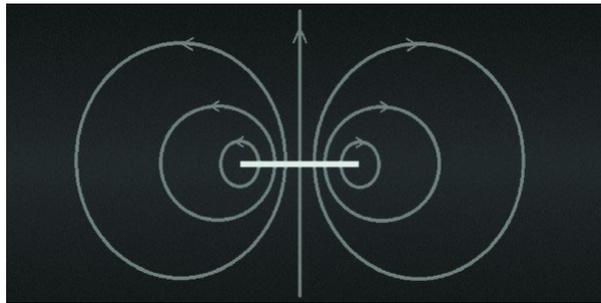




[RE-51] ELECTROMAGNETIC COMPATIBILITY (PN-07)



Curriculum (Syllabus)

Level of higher education	First (bachelor's)
Field	<i>G - Engineering, manufacturing, and construction</i>
Special	G5 - Electronics, electronic communications, instrument engineering, and radio engineering
Educational program	<i>Information and Communication Radioengineering</i>
Status of discipline	Compulsory component of the professional training cycle
Form of study	Full-time (daytime), accelerated full-time
Year of training	3rd year, 6th semester (full-time); 3rd year, 5th semester
Scope of the discipline	120 hours / 4 ECTS credits (Lectures 24 hours, Practical classes 16 hours, Laboratory classes 16 hours, Self-study 64 hours)
Semester control/assessment	Exam
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian
Information about the course leader/lecturers	Lecturer: O.Y. Sushko, PhD, Associate Professor, Associate Professor of the Radio Engineering Department Lab: O.Y. Sushko, PhD, Associate Professor, Associate Professor of the Radio Engineering Department
Teacher profile	

Curriculum

1. Description of the course, its purpose, subject matter, and learning outcomes

With the active development and miniaturization of electronics, EMC issues are becoming increasingly relevant. The course reveals the essence of the causes of EMC problems in modern radio-electronic systems and ways to overcome them, as well as the basics of radio frequency spectrum management.

The purpose of teaching the discipline is to familiarize students with the problem of EMC, consider the analysis of the electromagnetic environment, ensure the EMC of radio-electronic systems, and learn the basics of RF spectrum management.

In this course, students will learn to assess the susceptibility of radio-electronic devices and systems to various types of interference and to determine the basic technical methods of compensating for an interfering environment. Using modern technical means, they will determine the level of unwanted emissions from radio-electronic devices and systems and establish their compliance with standards.

After successfully completing the course, students will acquire the following skills and knowledge:

- the structure of international and national radio frequency tables and the main approaches to radio frequency spectrum management;
- the main mechanisms and characteristics of the propagation of useful radio signals and interference in different frequency bands;
- technical methods for reducing interference in radio-electronic systems; principles of frequency-territorial separation and frequency planning of communication networks;
- methods of modeling electromagnetic compatibility in modern software;
- assess electromagnetic compatibility in the case of interference from two or more radio systems of different types;
- calculate the energy characteristics of radio interference and useful signals propagation;
- assess electromagnetic compatibility of single- and multi-layer printed circuit boards.

In accordance with the professional educational programs (PEP) of the first "bachelor's" level of higher education, after mastering the academic discipline, students should acquire the following program competencies:

General competencies (GC)

GC-02 – Ability to apply knowledge in practical situations.

GC-07 – Ability to learn and acquire modern knowledge.

Professional competencies (PC)

PC-17 – Ability to apply modern CAD systems for design, structural synthesis, and highly efficient multi-parameter optimization of antennas, active and passive microwave devices.

PC-20 – Ability to select random signal parameters and optimize the communication channel according to the required criteria in the presence of noise and interference, perform engineering calculations of the main characteristics of random signals and devices for their processing.

PC-22 – Ability to analyze the architecture, calculate parameters, and formulate requirements for the components of modern 4G mobile information and communication systems.

