3GPP TSG RAN#102 RP-233616

Edinburgh, Scotland, December 11-15, 2023

Agenda Item:	**9.1.1.9**
Source:	**ZTE**
Title:	**Views on additional RAN1-led topics in Rel-19**
Document for:	**Discussion and decision**

Views on coverage enhancement in Rel-19 (1/3)

- **Strong level of support for Rel-19 coverage enhancement and the WID scope is converged according to the discussion in RAN#101.**

Moderator's observation in RAN#101:

- Strong level of support for the following proposed enhancements:
  - Multiple PRACH TX over different beams including beam selection for Msg3 (15 sources out of 18 sources)
  - PUSCH repetition scheduled by DCI 0_0 with C-RNTI (11 sources out of 18 sources)

- **Multiple PRACH transmissions with different beams**
  - **Motivation:**
    - PRACH coverage can be enhanced due to the higher beamforming gain by finer Tx beam during PRACH transmissions.
      - It is observed about 1~3 dB gain from beam sweeping with different fine Tx beams compared with multiple PRACH transmissions with the same wide Tx beam according to the evaluation in Rel-18.
    - It is also beneficial to subsequent uplink transmission, e.g., Msg3, for which the best Tx fine beam can also be used.

Fig.1 Multiple PRACH with same wide beam

Fig.2 Multiple PRACH with different fine beams

  - **Potential enhancements in Rel-19.**
    - E.g., PRACH resource partitioning among multiple PRACH transmissions with the same beam and different beams, Tx beam indication, etc.

© ZTE All rights reserved

Views on coverage enhancement in Rel-19 (2/3)

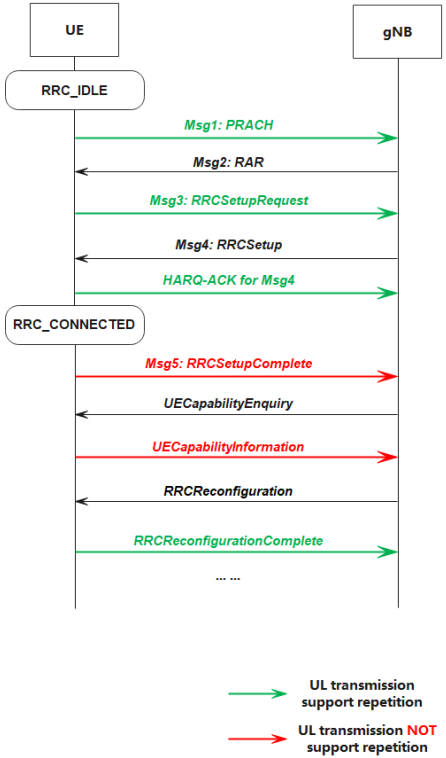
➢ PUSCH repetition type A for a PUSCH scheduled by DCI format 0_0 with CRC scrambled by C-RNTI

☐ Motivation:

- Msg5 PUSCH, which is scheduled by DCI format 0_0 with CRC scrambled by C-RNTI does NOT support repetition transmission yet.
- More UEs can access in the NW after implementing repetition of PRACH/Msg3/ Msg4 HARQ-ACK, but would be congested during Msg5 PUSCH transmission, which would jeopardize the commercialization of existing CE features in both TN and NTN scenarios.
- Re-transmission is not a typical way at least for NTN scenario due to larger delay and significant performance gap (at least 10 dB) comparing with Msg3 repetition.
- If segmentation is used for Msg5, about 32 segmentations are required to approach similar packet size as Msg3. The layer 2 header overhead increases significantly (e.g., 63.4% for 32 segmentations), making it an undesirable solution in reality.
- Except for Msg5, similar coverage issue could be observed for PUSCH carrying UE capability reporting.
- Msg5 enhancement is based on market research and technical analysis by ZTE and China Mobile Group Guangdong Co., Ltd.

☐ Potential enhancement in Rel-19:

- Request mechanism for repetition transmission of PUSCH scheduled by DCI format 0_0 with CRC scrambled by C-RNTI, e.g., via a higher layer signaling in Msg3 PUSCH during initial access
- Repetition transmission mechanism (including, repetition indication, RV determination, available slot determination and frequency hopping, etc.),
    - E.g., the same approach as Msg3 re-transmission which is scheduled by DCI format 0_0 with CRC scrambled by TC-RNTI can be reused.



© ZTE All rights reserved

Views on coverage enhancement in Rel-19 (3/3)

Objectives

- Specify multiple PRACH transmissions with different beams [RAN1, RAN2].
  - E.g., PRACH resource partitioning among multiple PRACH transmissions with the same beam and different beams, Tx beam indication, etc.
- Support PUSCH repetition type A for a PUSCH scheduled by DCI format 0_0 with CRC scrambled by C-RNTI [RAN1, RAN2]
  - Request mechanism, e.g., via a higher layer signaling in Msg3 PUSCH
  - Repetition transmission mechanism e.g., the same approach as Msg3 re-transmission which is scheduled by DCI format 0_0 with CRC scrambled by TC-RNTI can be reused.

