

230369 - CR - Cognitive Radio and Spectrum Sharing: a Key Technology of 5G Networks

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2019
Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 2,5 Teaching languages: English

Teaching staff

Coordinator: Casadevall Palacio, Fernando-Jose
Others: Casadevall Palacio, Fernando-Jose

Opening hours

Timetable: Tuesday 12 am to 2 pm
Thursday 12 am to 2 pm

Prior skills

Basic knowledge about radiocommunications.

Requirements

none

Degree competences to which the subject contributes

Specific:

- CE1. Ability to apply information theory methods, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing to communication and audiovisual systems.
- CE2. Ability to develop radio-communication systems: antennas design, equipment and subsystems, channel modeling, link dimensioning and planning.
- CE9. Ability to deal with the convergence, interoperability and design of heterogeneous networks with local, access and core networks, as well as with service integration (telephony, data, television and interactive services).

Transversal:

- CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
- CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Teaching methodology

- Lectures
- Individual work
- Extended answer test (Final Exam)

Learning objectives of the subject

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Most of the today's Wireless System are allocated in spectrum bands devoted for exclusive use of licensed users (licensed bands). New and advanced technological improvements has resulted in the huge development of personal wireless technologies. As the result spectrum scarcity happens. A solution to this problem is to let unlicensed users use the licensed frequencies, provided they can guarantee interference perceived by the primary license holders will be minimal. This new concept is called Cognitive Radio.

In this seminar you will know and understand the main concepts related to:

- Cognitive Radio and their applications and limitations in the context of the new 5G systems
- TV White Spaces and their applications
- Dynamic spectrum management, particularly the Licensed-Assisted Access (LAA) concept

Study load

Total learning time: 62h 30m	Hours large group:	20h	32.00%
	Self study:	42h 30m	68.00%

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Content

COGNITIVE RADIO AND SPECTRUM SHARED TECHNIQUES: A KEY TECHNOLOGY FOR 5G NETWORKS

Learning time: 62h 30m

Theory classes: 20h

Self study : 42h 30m

Description:

Topic 1 - Introduction

1.1 Reasons for the deployment of Cognitive Radio:

1.1.1 Evolution in terms of users and data traffic of mobile communication systems. Impact on 5G systems

1.1.2 Capacity fundamental limits of the transmission systems.

1.1.3 Available band: Spectrum measurements in BCN

1.2 Evolution of cellular systems and wireless mobile communications.

1.3 Cognitive Radio concept

1.4 Possible wireless and cellular applications.

Topic 2 - Cognitive Radio Properties

2.1 Cognitive Radio Concept

2.2 Functionalities. Concept Cognitive level:

2.2.1 Spectrum Awareness

2.2.2 Spectrum Selection

2.2.3 Spectrum Sharing

2.2.4 Mobility Spectrum

2.3 Structure of Cognitive Transceiver

Topic 3 - Spectrum Awareness Techniques

3.1 Spectrum Sensing techniques: Classification and performances

3.2 Databases (REM-Radio Environmental Maps)

3.3 Cognitive Pilot Channel

Topic 4 - TV White Spaces

4.1 Concept and scenarios

4.2 Architectures

4.3 Procedures and functionalities

4.4 Standardization

4.4.1 Description of the standards IEEE 802.22 and IEEE802.11af

Topic5. - Spectrum sharing and dynamic access technologies

5.1 Bandwidth requirements in 5G systems: Technological alternatives

5.2 Licensed-Assisted Access (LAA)

5.2.1. Main concepts and functional architecture

5.2.2. Stakeholders and responsibilities in the LAA context

5.2.3. Use Cases examples

Qualification system

Continuous assessment 50% of the final mark

Final exam 50% of final mark.

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Bibliography

Basic:

Venkataraman, H.; Muntean, G.-M. Cognitive radio and its application for next generation cellular and wireless networks [online]. Dordrecht: Springer, 2012 [Consultation: 13/06/2018]. Available on: <<http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10557950>>. ISBN 9789400718265.

Others resources:

- Papers and presentation published in IEEE, ITU, ETSI and other standardization bodies
- Papers published in magazines, conferences and other research bodies.

Audiovisual material

- Transparències del seminari
- Seminari slides