SILIKA Innovative Training Network

Silicon-based Ka-band massive MIMO antenna systems for new telecommunication services

The continuously growing need for higher data-rates and, therefore, more signal bandwidth in wireless communications, requires the use of multi-antenna base stations employing the recently introduced massive Multiple-Input-Multiple-Output (MIMO) concept and operating at millimeter-wave frequencies, e.g. 30 GHz. However, the implementation of such complex antenna systems into highly-integrated, energy- and cost-effective solutions is very challenging. Therefore, we propose an innovative antenna system concept utilizing silicon semiconductor electronics that can generate or receive at millimeter-wave frequencies in order to truly expand wireless communications into the outer limits of radio technology.

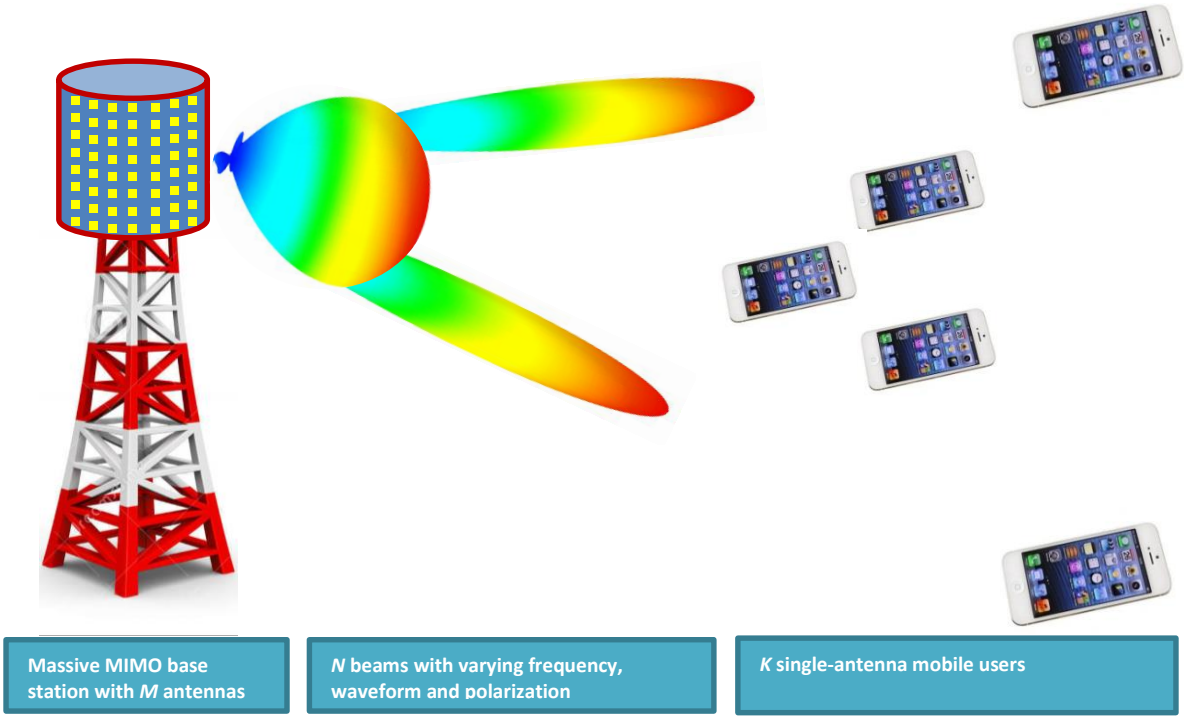

Figure 1: Conceptual drawing of a multi-antenna massive MIMO mm-wave 5G base station with M>>K. Multiple beams with different shapes, waveforms, frequency and polarization can be created simultaneously. The antenna system includes radiating elements, RF electronics and signal-processing.

SILIKA establishes a training network with leading R&D labs from European industries, universities and technology institutes in the domain of wireless infrastructure. This will be achieved by a multi-disciplinary approach combining expertise in all required areas to create a breakthrough towards millimeter-wave multi-antenna systems for energy-efficient and low-cost base stations for 5G wireless infrastructure. In the SILIKA Graduate School we will train 12 PhDs with post-master level technical courses and industrial workshops which are complemented by several professional-skill training modules relevant for working in multi-disciplinary project teams, see Figure 2. All PhDs will perform secondments in an industrial setting (see table I). The SILIKA consortium consists of key European players in the field of wireless infrastructure with a complementary field of expertise and with a proven track-record in joint collaborations. As a consequence, SILIKA will provide the ESRs with a comprehensive set of transferable skills relevant for innovation and long-term employability. The high level of participation of leading industries will ensure that the scientific results of SILIKA will be transferred to future products in the area of wireless infrastructure which will benefit the European economy.

