Qualcomm

RP-211942

3GPP TSG RAN#93e
Electronic Meeting, Sep 13 - 17, 2021
Agenda Item: 9.0.2

Views on <5MHz NR in dedicated spectrum for Rel-18

5G

Background

- NR BW < 5MHz for dedicated spectrum for **Railway**
  - (E)R-GSM 900MHz FDD bands are dedicated for Railway, which would have to support NR and simultaneously legacy GSM-R (to enable transition).
    - (E)R-GSM bands are re-farmed for FRMCS to share 5.6MHz x 2 by NR and GSM.
    - Approximate 3MHz x 2 can be used for NR railway.

- NR BW < 5MHz for dedicated spectrum for **Smart Utilities**
  - A dedicate nationwide allocation of 900MHz FDD band with 3MHz x 2 can be adopting 5G for smart grid private network.

- NR BW < 5MHz for dedicated spectrum for **PPDU**
  - Public Protection and Disaster Relief (PPDR) applications in Europe with 3MHz x 2 in B28 (700 APT) to be specified in n28 is potentially based on 5G.

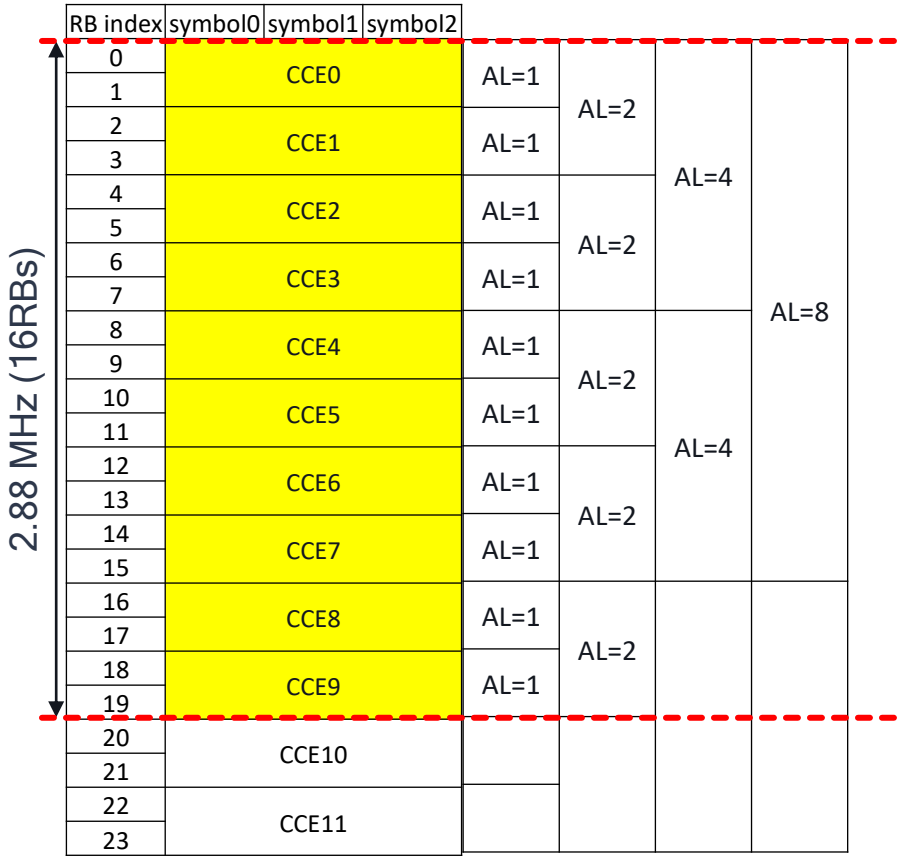
Email discussion on < 5MHz NR in dedicated spectrum (RP-211665)

- Good support for work in Rel-18 on BW < 5 MHz in dedicated spectrum with most companies supporting a work item while some have raised the possibility of a study first.
- Consider the following objectives as a starting point:
  - 3-5 MHz in dedicated FDD FR1 spectrum (RAN1)
    - SCS and CP: 15 kHz with normal CP
    - SSB: PSS/SSS without puncturing, PBCH based on current design while minimizing performance degradation
    - [PDCCH: Consider minimum changes to existing CORESET#0, e.g. puncturing where necessary]
    - [CSI-RS/TRS with flexible bandwidth]
    - PRACH format restriction with UL BW < 5 MHz
    - [If necessary, PUCCH changes without affecting performance]
  - Changes to support deploying NR (RAN4)
    - System parameters including channel and sync rasters
    - RF requirements for bands while minimizing impacts (reuse 5 MHz BW at least for FRMCS and specify RF requirement of 3 MHz BW for other cases)
  - Notes:
    - This work is only applicable to FR1 bands identified for utilities, railways and PPDR.
    - [Potential clarifications on UE types based on further discussions]
- In the following slides, we clarify the objectives of [subbullets]

NR CORESET0 in BW < 5MHz

- CORESET0 has min BW of 4.32MHz, larger than 3MHz.

