis (Technische Universität Dresden, Germany)	

**P1-2**

<b>Performance of 5G Time Sensitive Networking (Paper was not available)</b>	
Peter Rost (Nokia Networks, Germany)	

**P1-3**

<b>Optimal Offloading for Interdependent Tasks of Unmanned Aerial Vehicle in Edge Server aided Low Power Wide-Area Networks .....</b>	<b>204</b>
Qinwei He (Global Energy Interconnection Research Institute Europe GmbH, Germany); Xuebing Zhai (Global Energy Interconnection Research Institute Co., Ltd., China); Tianyu Yang (RWTH Aachen University, Germany); Chunyan An (Global Energy Interconnection Research Institute Co., Ltd., P. R. China); Yulin Hu (RWTH Aachen University, Germany)	

**P1-4**

<b>End-to-End Latency Distribution in Future Mobile Communication Networks.....</b>	<b>210</b>
Philipp Schulz (Barkhausen Institut, Germany); Lyndon Y. Ong (Ciena corporation, USA); Bashar Abdullah (Ciena Corp., Canada); Meryem Simsek (International Computer Science Institute, USA); Gerhard P. Fettweis (Barkhausen Institut, Germany)	

**P1-5**

<b>Cache Replacement in CoMP-Based Multi-Cell Networks with Unknown Content Popularity .....</b>	<b>215</b>
Sepehr Rezvani and Eduard Jorswieck (Technische Universität Braunschweig, Germany)	

**P1-6**

- On the Impact of Hardware Impairments in Noncoherent Massive MIMO Systems .....** **221**  
 Stephan Bucher, George Yammine and Robert F. H. Fischer (Ulm University, Germany);  
 Christian Waldschmidt (Ulm University, Germany)

**P1-7**

- Spatial Consistency Validation on Massive SIMO Covariance Matrices in the Geometry-Based Stochastic Channel Model QuaDRiGa .....** **227**  
 Sida Dai (Fraunhofer Heinrich Hertz Institute, Germany);  
 Nagham Ashraf Abdellatif (German University in Cairo, Egypt);  
 Martin Kurras, Stephan Jaeckel and Lars Thiele (Fraunhofer Heinrich Hertz Institute, Germany)

**P1-8**

- Resource Allocation for Full-Duplex MU-mMIMO Relaying: A Delivery Time Minimization Approach.....** **233**  
 Vimal Radhakrishnan, Omid Taghizadeh and Rudolf Mathar (RWTH Aachen University, Germany)

**P1-9**

- Transmit Power Allocation for Joint Communication and Sensing through Massive MIMO Arrays.....** **239**  
 Stefano Buzzi, Carmen D'Andrea (Università di Cassino e del Lazio Meridionale & Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT), Italy);  
 Marco Lops (University of Naples Federico II, Italy)

**P1-10**

- Active Channel Sparsification and Precoding for Dual-Polarized FDD Massive MIMO.....** **245**  
 Mahdi Barzegar Khalilsarai, Tianyu Yang, Saeid Haghighatshoar (Technische Universität Berlin, Germany);  
 Xinping Yi (University of Liverpool, Great Britain);  
 Giuseppe Caire (Technische Universität Berlin, Germany)

**P1-11**

- User-Centric Massive MIMO Systems with Hardening-based Clusterization .....** **251**  
 Alberto Alvarez Polegre, Ana Garcia Armada (Universidad Carlos III de Madrid, Spain)

**P1-12**

- Low-Complexity Detection for Multi-Dimensional Spatial Modulation Schemes .....** **256**  
 Daniel Rohweder (University of Applied Sciences, Konstanz, Germany);  
 Sebastian Stern and Robert F. H. Fischer (Ulm University, Germany);  
 Sergo Shavgulidze (Georgian Technical University, Georgia);  
 Juergen Freudenberger (University of Applied Sciences, Konstanz & Institute for System Dynamics (ISD), Germany)

**P1-13**

- Blind SISO Detection of M-ary CPM in Fast-Fading Flat Channels.....** **262**  
 Makram El Chamaa, Berthold Lankl (Bundeswehr University Munich, Germany)

