**3GPP TSG RAN WG1 #122 R1-25nnnnn**

**Bengaluru, India, Aug 25th – 29th, 2025**

**Source: Ad-Hoc Chair (AT&T)**

**Title: Session Notes of AI 9.4**

**Agenda Item: 9.4**

**Document for: Endorsement**

### 9.4 UE features for enhancements of network energy savings for NR

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

* **Alt. 1:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-1 | On-demand SSB SCell operation indicated by RRC based signaling in Case #1 | 1. Support RRC based signalling to indicate activation and deactivation of on-demand SSB transmission on the SCell in Case #1 (No always-on SSB on the cell) | 6-5 | Yes | No | UE does not support on-demand SSB transmission indicated by RRC based signaling in Case #1 | Per band | n/a | n/a | n/a | Note: it is up to RAN2 whether/how to update this FG for RRC based deactivation~~[~~Note: If UE supports both of FG 61-1 and FG 61-3, UE supports MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #1~~]~~ | Optional with capability signaling |

* **Alt. 2:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-1 | On-demand SSB SCell operation indicated by RRC based signaling in Case #1 | 1. Support RRC based signalling to indicate activation and deactivation of on-demand SSB transmission on the SCell in Case #1 (No always-on SSB on the cell) | 6-5 | Yes | No | UE does not support on-demand SSB transmission indicated by RRC based signaling in Case #1 | Per band | n/a | n/a | n/a | Note: it is up to RAN2 whether/how to update this FG for RRC based deactivationNote: RRC based OD-SSB activation for implicit deactivation via od-ssb-nrofBurst of on-demand SSB bursts is not supported~~[Note: If UE supports both of FG 61-1 and FG 61-3, UE supports MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #1]~~ | Optional with capability signaling |
| 61. Netw\_Energy\_NR\_enh | 61-1a | On-demand SSB SCell operation indicated to be activated by RRC based signaling and indicated to be adapted and deactivated by MAC CE signalling in Case #1 | 1. Support RRC based signalling to indicate activation and MAC CE based signalling to indicate adaptation and deactivation of on-demand SSB transmission on the SCell in Case #1 (No always-on SSB on the cell) | 61-1, 61-3 | Yes | No | UE does not support on-demand SSB transmission indicated to be activated by RRC based signaling and indicated to be adapted and deactivated by MAC CE signalling in Case #1 | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

* **Alt. 1:**

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| 61. Netw\_Energy\_NR\_enh | 61-2 | On-demand SSB SCell operation indicated by RRC based signaling in Case #2 for same center frequency | 1. Support RRC based signalling to indicate activation and deactivation of on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency between always-on SSB and on-demand SSB2. Supported time domain relation between on-demand SSB and always-on SSB | 6-5 | Yes | No | UE does not support on-demand SSB transmission on the SCell indicated by RRC based signaling in Case #2 for same center frequency between always-on SSB and on-demand SSB | Per band | n/a | n/a | n/a | Candidate value of component 2 = {Time-C1, Time-C1nC2}Note: * Time-C1: During OD-SSB transmission, the union of AO-SSB transmission and OD-SSB transmission has a periodic time domain pattern (the interval between SSB bursts is even and supported in legacy specification)
* Time-C1nC2 includes both Time-C1 and Time-C2

(Time-C2: During OD-SSB transmission, the union of AO-SSB transmission and OD-SSB transmission has a non-periodic time domain pattern)Note: it is up to RAN2 whether/how to update this FG for RRC based deactivation~~[~~Note: If UE supports one of both of FG 61-2 and FG 61-4, UE supports MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #2 for same center frequency~~]~~ | Optional with capability signaling |

* **Alt. 2:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-2 | On-demand SSB SCell operation indicated by RRC based signaling in Case #2 for same center frequency | 1. Support RRC based signalling to indicate activation and deactivation of on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency between always-on SSB and on-demand SSB2. Supported time domain relation between on-demand SSB and always-on SSB | 6-5 | Yes | No | UE does not support on-demand SSB transmission on the SCell indicated by RRC based signaling in Case #2 for same center frequency between always-on SSB and on-demand SSB | Per band | n/a | n/a | n/a | Candidate value of component 2 = {Time-C1, Time-C1nC2}Note: * Time-C1: During OD-SSB transmission, the union of AO-SSB transmission and OD-SSB transmission has a periodic time domain pattern (the interval between SSB bursts is even and supported in legacy specification)
* Time-C1nC2 includes both Time-C1 and Time-C2