CHALMERS UNIVERSITY OF TECHNOLOGY

TU/e

KU LEUVEN

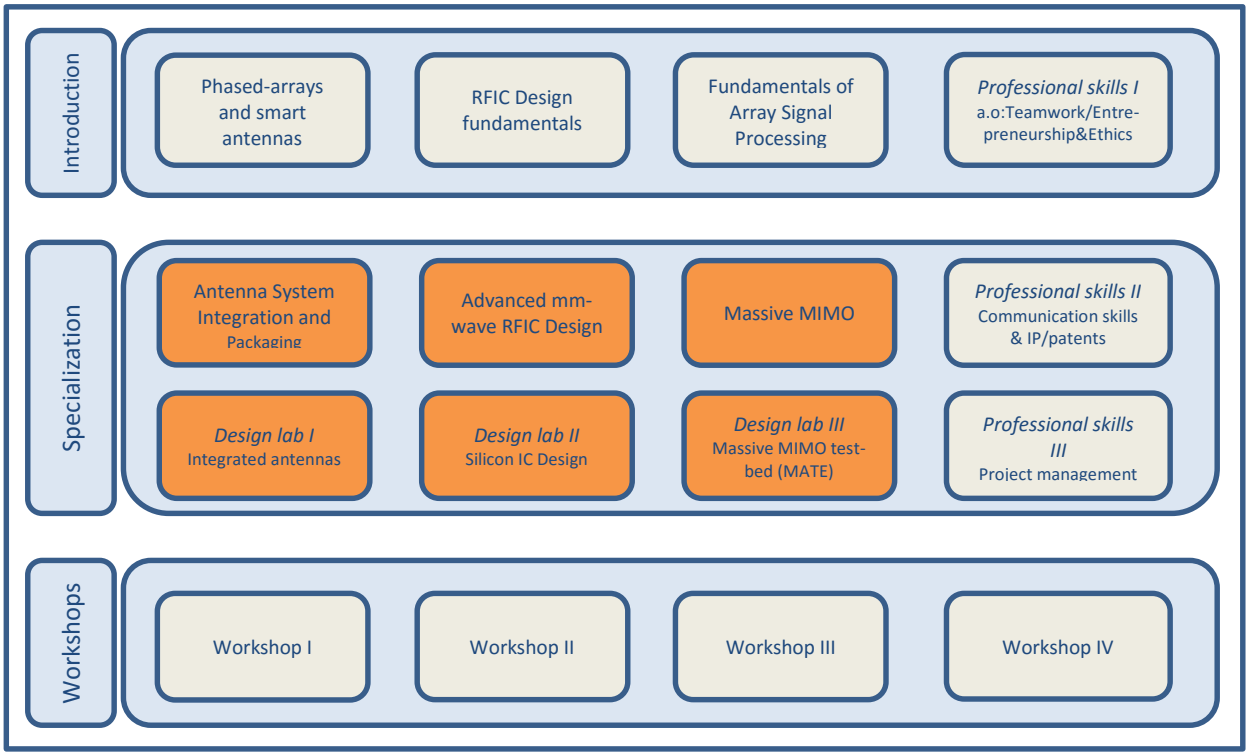

Figure 2: Overview of the courses in the SILIKA Graduate School training program.

Table I: Individual research projects (P) and relation with research lines (RL).

Individual PhD research project	Host 1 Academic	Host 2 Industry
P1: Advanced system-level design approaches for irregular array architectures	Chalmers (SE)	NXP (NL), TNO* (NL)
P2: System-level design of hybrid analog-digital beamformer architectures for quasi-optically beamforming arrays	TU Eindhoven (NL)	Ericsson (SE), ASTRON* (NL)
P3: Wide-scan silicon-based focal-line arrays with high EIRP	TU Eindhoven (NL)	Ericsson (SE)
P4: Radiating elements for sparse irregular 2D and 3D arrays	KU Leuven (BE)	NXP (NL), ASTRON (NL)
P5: The e-wall concept at mm-waves	KU Leuven (BE)	NXP (NL)
P6: Co-design of high-efficient silicon receiver with antenna-on-chip-in-package (AoCiP)	TU Eindhoven (NL)	OMP (BE), TNO* (NL)
P7: Contactless passive and active connections between antennas and transmitter integrated circuits	Chalmers (SE)	NXP (NL), SAAB* (SE)
P8: Synthesizer IC with array synchronization	KU Leuven (BE) joint with Chalmers (SE)	NXP (NL)
P9: Multi-physics IC design: Circuit/EM/Thermal	Chalmers (SE) joint with KU Leuven (BE)	NXP (NL)
P10: Calibration of antenna array systems and impairment mitigation methods	Chalmers (SE)	OMP (BE), Ericsson* (SE)
P11: Optimal environment specific algorithms for MIMO	KU Leuven (BE)	Ericsson (SE)
P12: Optimized waveforms for massive MIMO signal processing	TU Eindhoven (NL)	Ericsson (SE), QAMCOM* (SE)

**These projects will have a 2nd secondment next to the main industrial (18 month) secondment*