**P1-14**

- Performance Investigation of Angle of Arrival based Localization .....** **268**  
 Mislav Zane, Markus Rupp and Stefan Schwarz (TU Wien, Austria)

**P1-15**

- Highly accurate Multipath Component Delay Estimation .....** **272**  
 Wolfgang Zirwas (Nokia Siemens Networks GmbH & CoKG, Germany);  
 Diomidis S. Michalopoulos (Nokia Bell Labs, Germany);  
 Brenda Vilas Boas (Nokia Bell Labs & Ilmenau University of Technology, Germany);  
 Martin Haardt (Ilmenau University of Technology, Germany)

**P1-16**

- Performance Evaluation of LoS Round-Trip ToF Localization: A 60GHz Band Case Study .....** **278**  
 Nebojsa Maletic, Vladica Sark, Marcus Ehrig, Jesús Gutiérrez (IHP - Leibniz-Institut für Innovative Mikroelektronik, Germany);  
 Eckhard Grass (IHP & Humboldt-University Berlin, Germany)

**P1-17**

<b>Non-Line-of-Sight Based Radio Localization with Dual-Polarization Antenna Arrays .....</b>	<b>284</b>
Marco Marinho (Halmstad University, Sweden);	
Felix Antreich (Instituto Tecnológico de Aeronáutica (ITA), Brazil);	
Alexey Vinel (Halmstad University, Sweden);	
Fredrik Tufvesson (Lund University, Sweden);	
Muhammad Atif Yaqoob (TerraNet AB, Sweden)	

**P1-18**

<b>A Block Successive Convex Approximation Framework for Multidimensional Harmonic Retrieval and Imperfect Measurements .....</b>	<b>287</b>
Gerta Kushe (Technische Universität Darmstadt, Germany);	
Yang Yang (University of Luxembourg, Luxembourg);	
Marius Pesavento (Technische Universität Darmstadt, Germany)	

**P1-19**

<b>Analog Transmission of Correlated Sources in SIMO MAC using Hexagonal Lattices.....</b>	<b>292</b>
Pedro Suárez-Casal, Óscar Fresnedo and José P González-Coma, Darian Pérez-Adán, Luis Castedo (University of A Coruña, Spain)	

**Poster Session P2****P2-1**

<b>Indoor Measurements with Commercial 60 GHz WLAN Components .....</b>	<b>298</b>
Dennis Hoffmann, Felix Fellhauer, Maximilian Arnold and Stephan ten Brink (University of Stuttgart, Germany)	

**P2-2**

<b>Experimental Analysis of High Resolution Indoor THz SAR Imaging .....</b>	<b>303</b>
Aman Batra, Yamen Zantah and Michael Wiemeler (Universität Duisburg-Essen, Germany);	
Viet T. Vu, Mats I. Pettersson (Blekinge Institute of Technology, Sweden);	
Diana Goehringer (Technische Universität Dresden, Germany);	
Thomas Kaiser (Universität Duisburg-Essen, Germany)	

**P2-3**

<b>Drone-Based Spatial MIMO Measurements in Three Dimensions.....</b>	<b>308</b>
Marc Gauger, Maximilian Arnold and Stephan ten Brink (University of Stuttgart, Germany)	

**P2-4**

<b>Ultra-wideband Multipath Channel Characterization at 300 GHz .....</b>	<b>312</b>
Yamen Zantah, Mai Alissa, Theo Kreul, Thomas Kaiser (Universität Duisburg-Essen, Germany)	

**P2-5**

<b>Learning the Channel State Information Across the Frequency Division Gap in Wireless Communications .....</b>	<b>317</b>
Valentina Rizzello, Ilhem Brayek, Michael Joham and Wolfgang Utschick (Technische Universität München, Germany)	

**P2-6**

<b>Secure Transmission in Multi-Beam Satellites .....</b>	<b>323</b>
Kamel Shibli and Andreas Knopp (Bundeswehr University Munich, Germany)	

