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Railway, Smart Grid and PPDR support in Rel-18

RAN Rel-18 Workshop

28th June – 2nd July 2021

RWS-210121

Nokia, Nokia Shanghai Bell

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Railway, Smart Grid & PPDR support: Motivation

NR in spectrum allocations between 3 and 5 MHz

Certain sectors have narrow spectrum allocations, e.g.:

Future Railway Mobile Communication System (FRMCS) in Europe:

- Agreed to use NR
- 2x5.6 MHz FDD (874.4-880MHz / 919.4-925MHz)
- Soft migration from GSM-R requires parallel operation of GSM-R and NR, expected to last approx. 10 years (~2025-~2035)
- Approx. 3.6 MHz available for NR, depending on number of parallel GSM-R channels required

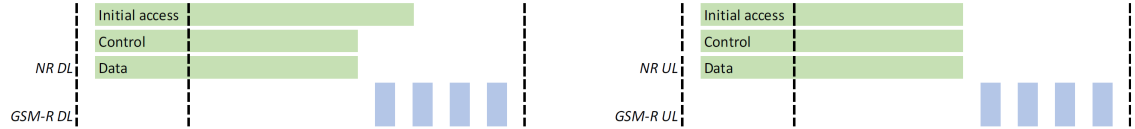
Smart grids:

- 2x3 MHz FDD in 900MHz in US

Public Safety:

- 2x3 MHz FDD in band 28 for PPDR in Europe

Overlay deployment with compact GSM-R channel placement



Unlike RedCap, these target markets do not have significant constraints on device size, complexity, number of antennas, power consumption => optimisation for these characteristics is superfluous.

Target is to adapt NR to the available bandwidths with minimal changes, building on existing NR ecosystem

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Railway, Smart Grid & PPDR support: Objectives

- Standardize a means of deploying NR in spectrum allocations between 3 and 5 MHz, for FR1 with 15kHz SCS
  - Minimize L1 impact:
    - No new numerologies
    - Minimize impact on SSB:
      - No change at all to sync signals (including no puncturing)
      - No remapping of broadcast channel: puncturing only (minimizes impact to UE)
    - No new CORESET0 size, puncturing of PDCCH only (at least for FRMCS case)
    - No new RF requirements for railway – use 5MHz channel bandwidth in RAN4 (assuming same operator for NR and GSM-R)
      - Interference between NR and GSM-R handled by implementation
      - Assume GSM-R channels are mapped at one side of the carrier => only one boundary between NR and GSM-R
- No optimisations for hand-held or low-power devices
- For evaluation purposes, sub-1GHz is assumed

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Background

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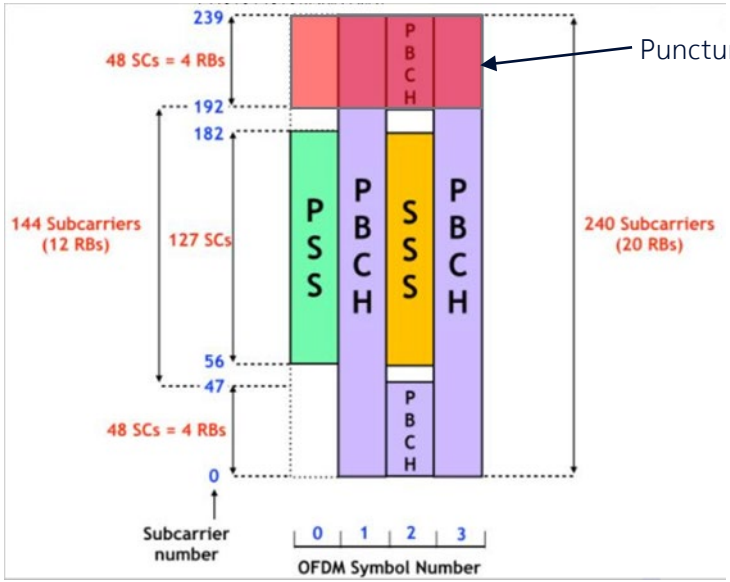
Initial simulation results for puncturing of PBCH

Assumptions:

- One-sided puncturing of PBCH as shown below (2 or 4 PRBs) (no remapping)
- AWGN interference is used to mimic GSM-R interference
- gNB does not transmit PBCH on those GSM-R “PRB”s and UE does detection assuming correct knowledge of PBCH Tx BW



1% BLER

Interference power vs. PBCH power [dB]	SINR loss [dB] due to puncturing 2 PRBs	SINR loss [dB] due to puncturing 4 PRBs
-100	0.89	2.25
0	0.97	2.31

Observations:

- Given UE knowledge of PBCH Tx bandwidth, the PBCH link budget degradation is less than 1dB for 2-PRB puncturing, and approx. 2.25dB for 4-PRB puncturing

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