

Network Energy Saving enhancements in Rel-19

Motivation

- Network energy saving (NES) is of great importance for environmental sustainability and for operational cost savings
- TR38.864 has captured many techniques as beneficial for NES but to make Rel-18 NES scope manageable, only some of them are being specified in Rel-18, i.e., cell DTX/DRX, spatial element adaptation, and transmission power adaptation
- In addition, Rel-18 NES work item (with only four RAN1 meetings) is expected to support just a basic functionality which leaves other potential enhancements to the next releases.
- So, Rel-19 NES should specify additional necessary enhancements including the leftovers identified beneficial through Rel-18 study and work items

Spatial domain: Adaptation of TRPs in mTRP operation

ESG (energy saving gain) in TR38.864

- Semi-static TRP reduction: 36.9 % ~ 41.6 %
- Dynamic TRP reduction: 19.7 % ~ 28.7 %

Conclusion in TR38.864

- The TR has concluded that adaptation of TRP in multi-TRP operation has the potential to provide large network energy saving gain.

Potential objectives

- Enhancements on TRP adaptation, e.g., indicating TRP adaptation, UE measurements, CSI feedback, beam management, power control, radio link monitoring, cell (re)selection, handover, initial access, etc [RAN1, RAN2, RAN3, RAN4]
- Joint operation of TRP adaptation and NES techniques specified in Rel-18, e.g., cell DTX/DRX, spatial/power domain adaptation [RAN1, RAN2, RAN4]

Time domain: Adaptation of common channels/signals

ESG (energy saving gain) in TR38.864

- Adaptation of SSB/SIB1 transmission periodicity: 0.9 % ~ 84.8 %
- UE WUS (wake-up signal) triggering SSB/SIB1/RACH: 6.2 % ~ 80.7 %

Conclusion in TR38.864

- 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.

Potential objectives

- Enhancement of SSB/SIB1 transmission adaptation including transmission periodicity/occasion, gNB indication and UE request [RAN1, RAN2]

Leftovers from Rel-18 work item

Justification

- According to current Rel-18 NES WI progress, there is a risk that CSI-RS power adaptation and beam management aspects may not be fully supported in Rel-18.
- CSI-RS power adaptation together with PDSCH power adaptation allows materialized NES gain and simplified network adaptation. Beam management aspects are key to enable NES for FR2 gNBs.
- Rel-18 cell DTX/DRX mechanism is limited for RRC_CONNECTED UEs. In addition, adaptation flexibility and signaling reliability have been discussed but they end up with minimal spec support.

Potential objectives

- Enhancement on CSI-RS transmit power adaptation and beam management to support spatial/power domain adaptation [RAN1, RAN2, RAN4]
- Enhancements on cell DTX/DRX for IDLE/INACTIVE UEs [RAN1, RAN2]
- Provisioning of reliable cell DTX/DRX adaptation and support of multiple cell DTX/DRX configurations (RAN1, RAN2)

Topological domain: NES for various network topology

Justification

- Coverage is a fundamental aspect of cellular network deployments.
- 3GPP has introduced different types of network nodes such as IAB (Rel-15/16) and NCR (Rel-18) for coverage as well as flexible network deployments.
- 3GPP has a lack of study on whether/how to apply NES techniques to a serving gNB having child IAB or NCR node, and to child IAB and NCR nodes themselves.

Potential objectives

- Specify necessary enhancements for network energy saving of NCR/IAB node. [RAN1, RAN2, RAN3]

Potential WI scope

Adaptation of TRPs in mTRP operation

- Enhancements on TRP adaptation, e.g., indicating TRP adaptation, UE measurements, CSI feedback, beam management, power control, radio link monitoring, cell (re)selection, handover, initial access, etc [RAN1, RAN2, RAN3, RAN4]
- Joint operation of TRP adaptation and NES techniques specified in Rel-18, e.g., cell DTX/DRX, spatial/power domain adaptation [RAN1, RAN2, RAN4]

Adaptation of common channels/signals

- Enhancement of SSB/SIB1 transmission adaptation including transmission periodicity/occasion, gNB indication and UE request [RAN1, RAN2]

Leftovers from Rel-18 work item (subject to Rel-18 progress)

- Enhancement on CSI-RS transmit power adaptation and beam management to support spatial/power domain adaptation [RAN1, RAN2, RAN4]
- Enhancements on cell DTX/DRX for IDLE/INACTIVE UEs [RAN1, RAN2]
- Provisioning of reliable cell DTX/DRX adaptation and support of multiple cell DTX/DRX configurations (RAN1, RAN2)

Support of NES solutions in a network topology including NCR or IAB nodes

- Specify necessary enhancements for network energy saving of NCR/IAB node. [RAN1, RAN2, RAN3]