



Subject card

Subject name and code	The EMC measurement methods, PG_00044108						
Field of study	Electrical Engineering						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024		
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		English		
Semester of study	2		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Metrology and Information Systems -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Beata Pałczyńska				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		5.0		15.0	50
Subject objectives	Introduce students with the methods and tools for EMC measurements						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K7_U03		The student determines the subject of measurements and EMC research regarding emission and immunity tests.		[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information		
	K7_W02		The student defines the basic types of EMC testing. Explains the measurement methods on basic at present obligatory norms and standards.		[SW3] Assessment of knowledge contained in written work and projects		
	K7_W01		The student can mathematically describe the phenomena related to the spread of electromagnetic disturbances. He understands the issues presented in EMC standards.		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	K7_U02		The student can present selected issues related to the methodology of counteracting electromagnetic disturbances.		[SU5] Assessment of ability to present the results of task		

Subject contents	The overview of EMC standards. Types of EMC testing. The measurement environment: an OATS, an anechoic chamber, a TEM cell, a GTEM cell.		
	The instrumentation for emission testing: EMI receivers, spectrum analyses, preselectors and filters, digital storage oscilloscopes.		
	The instrumentation for immunity testing: signal sources, RF power amplifiers, signal modulators. Measurement devices for conducted EMI; measurements by direct connection; inductively coupled devices. Standard conducted emission measurement. Standard conducted immunity testing.		
	Antennas for EMC measurement. Standard radiated emission measurement. Standard radiated immunity testing		
	The EMC measurement uncertainty.		
	The methodology of EMC measurements for small electrical and electronic equipment. The alternative EMC measurement method using the GTEM cell testing and measurement techniques.		
Prerequisites and co-requisites	Basic knowledge on physics, mathematics, metrology and electronics. Knowledge on electrical metrology. Ability to use the standards and norms.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory - completed exercises	100.0%	80.0%
	Lecture - Final test	60.0%	20.0%
Recommended reading	Basic literature	1. Więckowski T. W., Badania kompatybilności elektromagnetycznej urządzeń elektrycznych i elektronicznych. Wydawnictwo Politechniki Wrocławskiej. Wrocław 2013 2. Charoy A.: Kompatybilność elektromagnetyczna. Zakłócenia w urządzeniach elektronicznych. t.1-4. WNT, 1999. 3. Clayton R. Paul, Introduction to Electromagnetic Compatibility, 2nd Edition, Wiley, 2009.	
	Supplementary literature	1. Hasse L., Kołodziejski J., Konczakowska A., Spiralski L., Zakłócenia w aparaturze elektronicznej, Radioelektronika Sp.z o.o., Warszawa, 2. Henry W. Ott, Electromagnetic Compatibility Engineering, Wiley, 2009.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. The requirements of standard measuring of a conducted emission. 2. The requirements of standard measuring of a radiated emission. 3. The measurement requirements of conducted immunity testing. 4. The measurement requirements of radiated immunity testing. 5. The identification of uncertainty sources in EMC measurement.		
Work placement	Not applicable		