**P2-7**

<b>Bounds on the Ergodic Secret-Key Capacity for Dependent Fading Channels.....</b>	<b>329</b>
Karl-Ludwig Besser and Eduard Jorswieck (Technische Universität Braunschweig, Germany)	

**P2-8**

<b>Carrier Phase Distortions with anti-jammer Techniques using GNSS Array Receivers .....</b>	<b>334</b>
Tobias Bamberg (German Aerospace Center (DLR), Germany);	
Michael Meurer (German Aerospace Center (DLR) & RWTH Aachen University, Germany)	

**P2-9**

- Cloud-Aided Multi-Way Multiple-Antenna Relaying with Best-User Link Selection and Joint ML Detection .....340**  
Flavio Duarte (Centre for Telecommunications Studies (CETUC), Pontifical Catholic University of Rio de Janeiro, Brazil);  
Rodrigo C. de Lamare (Pontifical Catholic University of Rio de Janeiro & University of York, Brazil)

**P2-10**

- Minimax Solution to the Partial Decode-and-Forward Rate Maximization in the MIMO Relay Channel .....345**  
Christoph Hellings, Yushu Yang and Wolfgang Utschick (Technische Universität München, Germany)

**P2-11**

- A Compact Dual-Band Antenna Based on Defected Ground Structure for ISM Band Applications .....351**  
Adnan Ghaffar and Xue Jun Li (Auckland University of Technology, New Zealand);  
Wahaj Abbas Awan (COMSATS, Sahiwal, Pakistan);  
Niamat Hussain (Chungbuk National University, Korea)

**P2-12**

- A Compact Flexible Antennas for ISM and 5G Sub-6-GHz band Application .....353**  
Wahaj Abbas Awan (COMSATS, Sahiwal, Pakistan);  
Niamat Hussain (Chungbuk National University, Korea);  
Adnan Ghaffar (Auckland University of Technology, New Zealand);  
Abir Zaidi (Hassan II University of Casablanca, Morocco);  
Xue Jun Li (Auckland University of Technology, New Zealand)

**P2-13**

- Conformal Adaptive Phased Array for the 2.4 GHz ISM band .....356**  
Denis Le Goff, Ghislain Riondet, Louis Barbier, Yuchan Song and Koen Moutahaan (National University of Singapore, Singapore)

**P2-14**

- General rank beamforming using full rate real-value OSTBC for multicasting networks .....362**  
Dima Taleb (Communication Systems Group, Germany); Marius Pesavento (Technische Universität Darmstadt, Germany)

**P2-15**

- On the Mapping between Steering Direction and Frequency of a Uniform Linear Array with Fixed True Time Delays .....367**  
Wolfgang Rave, Christoph Jans (Technische Universität Dresden, Germany)

**P2-16**

- Multi-User Digital Beamforming Based on Path Angle Information for mm-Wave MIMO Systems .....373**  
Israa Khaled (IMT Atlantique, France);  
Ammar El Falou (Lebanese University);  
Charlotte Langlais (IMT Atlantique Bretagne Pays de la Loire & Lab-STICC, France);  
Bachar ElHassan (Lebanese University & Order of Engineers and Architects in Tripoli, Lebanon);  
Michel Jezequel (IMT Atlantique, France)

**P2-17**

- 3D Beamforming in Reconfigurable Intelligent Surface-assisted Wireless Communication Networks .....379**  
S. Mohammad Razavizadeh (IUST, Iran);  
Tommy Svensson (Chalmers University of Technology, Sweden)

**P2-18**

- Pulse-Shaped OTFS for V2X Short-Frame Communication with Tuned One-Tap Equalization .....384**  
Andreas Pfadler (Volkswagen AG, Germany);  
Peter Jung, Slawomir Stanczak (Technische Universität Berlin & Fraunhofer Heinrich Hertz Institute, Germany)

**P2-19**

- Investigation of Optimal MCS and Subcarrier Spacing in MBSFN Systems .....390**  
Kiril Kirev and Stefan Schwarz (TU Wien, Austria)