3GPP TSG RAN Meeting #91e
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Document for: Discussion and decision

RP-210537

Scope revision of Rel-17 WI on support of reduced capability NR devices

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RAN1 aspects - on reduced max UE bandwidth

The possibility of, and any associated conditions for, optional support of a wider bandwidth up to 40MHz after initial access for this case will be further discussed at RAN#91e.

- **Do not support a wider bandwidth up to 40 MHz after initial access**
  - The reference bit rate required can be met with 20 MHz UE bandwidth capability in real networks, and is more meaningful than peak data rate. Support of 150 Mbps DL and 50 Mbps UL peak data rate is not relevant to most wearable UEs. The study phase did not set any requirement for wearable devices with 1Rx to achieve 150 Mbps DL peak data rate.
    - For FDD, typical carrier bandwidth for FDD operators does not exceed 20 MHz
      - Given this, there is little practical availability of higher data rates from a 40 MHz bandwidth in FDD.
    - For TDD, UE with 20MHz also has the capability to achieve 150/50 Mbps DL/UL peak data rate
      - This further reduces the motivation to split the market and UE types between bandwidth capabilities.
      - As in LTE, marketing of peak rate is typically independent of TDD configurations, and thus the 20 MHz will satisfy the marketing needs, resulting in a simplified and unified ecosystem.
  - Proposals to generally increase the data rate of RedCap UEs are not a priority in the SI nor WI.
  - Difficult for network to ensure these higher-cost RedCap UEs are only used for certain use cases, as use cases are unlikely to be known to at time of network access. It also complicates network scheduling as it needs to handle more kinds of UEs.
  - Segments and complicates the IoT market, leading to significant negative impact on industry chain, dilution of economies of scale.

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RAN1 aspects - on minimum number of Rx for TDD

For frequency bands where a legacy NR UE (other than 2-Rx vehicular UE) is required to be equipped with a minimum of 4 Rx antenna ports, the minimum number of Rx branches supported by specification for a RedCap UE will be decided at RAN#91e; hence no specific work for these frequency bands will be done before RAN#91e.

- **Support both 1 Rx and 2 Rx as optional UE capabilities for both FDD and TDD, as well as access control mechanism as a useful tool** [RAN1, RAN2]
  - RAN needs to find a solution to enable the small form-factors called for by existing engineering development and business interests in wearable applications
  - We encourage companies to consider a combination of radio protocol measures such as access control mechanisms, as well as per-band association with 1 Rx and 2 Rx if the former is not deemed sufficient
    - By which, a RedCap UE with 1 Rx that is not allowed to access can select another band allowing 1 Rx

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RAN1 aspects - on handling of coverage recovery

The appropriate WI for handling of any potential coverage recovery aspects related to RedCap UEs devices will be considered at RAN#91e.

- **RAN to explicitly task RAN1 to conclude which of the Rel-15/16 coverage features and Rel-17 CE WI features are applicable for RedCap UEs, with minimum necessary changes, if any**
  - A need to improve UL coverage for RedCap is observed according to the SI, but optional features in previous releases and R17 CE WI were not considered. Thus, it's necessary to ensure such need can be mitigated by utilizing those features when applicable.
  - An explicit objective specific for RedCap DL coverage recovery is unnecessary.

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RAN1 aspects - on power saving

- Power saving features should be utilized by RedCap UE, e.g. RRM measurement relaxation and eDRX discussed in RAN2
- Similarly, features discussed in power saving WI should be also utilized by RedCap devices to be more competitive than LTE modems. The justification section in the power saving WID confirms that power saving for IDLE/inactive-state UE needs to consider RedCap devices
- It would be useful to **set a note in the objective section in the power saving WID to ensure the use of UE power saving features for RedCap devices, when applicable**.

3 Justification

……skipped text……

In Rel-17, additional enhancements are required to address outstanding issues in Rel-16, namely idle/inactive-mode power consumption in NR SA deployments, considering both eMBB UEs and Reduced Capability NR Devices, connected-mode power consumption with FR2 deployments, and optimizing network utilization of Rel-16 UE assistance information.

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RAN2 aspects

- Specify eDRX mechanism for both RRC_INACTIVE and RRC_IDLE with eDRX cycle >10.24s, as RAN2 recommended
- Specify RRM measurement relaxation mechanism for neighboring cells for RRC_IDLE/INACTIVE for stationary devices, as RAN2 recommended
- On higher layer capability reduction
  - The following UE complexity reduction techniques for higher layers have been discussed in RAN2:
    - Reduction of the maximum number of DRBs which UE needs to mandatorily support
    - Reduction of L2 buffer size
    - Reduction of 18 bit SN size of PDCP and RLC
    - Relaxation of RRC processing delay requirements.
  - The reduction of supported number of DRBs and reduction of 18 bit SN size is useful to reduce complexity
  - Reduction of L2 buffer size and processing delay requirements are not key factors for complexity
  - **Propose to set at least the below objectives for higher layer capability reduction during WI phase:**
    - **Reduction of the maximum number of DRBs which UE needs to mandatorily support**
    - **Reduction of 18 bit SN size of PDCP and RLC**

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Proposals

- FR1 RedCap UE is not allowed to report a maximum bandwidth larger than 20 MHz after initial access
- Optionally support both 1 Rx and 2 Rx, and consider to define per-band association with the minimum allowed number of Rx, if access control mechanism is not deemed sufficient
- Task RAN1 to conclude which Rel-15/16 UL coverage features and Rel-17 coverage enhancements WI features are applicable for RedCap UEs with minimum necessary changes, if any
- Set a note in the objective section in the power saving WID to ensure the use of UE power saving features for RedCap devices, when applicable
- Specify eDRX mechanism for both RRC_INACTIVE and RRC_IDLE with eDRX cycle >10.24s, as RAN2 recommended
- Specify RRM measurement relaxation mechanism for neighboring cell for RRC_IDLE/INACTIVE for stationary devices, as RAN2 recommended
- Higher layer capability reduction during WI phase should include at least:
  - Reduction of the maximum number of DRBs which UE needs to mandatorily support
  - Reduction of 18 bit SN size of PDCP and RLC

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Thank you.

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