

5G

Agenda Item:

Source:

Document for:

8A.2.5

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Discussion

Views on Network Energy Savings Enhancements in Rel-19

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+ NES in Rel-18

- Various techniques in time, frequency, spatial and power domains have been studied and evaluated in Rel-18 NES SI. However, due to limited TU, only A-4, B-1 (B-1-1: SSB- and/or SIB1-less operation for inter-band CA), C-1, D-1 are specified in Rel-18 NES WI.

	Techniques
Time domain	A-1: Adapting transmission/reception of common channels/signals A-2: Adaptation of UE specific signals and channels A-3: UE wake up signal (WUS) for gNB A-4: Adaptation of DTX/DRX A-5: Adaptation of SSB/SIB1
Frequency domain	B-1: Multi-carrier energy savings enhancements B-2: Adaptation of bandwidth part of UE(s) within a carrier B-3: Adaptation of bandwidth of UE(s) within a BWP
Spatial domain	C-1: Adaptation of spatial elements C-2: Adaptation of TRPs in mTRP operation
Power domain	D-1: Adaptation of transmission power of signals and channels D-2: Over the air digital pre-distortion D-3: Tone reservation D-4: PA power bias adaptation D-5: UE post-distortion

+ NES enhancements in Rel-19

- NES enhancements should be studied and specified in Rel-19 to further release the heavy burden of energy consumption for operators.
- Rel-18 SI evaluated but not specified techniques could be further studied in Rel-19. However, down-selection of the long list of techniques are anyway required.
 - Rel-18 left-overs and enhancements should be further studied and specified, if needed.
 - Rel-18 focused on NES for RRC CONNECTED. Rel-19 should focus more for RRC IDLE and RRC INACTIVE.
 - Backward compatibility can be considered, but should not be a critical factor.
 - Rel-19 should study and specify NES techniques that provide noticeable energy saving gain.

+ Higher resolution spatial-domain adaptation for NES

• Background:

- Enhancements to enable energy savings via spatial-domain and/or power-domain adaptation schemes are supported in Rel-18

Drawback:

- For spatial-domain adaptation, scope is limited to single-TRP Type-I codebook (low resolution), whereas Type-II codebooks with higher resolution are not supported.
- NES enhancements for multi-TRP deployments are not supported

• Proposal:

- Specify spatial-domain NES enhancements via Type-II codebook types, e.g., Rel-16 eType-II CB
- Study and specify NES enhancements for multi-TRP deployment,
 - Dynamic activation/deactivation between multi-TRP and single-TRP for NES purposes, or between different TRPs
 - CSI enhancements by taking Rel-18 Type-II CB for CJT as a starting point
 - Beam management and enhanced TCI
- Study, and, if needed, specify enhancements on BFD/BFR/RLM, EPRE variations due to NES support

+ RS configuration enhancements to improve cell DTX for NES

• Background:

- Enhancements to enable energy savings via cell DTX and/or cell DRX activation for a limited number of signals/channels are supported in Rel-18

Drawback:

- Not monitoring the list of selected signals/channels associated with cell DTX/DRX can have detrimental impact on network performance.
- Many signals/channels are expected to be monitored during non-active periods of cell DTX/DRX, e.g., TRS, CSI-RS for BM, HARQ-ACK feedback, PRS, RACH, leading to marginal energy savings

• Proposal:

- Study, and, if needed, specify configuration enhancements to enable more L1 signals/channels to be muted during non-active periods of cell DTX/DRX with reduced performance degradation, e.g., CSI-RS for BM, TRS, HARQ-ACK feedback, PRS, RACH.

+ Time/frequency domain techniques

- **Proposal:** study and specify below time/frequency domain techniques,
 - On-demand SSB/SIB1 based on UE WUS, e.g.,
 - Design of WUS, new signal/channel or using legacy signal/channel as WUS
 - Configuration of WUS, including the time/frequency/spatial allocations, association of WUS with DL signals
 - Mechanism on how the UE can be informed about cell activity or lack of activity.
 - SSB- and/or SIB1-less operation, e.g.,
 - System information retrieving of an ES carrier from associated carriers/cells and carrier switching
 - Paging for the cell that does not transmit SSB and/or SIB1
 - RA enhancements for UEs to access the SSB/SIB1-less carrier/cell
 - Activation of SSB and/or SIB1 of a carrier/cell based on needs, e.g., the number of RRC IDLE/INACTIVE UEs
 - Dynamic adaptation of bandwidth part of UE(s) within a carrier, e.g.,
 - Enhancements to enable UE group-common or cell-specific BWP configuration and/or switching
 - Enhancements to support SPS PDSCH reception/Type-2 CG PUSCH transmission/SP-CSI reporting on PUSCH without reactivation after the BWP switching
 - Enhancements to enable energy savings via cell DTX and/or cell DRX activation in RRC INACTIVE, e.g. MO-SDT, MT-SDT

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thanks.