Program learning results (PLR)

According to the first "bachelor's" level of higher education, as a result of mastering the academic discipline, students must demonstrate the following program learning results:

PRL-01 – Analyze, argue, and make decisions when solving specialized tasks and practical problems in telecommunications and radio engineering, which are characterized by complexity and incomplete certainty of conditions.

PLR-05 – Skills in evaluating, interpreting, and synthesizing information and data.

PLR-17 – Understanding and compliance with domestic and international regulatory documents on the development, implementation, and technical operation of information and telecommunications networks, telecommunications, and radio engineering systems.

PLR-21 – Ensuring the reliable and high-quality operation of information and communication networks, telecommunications and radio engineering systems.

PLR-29 – Measure the basic parameters of antennas, microwave devices, and active microwave receiving systems.

2. Prerequisites and post-requisites of the discipline (place in the structural-logical scheme of training under the relevant educational program)

Before taking this course, students are recommended to master the material of the course "Antennas and Microwave Devices" and understand the principle of operation and basic characteristics of receiving and transmitting devices.

3. Content of the academic discipline

1. Basics of radio frequency resource management
2. Technical basics of electromagnetic compatibility analysis of radioelectronic devices
3. Methods of ensuring EMC of radioelectronic devices
4. Methods of frequency planning for radio communication and broadcasting networks
5. Technical means of ensuring EMC of RES when affected by interference in communication systems
6. RES optimization and computer modeling of EMC
7. Organization of radio control services
8. Methods of analysis and technologies for ensuring EMC of RES located at a single facility
9. Industrial radio interference

The EMC RES course provides a full cycle of 5 laboratory works conducted at the antenna laboratory, namely:

- 1) Research on the antenna coupling coefficient, where students measure the mutual interference of two RES and study the effect of shielding on interference.
- 2) Study of spurious emissions from signal formation and generation devices, where the frequency response of the signal generator and the full spectrum of spurious emissions and their characteristics are measured.
- 3) Research on WI-FI coverage and the susceptibility of WI-FI mobile phone connections to interference, where students measure signal attenuation with distance, WI-FI signal level using a mobile phone, and experimentally determine the interference immunity of WI-FI connections.
- 4) Study of the radiation level of radio-electronic devices, where the level of such devices as microwave ovens and mobile phones is studied.
- 5) Research on the electromagnetic spectrum up to 1.7 GHz using a software-defined radio (SDR) and a selective voltmeter, where students use a laptop and an SDR receiver to study the characteristics of radio and television broadcast signals using different antennas.

4. Teaching materials and resources

- 1) Ivanov V.O. "Electromagnetic Compatibility of Radio Electronic Equipment," 2014, ISBN: 978-966-598-859-5.
- 2) Electromagnetic Compatibility in Power Supply Systems: Textbook / I.V. Zhezhelenko, A.K. Shidlovsky, G.G. Pivnyak, Yu.L. Saenko.-D, National Mining University, 2009.-319 p.: ill. ISBN 978-966-350-153-6.
- 3) Chernikhov Yu.V. Electromagnetic compatibility of technical means in automated control systems: Teaching aid. - Dnipropetrovsk: HIPOPRM, 2007. - 80 p.
- 4) Volodymyriv V.I., Doktrov A.L., Elizarov F.V. et al., Electromagnetic Compatibility of Radioelectronic Equipment and Systems. Edited by N.M. Tsarkov.

Educational content

5. Methods of mastering the academic discipline (educational component)

Relevant literary sources are indicated for each topic of the course. Students are encouraged to independently study the relevant materials after the lecture. During practical classes, the practical aspects of the course are explained in detail, and students are encouraged to actively participate in discussions and ask clarifying questions. Practical classes also include a review of relevant webinars on EMC topics.

The HCW includes two assignments based on the materials from both lectures and practical classes. The HCW is completed in written form, and assessment takes place through an individual interview with the student to evaluate their understanding of the material.

