

Ultra Wide Band (UWB) Radio Fundamentals
Second Year, M.Sc. in Communications and Electronic Engineering (First semester)
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Course material: *Available on the course webpage at <http://acts.ing.uniroma1.it/uwb.php>*

- Ultra Wide Band radio
 - Definition
 - IEEE and industrial standards: IEEE 802.15.4a, UWB Alliance, Wireless USB, IEEE 802.15.4z
 - Generation of UWB signals
 - Impulse Radio (IR): Time-hopping UWB, Direct-Sequence UWB
 - Continuous waveform: Multi-Band UWB signals
 - UWB signals in the TeraHertz band
 - Power Spectral Density of UWB signals
 - Time-Hopping UWB
 - Direct-Sequence UWB
 - Multi-Band UWB
 - Performance analysis for the UWB radio link
 - Power limits and emission masks
 - Link budget
 - Pulse shaper design for IR-UWB
 - Base pulse
 - Effects of derivation and variation of pulse duration
 - Pulse shaper design as a function of emission masks constraints
 - The UWB channel and receiver
 - Propagation of UWB signals over a multipath free AWGN channel and over a multipath affected UWB radio channel
 - The UWB channel model proposed by IEEE 802.15.3a and IEEE 802.15.4a
 - The TeraHertz channel
 - Temporal diversity and RAKE receiver
 - Synchronization in IR-UWB communications systems
 - Multi User UWB wireless communications
 - Multiple access and multiuser interference
 - Multiuser IR-UWB interference models: Standard Gaussian Approximation and “Pulse collision”
 - Interference models for UWB in the TeraHertz
 - Ranging and positioning in UWB systems
 - Ranging based on distance and angle estimation
 - Positioning algorithms
 - Applications: tagging, user tracking and contact tracing with UWB
 - Ultra Wide Band networks: Medium Access Control design
 - Medium Access Control (MAC): general principles and functions
 - The 802.15.4/4a MAC protocol
 - Experimental platforms
 - The Qorvo development boards
 - MAC and positioning experiments
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