UAB

Universitat Autònoma de Barcelona

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Access Technologies

Code: 102697
ECTS Credits: 6

Degree	Type	Year	Semester
2500898 Telecommunication Systems Engineering	OT	4	2

Contact

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Use of languages

Principal working language: catalan (cat)

Some groups entirely in English: Yes

Some groups entirely in Catalan: Yes

Some groups entirely in Spanish: Yes

Teachers

David Gomez Casco

Prerequisites

It is advisable to have completed the courses "Fundamentals of Communications" and "Digital Signal Processing".

Objectives and Contextualisation

The course focuses on the study of two main access technologies, namely those based on multicarrier modulations and on spread spectrum modulations. The objectives are:

- To understand the general principles of operation of both technologies.
- To design the corresponding schemes for transmission and reception.
- To comprehend the restrictions of each technology in terms of available resources, in order to design efficient systems.
- To assess the performance in the presence of timing errors and / or multi-user interference.
- To implement techniques for channel estimation, synchronization and symbol detection.
- To know the basic characteristics of real systems, such as DVB-T, GPS or LTE, and to relate their specific aspects to the theory explained during the course.

Content

1. **Access schemes in existing systems.**
2. **Multicarrier technology**
   1. Transmission schemes .
      1. Signal model and cyclic prefix.
      2. Dispersive channel vs multiplicative channel.
      3. Block transmission using FFT.
      4. Applications: WLAN, xDSL, DVB-T, LTE.
   3. Reception schemes.

1. Effect of frequency and time synchronization errors.
2. Channel estimation based on pilots.
3. Synchronization based on the cyclic prefix.
5. Design multicarrier signals.
    1. Design criteria.
    2. System dimensioning.
    3. Allocation of resources (pilots, power) and bitloading / waterfilling algorithms.
7. Multi-user access techniques.

4. **Spread spectrum technology**
    1. Transmission schemes .
        1. Fundamentals of spectrum spectrum.
        2. Generation and properties of pseudorandom sequences.
        3. Applications: GPS, UMTS / W-CDMA.
    3. rReception schemes .
        1. Block diagram of the receiver.
        2. Performance in AWGN channel, in the presence of multi-user interference and external interference.
        3. Effect of themultipath channel (RAKE receiver).
        4. Effect of near-far interference, multi-user detection.
    5. Synchronization.
        1. Acquisition stage .
        2. Tracking stage.
    7. Case study: GPS

6. **PBL (Project-based learning) activity**
    Resolution of a practical problem in group.