

Module Description, available in: EN

Wireless Communications

General Information

Number of ECTS Credits

3

Module code

TSM_WireCom

Valid for academic year

2023-24

Last modification

2022-10-18

Coordinator of the module

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Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

| | Lausanne | | | Lugano | Zurich | | |
|----------------------|----------|--|--|--------|----------|--|--|
| Instruction | | | | | X E 100% | | |
| Documentation | | | | | X E 100% | | |
| Examination | | | | | X E 100% | | |

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

The students are expected to have knowledge on the basic modulation schemes including amplitude, frequency and phase.

They must also have studied the fundamentals of coding techniques. Other required competences that may be acquired through personal work are statistics, probabilities, wave theory, Fourier analysis and the OSI reference model.

Brief course description of module objectives and content

The module starts with the basics of the Physical and Data Link layers of advanced wireless systems.

Then the students will be exposed to the definition or functioning of a selection of the most important wireless standards at the present time. The focus will be on the physical layer and the medium-access layer.

Exercises will be used throughout the course to exemplify the use and application of the learnt material to compare the existing standards for a given problem in the context of the merits and limitations of each technology.

Aims, content, methods

Learning objectives and acquired competencies

The student will be able to

- discriminate between the various advanced modulation, coding and transmission concepts and explain their benefits and limitations
- explain the key characteristics of a selection of the most important wireless standards at the present time in regards to the Physical and Data Link layers
- find specific information in the standardisation documents
- select the most suitable wireless technology for a practical problem.

Contents of module with emphasis on teaching content

Common Fundamentals (25%)

Applications, requirements, market and frequency spectrum issues in wireless communications. Wireless receivers and transmitters. Digital modulation and coding. Radio propagation.

Standards(75%)

Introduction to a selection of the most important standards at the time of the course (the actual technologies taught may differ somewhat from this list) :

- GSM / UMTS / LTE / 5G
- GNSS (GPS, Galileo)
- WLAN / Bluetooth
- RFID
- DAB
- etc.

Teaching and learning methods

- Lectures
- Work through exercises or perform simulations under supervision
- Self-study:
 - completion of exercises
 - research using the standards documents, online and library resources
 - Analysis of case studies

Literature

- Ke-Lin Du, M.N.S. Swamy, "Wireless Communication Systems", Cambridge, 2010
- J.-F. Wagen, "Mobile & Wireless Networks and Services", HEIA-FR book
- J. Proakis, M. Salehi, "Digital Communications", McGraw-Hill Press
- A. Paulraj, N. Nabar, D. Gore, "Introduction to Space-Time Wireless Communications", Cambridge Press
- C. Lüders, "Mobilfunksysteme", Vogel Verlag
- M. Sauter, "Grundkurs Mobile Kommunikationssysteme", Springer Vieweg Verlag
- D. von Grünigen, "Digitale Signalverarbeitung", Fachbuchverlag Leipzig
- Klaus Finkenzeller, "RFID-Handbuch", 7. Auflage, Hanser Verlag
- J. Schiller, "Mobilkommunikation", Addison-Wesley
- J.-M. Zogg, "Telemetrie mit GSM/SMS und GPS Einführung", Franzis Verlag
- R. Tanner (ed.), J. Woodard (ed.), "WCDMA Requirements and Practical Design", Wiley
- M. Sauter, "From GSM to LTE Advanced PRO and 5G", Wiley, 2011
- E. Dahlman, St. Parkvall, J. Skold, "4G LTE / LTE Advanced for Mobile Broadband", Elsevier
- E. Dahlman, St. Parkvall, J. Skold, "5G NR: The Next Generation Wireless Access Technology", Academic Press
- Gordon Colbach, "The WiFi Networking Book"
- Standards, e.g. 3GPP, IEEE 802.x, ETS 300 401, ISO/IEC 18000-6C, ISO/IEC 15693

Assessment

Certification requirements

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

Calculator

Other permissible aids

Part of the exam will be open book and there may be also a part in which no reference material is allowed.

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

Calculator.

Other permissible aids

No reference material will be allowed.