

Aims

Overview of wireless telecommunications systems and issues related to their design, even in reference to the regulations . Acquisition of numerical and graphical methods for solving problems related to the adaptation of analog physical modules, considering stability and gain constraints. Notes about the reliability and quality related to the design and manufacture of wireless electronic devices.

Prerequisites

basics of electrical engineering, electronics , electromagnetic propagation.

Course content

- **Introduction**
Block diagram of a wireless telecommunications system;
Transmitter (outline): FDMA, CDMA, Tx frequency band, power, modulation , distortion of the modulated signal, channel spacing, emission of unwanted signals, adjacent channel noise, the block diagram of a GSM Tx ;
Receiver : superheterodyne design , Rx frequency band , frequency conversion , (up, down) converter in the frequency domain, conversion of the modulated signal, sensitivity, selectivity, blocking, interference, block diagram of a GSM Rx .
- **The functional blocks of a superheterodyne receiver ;**
preselector and IF filters, image frequency; low noise amplifier - LNA (main characteristics, noise, linearity, compression); mixer (main characteristics, gain, isolation between the ports); local oscillator (main characteristics, effect of noise on the selectivity).
- **Noise figure** of one amplifier and many cascaded amplifiers, noise temperature, minimum detectable signal, allowable noise figure, dynamic range.
- **Linearity of an amplifier**, non-linearity more stages in cascade , dynamic , inter-modulation (IP2, and IP3), the designing of the graph for IP3 , spurious-free dynamic range.
- **Recalls** about the Smith chart, the resonance quality factor Q, the S-parameters.
- **Impedance matching** with LC passive elements both without the use of the Smith chart as well as using the Smith chart .
- **Design** of an amplifier with impedance matching networks on input and output ports using the Smith chart to meet gain and stability criteria.
- **The mixer as a circuit; switching type, diode type, Gilbert cell and key features.**
- **RF oscillators**; three point, Hartley, Colpitts and Hartley with autotransformer, Variable capacity diode (Varicap) used in voltage controlled oscillators (VCO); Frequency stability, crystal oscillators and key features.
- **The phase locked loop (PLL)**, frequency synthesizers.
- **Principles of reliability** with reference to design and manufacturing of electronic devices used for wireless telecommunications.

Teaching methods :

lectures and consolidation exercises.

Final test:

Written and verbal examination.

Books:

notes distributed during the lessons.