- **Proposal:**
  - Reuse existing CORESET0 with minimum changes, limit the BW of CORESET0 within the dedicated spectrum by puncturing.
    - E.g., use only 16 RBs with legacy RE/CCE mapping and AL=1/2/4/8 based on CCE hashing function



e.g., BW = approx. 3MHz

NR CSI-RS/TRS in BW < 5MHz

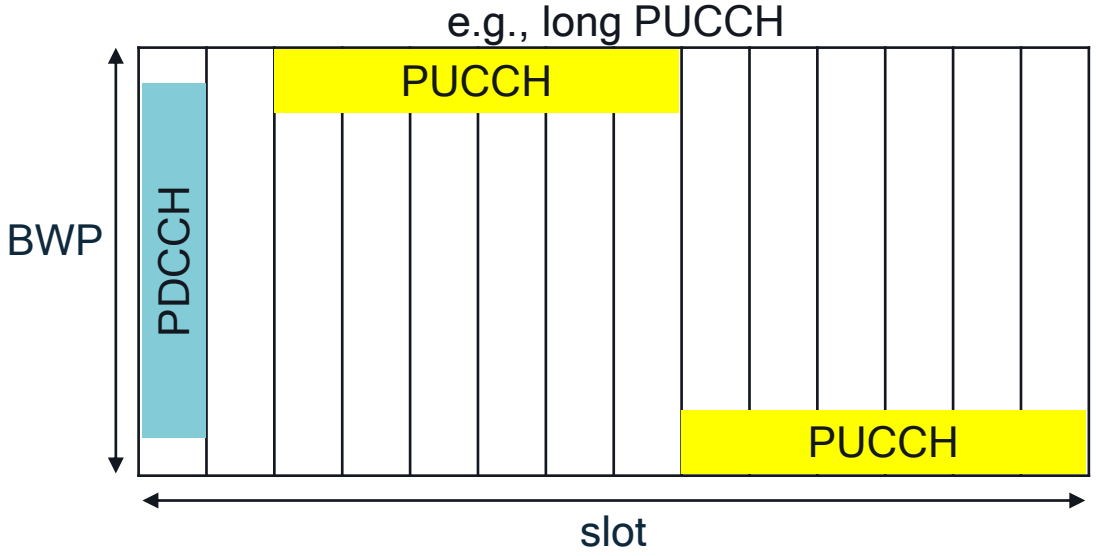
- Legacy CSI-RS has min BW of 5MHz, larger than the dedicated spectrum.
  - UE shall expect that $N_{CSI-RS}^{BW} \geq \min(24, N_{BWP}^{size})$.
- In Rel-16, flexible TRS BW can be configured as 5~10MHz if BWP=10MHz based on UE capability.

- **Proposal:**
  - Configure BWP as 5MHz but support flexible CSI-RS/TRS BW to be within dedicated spectrum with BW < 5MHz.
    - E.g., flexible TRS with 16 or 20RBs based on UE capability.

- NOTE: This proposal is similar to the one introduced under TEI in Rel-16 (*trs-AdditionalBandwidth-r16*)

NR PUCCH in BW < 5MHz

- Legacy PUCCH can use frequency hopping within UL BWP.
- If UL BWP is 5MHz, UL PUCCH frequency hopping will be out of the dedicated spectrum.
- **Proposal:**
  - Alt1: Change frequency hopping pattern for UEs with BW < 5MHz.
  - Alt2: No PUCCH frequency hopping for UEs with BW < 5MHz.



Proposal (delete [ ] of PDCCH, CSI-RS/TRS, PUCCH)

- Objectives for NR BW < 5MHz in dedicated spectrum:
  - 3-5 MHz in dedicated FDD FR1 spectrum (RAN1)
    - SCS and CP: 15 kHz with normal CP
    - SSB: PSS/SSS without puncturing, PBCH based on current design while minimizing performance degradation
    - ~~[~~PDCCH: Consider minimum changes to existing CORESET#0, e.g. puncturing where necessary~~]~~
    - ~~[~~CSI-RS/TRS with flexible bandwidth~~]~~
    - PRACH format restriction with UL BW < 5 MHz
    - ~~[~~If necessary, PUCCH changes without affecting performance~~]~~
  - Changes to support deploying NR (RAN4)
    - System parameters including channel and sync rasters
    - RF requirements for bands while minimizing impacts (reuse 5 MHz BW at least for FRMCS and specify RF requirement of 3 MHz BW for other cases)
  - Notes:
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    - [Potential clarifications on UE types based on further discussions]

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Thank you

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