In addition, for better assimilation of the material, appropriate consultations are held throughout the semester, as well as before exams and laboratory work.

6. Self-study of the student

Students must complete assignments to prepare for and defend laboratory work for the course.

Some topics are also assigned for independent study, with the opportunity to ask the instructor questions on these topics during consultations.

Policy and control

7. Academic discipline policy (educational component)

Class attendance

Attendance at lectures, practical classes, and laboratory classes is mandatory in accordance with the Regulations on the Organization of the Educational Process at Igor Sikorsky KPI. In case of illness, the student is required to submit a duly completed certificate of the duration of treatment from the institution where the treatment was provided. In other cases (e.g., family circumstances), the issue is resolved on an individual basis with the instructor. Material from classes that were missed for one reason or another must be mastered independently. To assist students, links to video recordings of all lectures are available at <http://dtsp.kiev.ua> and <https://do.ipk.kpi.ua/course/view.php?id=454>.

Missed tests

Submission of laboratory work results is mandatory. Late submission will result in a zero grade. In case of late submission for valid reasons (e.g., illness) confirmed by relevant documents, the student has the opportunity to take the test at another time agreed with the teacher without a grade reduction.

Students can automatically receive credit based on the points they earn during the semester.

Announcement of test results

The results of self-study are entered into the Moodle LMS and announced to each student individually in person or remotely, accompanied by assessment sheets (in the Moodle LMS) in which students can see their grades according to specific criteria, as well as the main mistakes and comments on them.

The test is conducted in writing with a personal interview with the student. The test can also be conducted in the form of tests and assignments using the capabilities of the Moodle LMS.

Academic integrity

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more details, see: <https://kpi.ua/code>.

Ethical standards

The standards of ethical conduct for students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more information, visit: <https://kpi.ua/code>.

Procedure for appealing the results of control measures

Students have the opportunity to ask any question regarding the procedure for conducting and/or evaluating tests and expect that it will be considered in accordance with predetermined procedures.

Students have the right to appeal the results of control measures, but they must provide a reasoned explanation of which criteria they disagree with according to the assessment sheet and/or comments.

8. Types of assessment and rating system for assessment learning outcomes (RSA)

To be admitted to the exam, it is mandatory to defend all laboratory works, HCW (MT), and present a selected topic, which takes place during practical classes.

- Laboratory work - 40 (5 pieces at 8 points each)
- HCW - 10 points
- Presentation of a selected topic - 10 points

During the semester, students can earn a maximum of 60 points. 40 points are carried over to the exam. The exam is written with an individual oral interview.

Table of correspondence between rating points and grades on the university scale

Number of points	Grade
100	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

9. Additional information on the discipline (educational component)

Description of material, technical, and informational support for the discipline

The EMC RES course is provided with a full cycle of 5 laboratory works carried out at the antenna laboratory, namely:

- Research on the antenna coupling coefficient, where students measure the mutual interference of two RES and study the effect of shielding on interference.
- Research on the spurious emissions of signal formation and generation devices, where the frequency response of the signal generator and the full spectrum of spurious emissions and their characteristics are measured.
- Research on WI-FI coverage and the susceptibility of WI-FI mobile phone connections to interference, where students measure signal attenuation with distance, WI-FI signal level using a mobile phone, and experimentally determine the interference immunity of WI-FI connections.

- Research on the radiation level of radio-electronic devices, where the level of such devices as microwave ovens and mobile phones is studied.
- Research on the electromagnetic spectrum up to 1.7 GHz using a software-defined radio (SDR) and a selective voltmeter, where students use a laptop and an SDR receiver to study the characteristics of radio and television broadcast signals using different antennas.

Work program for the academic discipline (syllabus):

Compiled by [O. Yu. Sushko](#);

Approved by the RED (Minutes No. 06/2025 dated June 24, 2025).

Approved by the REF Methodological Commission (protocol No. 06/2025 dated 25.06.2025).