



IDENTIFYING DATA

Wideband Radio Systems

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|---------------------|---|----------|------|------------|
| Subject | Wideband Radio Systems | | | |
| Code | V05M145V01312 | | | |
| Study programme | Telecommunication Engineering | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 5 | Optional | 2nd | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | García Sánchez, Manuel | | | |
| Lecturers | García Sánchez, Manuel Santalla del Río, María Verónica | | | |
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| Web | http://www.faitic.uvigo.es | | | |
| General description | Wideband radio systems. | | | |

Competencies

| | |
|------|--|
| Code | |
| C19 | CE19/RAD2 Ability to perform theoretical design, experimental band systems measurement and practical implementation broadband for current applications |

Learning outcomes

| | |
|--|-------------------------------|
| Expected results from this subject | Training and Learning Results |
| Theoretical and experimental knowledge of wideband systems | C19 |
| Knowledge of designs of wideband active and passive elements | C19 |
| Fundamentals of wideband signal generation and reception | C19 |
| Fundamentals of wideband signal measurement | C19 |

Contents

| | |
|----------------------------------|--|
| Topic | |
| Introduction | Definitions and basic concepts Communication systems Radio systems. Antennas. Radioelectric spectrum. Modulation. Radio channel. Propagation channel. |
| Description of the radio channel | Free space Undistorted transmission Attenuation. Multipath Fading. Doppler spread. Delay spread. Frequency selective channels. Precursors. |
| Mathematical characterization | Narrowband Statistical amplitude distributions Doppler spectrum Wideband Bello formulation |

| | |
|---------------------------------|---|
| Channel sounders | Narrowband Doppler. Nyquist limit. Wideband. Frequency domain sounders: VNA Time domain sounders. RF pulse. Sliding correlation sounders. Sounder design and performance assesment. Narrowband sounder with spectrum analyzer 0 span. VNA based sounder. Sliding correlation sounder. |
| Channel sounders lab | Building a wideband sounder to measure the radio channel. |
| Wideband modulations | Delay spread. Inter symbol interference. Irreducible BER. Frequency hopping; GSM OFDM. Guard interval. Pilot tones. Equalization. PAPR. Amplifiers. DVB-T. 4G. CDMA. Processing gain. Noise. Adquisition and tracking. RAKE receiver. 3G. Power control. Cellular breathing. |
| UWB systems | 1. Definition. Specificities. Regulation 2. Channel characteristics. 3. Impulse radio UWB. 4. Multiband OFDM approach to UWB. 5. Applications |
| Wideband and UWB antenna design | 1. Wideband antennas. Definition and requirements. 2. Characterization of wideband antennas 3. Examples and applications. 4. UWB antennas. Definition and requirements. 5. Characterization of UWB antennas 6. Examples and applications. |
| UWB applications | Radar Ground penetrating radar Positioning and location Medical imaging Emerging applications |

Planning

| | Class hours | Hours outside the classroom | Total hours |
|--|-------------|-----------------------------|-------------|
| Seminars | 2 | 6 | 8 |
| Laboratory practises | 20 | 60 | 80 |
| Master Session | 6 | 18 | 24 |
| Short answer tests | 1 | 5 | 6 |
| Practical tests, real task execution and / or simulated. | 1 | 6 | 7 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

| | Description |
|----------------------|---|
| Seminars | Activities designed to work on a specific topic , which allow deepen or complement the contents of the subject. |
| Laboratory practises | Building and testing wideband radio channel sounders |
| Master Session | Master lecture given by the teacher |

Personalized attention

| Methodologies | Description |
|----------------------|--|
| Master Session | The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. |
| Laboratory practises | The students could ask questions during classes, during sheduled hours for the professors to atend the students or by email. |

Assessment

| | Description | Qualification | Training and Learning Results |
|----------------------|------------------------------------|---------------|-------------------------------|
| Laboratory practises | Practice written and oral reports. | 40 | C19 |
| Master Session | Short answer test | 60 | C19 |

Other comments on the Evaluation

First call:

Following the guidelines of the master we offer to the students two schemes of evaluation: continuous assessment and final assessment. The students will have to opt by one of the two schemes before a given date.

Second call: just final exam.

Sources of information

Basic Bibliography

J.D. Parsons, **The Mobile Radio Propagation Channel,**

Complementary Bibliography

H. Schulze, **Theory and applications of OFDM and CDMA,**

Recommendations
