2.3.5 Microwave Engineering and Measurement Techniques

Lecturer	Prof. Dr.-Ing. Thomas Zwick, Dr.-Ing. Mario Pauli
Content	The course will introduce the basics of microwave engineering and its methodology. In the second part the standard microwave measurement methods will be introduced based on their working principle, functionality and calibration techniques. In the third part hands-on experience will make you familiar with typical microwave measurement systems and their proper use.
Course Objectives	The following selection of topics will be presented: ▪ Electromagnetic field theory ▪ Transmission line theory, cables and wave guides ▪ Microwave network analysis ▪ Impedance matching and tuning ▪ Microwave components and radio systems engineering ▪ Basics of microwave measurement techniques ▪ Frequency and power measurement ▪ Network and spectrum analyzer ▪ Hands-on experience: network analysis, signal analysis, digital oscilloscopes
Learning Targets/ Skills	After course completion, participants should be able to a) communicate effectively with microwave engineers; b) judge the technical complexity and feasibility of microwave components and systems and to specify them reasonably; c) use any microwave measurement equipment properly; d) start designing and testing basic microwave components or systems required for their project work
Pre-Requisites	Basics in electronics, electrodynamics, communication theory, higher mathematics
Duration	3 x 6h (3 days)
Teaching Method	Formal lectures, tutorial style discussion, lab tour, lab work
Course Material	Lecture slides
Literature	▪ David M. Pozar. Microwave Engineering. John Wiley & Sons ▪ Thumm, Wiesbeck, Kern: Hochfrequenzmesstechnik, B.G. Teubner. ▪ Fundamentals of Vector Network Analysis, Michael Hiebel, Rohde & Schwarz ▪ Fundamentals of Spectrum Analysis, Christoph Rauscher, Rohde & Schwarz
Contact Lecturer	Dr.-Ing. Mario Pauli: ***mario.pauli@kit.edu***

Schedule: Microwave Engineering and Measurement Techniques	
Institute	**Content (selected keywords)**
Day 1	
	Lecture: electromagnetics & transmission line theory
	Lecture: network analysis, matching, interconnects & antennas
	Lecture: millimeter-wave amplifiers
	Lab Tour & Discussion: millimetre wave labs
Day 2	
	Lecture: Frequency Measurement
	Lecture: Power Measurement
	Lecture: Spectrum Analysis
	Lecture: Network Analysis
Day 3	

Schedule: Microwave Engineering and Measurement Techniques	
Institute	**Content (selected keywords)**
	Hands-on lab: network analysis, spectrum analysis, time domain measurements, calibration techniques