

**Module Description, available in: EN**

## Wireless Communications

### General Information

**Number of ECTS Credits**

3

**Module code**

TSM\_WireCom

**Valid for academic year**

2025-26

**Last modification**

2023-08-30

**Coordinator of the module**

Luciano Sarperi (ZHAW, sarp@zhaw.ch)

**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		
<b>Instruction</b>					X E 100%		
<b>Documentation</b>					X E 100%		
<b>Examination</b>					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 basic knowledge on serial communication, communication topologies (e.g. point-to-point, point-to-multipoint), OSI reference model, statistics and Fourier analysis.

### Brief course description of module objectives and content

The module starts with the physical properties of radio propagation, analog and digital modulation and forward error correction.

Then the students will be exposed to the functioning and characteristics 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 module content to examine existing standards for a given

problem in the context of the merits and limitations of each technology.

## Aims, content, methods

### Learning objectives and competencies to be acquired

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
- research information on different wireless technologies
- select the most suitable wireless technology for a practical problem.

### Module content with weighting of different components

#### Common Fundamentals (25%)

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

#### Standards(75%)

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

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

### Teaching and learning methods

- Lectures
- Work through exercises
- Self-study:
  - completion of exercises
  - research using online and print 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

### Additional performance assessment during the semester

The module does not contain an additional performance assessment during the semester

### Basic principle for exams

**As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.**

#### **Standard final exam for a module and written resit exam**

**Kind of exam**

Written exam

**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.

**Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.**

#### **Special case: Resit exam as oral exam**

**Kind of exam**

Oral exam

**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.