

5G NR Physical Layer – 2 days

CONTENTS

The course provides a technical description of the 5G New Radio (NR) radio interface.

The course describes the physical layer design of NR in terms of OFDM numerologies, radio frames, subframes and slot configurations. The course explains the purpose of, and processing of, physical channels with particular focus on control channels. Reference signals for data demodulation, CSI measurements, and sounding are explained. Layer 1 procedures for synchronization, random access, scheduling, HARQ, measurements and beam management are described.

An overview of the NR RRC and MAC protocols is included in chapter 1 for completeness, with particular focus on the role of the RRC and MAC protocols in relation to layer 1.

PREREQUISITES

Reasonably good technical knowledge of the LTE physical layer and the LTE radio protocols is highly recommended but not compulsory.

Note: This course is not delivered with the FoldOut methodology.

NR Overview

- Summary of radio techniques used in NR
- NR Channel Architecture
- Radio Resource Control protocol (for L1 operation)
- Medium Access Control protocol (for L1 operation)
- Overview of physical channels and signals

NR Physical Layer Design

- Spectrum allocation for 5G
- Bandwidth adaptation and Bandwidth Parts (BWP)
- OFDM numerologies for NR
- NR radio frame and subframe structure
- Slots and slot formats
- Self-contained slots for TDD operation

Synchronization and Initial Access

- SS/PBCH Blocks (mapping, transmission)
- Beamforming and beam sweeping
- PBCH processing and the MIB
- Common Control Resource Set 0 (CORESET #0)
- System Information Block 1
- PRACH and the random access procedure
- Initial beam selection

Control Channels

- UE-specific CORESETs
- DCI formats for scheduling and other purposes
- Coding and mapping of PDCCH
- PUCCH coding and resource selection
- DM-RS mapping for PDCCH and PUCCH

Data Channels

- Layer 1 processing for DL-SCH and UL-SCH
- DM-RS mapping for PDSCH and PUSCH
- Scheduling and HARQ timing
- Time and frequency domain resource allocation
- Beam adjustment
- Beam failure detection and recovery

Measurements and Feedback

- ACK/NACK signalling on PUCCH
- CSI reporting and CSI-RS configuration
- SRS configuration and SRS triggering
- Other reference signals

NR/LTE Interworking

- EN-DC (DC between LTE and NR)
- Spectrum sharing between LTE and NR