3GPP TSG RAN Meeting #98e
Electronic Meeting, December 12-16, 2022
Agenda Item: 9.2.5

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Views on scope for Network Energy Savings WI

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5G

Study Item Conclusion Highlights (TR 38.864)

- Enhancements in time and frequency domain
  - Adaptation of DTX/DRX, including alignment of Cell DTX/DRX with UE DRX, is beneficial for network energy savings.
  - Adaptation/reduction/elimination of common channels/signals (UE WUS can also be considered) in single or multi-carrier operation are beneficial for network energy savings.
- Enhancements in spatial domain
  - At least dynamic adaptation of spatial elements is beneficial for network energy savings and can be recommended.
  - Dynamic adaptation of TRPs in mTRP scenario also has the potential to provide large network energy saving gain.
- Enhancements in power domain
  - At least dynamic adaptation of downlink transmission power is beneficial for network energy savings.
- Higher layer aspects
  - It is feasible to handle legacy UEs and NES-capable UEs via cell (re-)selection techniques. It is also feasible and possible to enhance the CHO framework.
  - A means that one can prevent legacy UEs from camping on NES cells (of which definition can be left to WI phase), and/or allow NES-capable UEs to (down-)prioritize specific NES cell(s) on specific frequency, is needed, which is left to the WI phase depending on whether the existing mechanism for cell (re)selection is sufficient according to the NES techniques specified.

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Study Item Conclusion Highlights (TR 38.864)

- Several Power Amplifier Efficiency (PAE) improvements techniques were introduced in TR
  - D-2 Over the air digital pre-distortion (OTA-DPD) in which the UEs assist the gNB in reducing nonlinear impairments introduced by the PA
  - D-3 Channel aware tone reservation that exploits the channel nulls to carry TR tones, potentially considering channel conditions and characteristics
  - D-4 BS PA Backoff Adaptation: reduction of the power amplifier backoff in cases of no or low load, coordinated among neighbouring cells
  - D-5 UE post distortion (DPoD) in which UEs perform received signal post-distortion processing to combat non-linear impairments from the transmitter

- UE post distortion (DPoD) technique provides the highest BS energy saving (16.1%) from the proposed techniques
  - PAE improvement is utilized to reduce the power backoff of the PAs in the gNB without UPT/latency impact.
  - In this technique, the UE perform received signal post-distortion processing, and it is applicable for any traffic and load.

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Views on R18 Network Energy Saving WI Scope

RAN1-led items

- **Technique in spatial domain**
  - Specify enhancements for dynamically adapting the number of antenna ports at gNB in transmitting and/or receiving UE-specific channels and signals (RAN1)
- **Technique in time domain**
  - (1st priority) Specify mechanism to support cell DTX/DRX (RAN1, RAN2, RAN3)
    - Specify UE behavior and procedures when cell DTX/DRX is in operation
    - Specify signaling details of cell DTX and cell DRX, e.g., configuration, activation/triggering and de-activation.
    - Note: at least SSB transmission is not impacted when cell DTX/DRX is in operation
  - (2nd priority) Specify procedure for on-demand SSB/SIB1 transmission (RAN1, RAN2)
    - Light SSB combined with UE WUS can be considered as part of on-demand SSB transmission procedure
    - Compact SSB transmission following the triggering of SSB transmission can be considered
- **Technique in power domain**
  - (1st priority) Specify mechanism to support post-distortion processing at UE to combat non-linear impairments from the gNB (Technique D-5 in TR 38.864)
    - It could be complemented by techniques reducing out-of-band impairments, and/or by coordinating allocations for impacted UEs
  - (2nd priority) Specify enhancements for dynamically adapting the transmission power of UE-specific PDSCH (RAN1)

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Views on R18 Network Energy Saving WI Scope

RAN2/3-led items

- Cell selection/reselection enhancements (RAN2)
  - Specify a mechanism so that cells applying NES technique(s) can bar legacy UEs from camping, while allowing NES-capable Rel-18 UEs to camp on.
  - Specify a mechanism so that a NG-RAN node can configure NES-capable Rel-18 UEs to prioritize/down-prioritize specific cell(s) or frequencies applying NES technique(s)
- Specify CHO enhancements e.g., evaluation of CHO conditions depending on whether the source/target cell applies NES technique(s) (RAN2)
- Inter-node beam activation (RAN3)
- F1AP enhancements for paging UEs in a restricted area to save network energy (RAN3)

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