© ZTE All rights reserved

Views on multi-carrier enhancement in Rel-19 (1/3)

- **Overall good support for a Rel-19 WID on multi-carrier enhancement, while companies' views on the detailed scope are divergent.**
  - We see a strong need for this direction to address the real market demands, and the prioritized items are listed below

- **Capability sharing among different carriers in multi-carrier scenarios**
  - For Tx switching in Rel-16~18, 1/2 Tx antenna can be shared among up to 4 bands.
  - It is worthwhile to study other potential capabilities that can be shared among different carriers.
    - E.g., UE baseband processing capabilities (HARQ entity, bandwidth size, PDCCH monitoring, number of active BWPs or FDMed PDSCHs/PUSCHs in one carrier etc.), or any RF components?

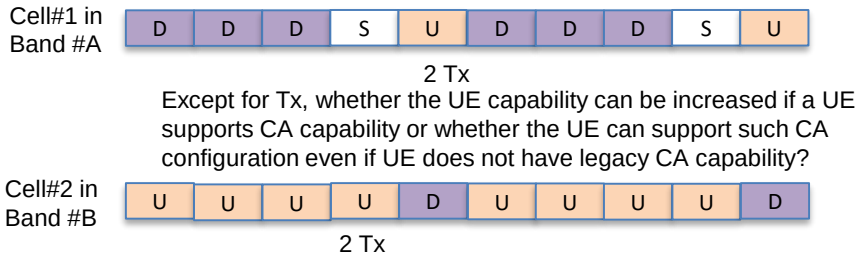


Fig.1, Scenario 1: A UE is configured with **complementary TDD CA**, where only one carrier has DL or UL at a given time.

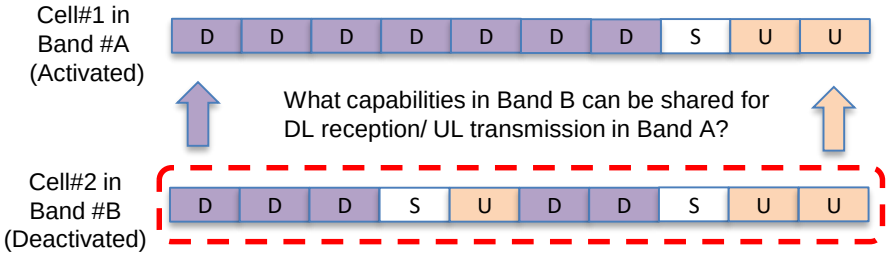


Fig.2, Scenario 2: A UE reports support of a feature in BC A+B, while **only the cell in Band A is configured/activated**.

© ZTE All rights reserved

Views on multi-carrier enhancement in Rel-19 (2/3)

- **Scell with UL only transmission**
  - Better spectrum utilization e.g. due to re-farming / spectrum restriction
    - Some spectrum may only be used for UL transmission due to regulations, e.g., 2.3 GHz in China, 3.5 GHz/C bands in area near the airport in India and US.
    - With the deployment of NR network, operators may re-farm some of the UMTS/LTE bands, e.g., n34 (TDD, 2010 MHz – 2025 MHz), to NR to improve UL coverage and throughput.
  - Coexistence with FPU (Field Pickup Unit) in Japan
    - Japan is planning to start assigning frequencies in the 2.3 GHz band by the end of 2023.
    - It's essential to protect the incumbent service FPU (which only has UL service) from the foreseen IMT deployment, otherwise IMT BS DL CLI towards to FPU receiver would be significant.
  - Benefit for network energy saving and cost reduction
    - Scenario 2a is prioritized in Rel-18 NES discussion in RAN4.
      - *'Scenario 2a: No DL transmission but with UL reception at the NW side on the SSB -less SCell .'*
  - Avoid interference of UL band of one cell to the DL band of another cell.
    - n5 DL and n8 UL frequency ranges partially overlap. Non-simultaneous n5 DL and n8 UL operation for UL CA of CA_n5-n8 by a state of (UL, DL) = (n5+n8, n8) is under discussion in Rel-18 in RAN2 and RAN4 (Details in R4-2306465).

© ZTE All rights reserved

Views on multi-carrier enhancement in Rel-19 (3/3)

Objectives

- Specify capability sharing among different carriers in multi-carrier scenarios under configurations where a UE only needs to transmit UL or receive DL in one carrier at a given time.
  - Support increased UE capability reporting for a UE supporting CA
  - Support certain CA configuration for a UE does not report CA capability.
- Specify Scell with UL only transmission.
  - To define the RRM requirement for Scell activation delay requirement for Scell with UL only transmission under the assumption of no configuration of TRS and CRS-RS during Scell activation procedure [RAN4]

© ZTE All rights reserved