(Time-C2: During OD-SSB transmission, the union of AO-SSB transmission and OD-SSB transmission has a non-periodic time domain pattern)Note: it is up to RAN2 whether/how to update this FG for RRC based deactivationNote: RRC based OD-SSB activation for implicit deactivation via od-ssb-nrofBurst of on-demand SSB bursts is not supported~~[Note: If UE supports one of both of FG 61-2 and FG 61-4, UE supports MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #2 for same center frequency]~~ | Optional with capability signaling |
| 61. Netw\_Energy\_NR\_enh | 61-2b | On-demand SSB SCell operation indicated to be activated by RRC based signaling and indicated to be adapted and deactivated by MAC CE signalling in Case #2 for same center frequency | 1. Support RRC based signalling to indicate activation and MAC CE based signalling to indicate adaptation and deactivation of on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency 2. Supported time domain relation between on-demand SSB and always-on SSB | 61-2, 61-4 | Yes | No | UE does not support on-demand SSB transmission on the SCell indicated to be activated by RRC based signaling and indicated to be adapted and deactivated by MAC CE signalling in Case #2 for same center frequency | Per band | n/a | n/a | n/a | Candidate value of component 2 = {Time-C1, Time-C1nC2}Note: * Time-C1: During OD-SSB transmission, the union of AO-SSB transmission and OD-SSB transmission has a periodic time domain pattern (the interval between SSB bursts is even and supported in legacy specification)
* Time-C1nC2 includes both Time-C1 and Time-C2

(Time-C2: During OD-SSB transmission, the union of AO-SSB transmission and OD-SSB transmission has a non-periodic time domain pattern) | Optional with capability signaling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

* **Alt. 1:**

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| 61. Netw\_Energy\_NR\_enh | 61-2a | On-demand SSB SCell operation indicated by RRC based signaling in Case #2 for different center frequency | 1. Support RRC based signalling to indicate activation and deactivation of on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequencies~~y~~ between always-on SSB and on-demand SSB | 61-2 | Yes | No | UE does not support on-demand SSB transmission on the SCell indicated by RRC based signaling in Case #2 for different center frequencies~~y~~ between always-on SSB and on-demand SSB | Per band | n/a | n/a | n/a | Note: it is up to RAN2 whether/how to update this FG for RRC based deactivation~~[~~Note: If UE supports both of FG 61-2a and one of FG 61-4a, UE supports MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #2 for different center frequency~~]~~ | Optional with capability signaling |

* **Alt. 2:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-2a | On-demand SSB SCell operation indicated by RRC based signaling in Case #2 for different center frequencies~~y~~ | 1. Support RRC based signalling to indicate activation and deactivation of on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequencies~~y~~ between always-on SSB and on-demand SSB | 61-2 | Yes | No | UE does not support on-demand SSB transmission on the SCell indicated by RRC based signaling in Case #2 for different center frequencies~~y~~ between always-on SSB and on-demand SSB | Per band | n/a | n/a | n/a | Note: it is up to RAN2 whether/how to update this FG for RRC based deactivationNote: RRC based OD-SSB activation for implicit deactivation via od-ssb-nrofBurst of on-demand SSB bursts is not supported~~[Note: If UE supports both of FG 61-2a and one of FG 61-4a, UE supports MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #2 for different center frequency]~~ | Optional with capability signaling |
| 61. Netw\_Energy\_NR\_enh | 61-2c | On-demand SSB SCell operation indicated to be activated by RRC based signaling and indicated to be adapted and deactivated by MAC CE signalling in Case #2 for different center frequencies | 1. Support RRC based signalling to indicate activation and MAC CE based signalling to indicate adaptation and deactivation of on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequencies between always-on SSB and on-demand SSB | 61-2a, 61-4a | Yes | No | UE does not support on-demand SSB transmission on the SCell indicated to be activated by RRC based signaling and indicated to be adapted and deactivated by MAC CE signalling in Case #2 for different center frequencies | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-3 | On-demand SSB SCell operation indicated via MAC CE in Case #1 | 1. Support MAC CE based signalling to indicate activation, ~~[~~adaptation,~~]~~ and deactivation of on-demand SSB transmission on the SCell in Case #1 (No always-on SSB on the cell)2. Supported on-demand SSB deactivation mechanisms: Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indicationImplicit deactivation via *od-ssb-nrofBurst* of on-demand SSB bursts to be transmitted after on-demand SSB is indicated | ~~FFS~~ 6-5 | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE in Case #1 | Per band | n/a | n/a | n/a | Component 2 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| 61. Netw\_Energy\_NR\_enh | 61-4 | On-demand SSB SCell operation indicated via MAC CE in Case #2 for same center frequency | 1. Support MAC CE based signalling to indicate activation, ~~[~~adaptation,~~]~~ and deactivation of on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency between always-on SSB and on-demand SSB2.Supported time domain relation between on-demand SSB and always-on SSB3. Supported on-demand SSB deactivation mechanisms: - Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication- Implicit deactivation via *od-ssb-nrofBurst* of on-demand SSB bursts to be transmitted after on-demand SSB is indicated | ~~FFS~~ 6-5 | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE in Case #2 for same center frequency between always-on SSB and on-demand SSB | Per band | n/a | n/a | n/a | Candidate value of component 2 = {Time-C1, Time-C1nC2}Note: * Time-C1: During OD-SSB transmission, the union of AO-SSB transmission and OD-SSB transmission has a periodic time domain pattern (the interval between SSB bursts is even and supported in legacy specification)
* Time-C1nC2 includes both Time-C1 and Time-C2

(Time-C2: During OD-SSB transmission, the union of AO-SSB transmission and OD-SSB transmission has a non-periodic time domain pattern)Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-4a | On-demand SSB SCell operation indicated via MAC CE in Case #2 for different center frequencies~~y~~ | 1. Support MAC CE based signalling to indicate activation, ~~[~~adaptation,~~]~~ and deactivation of on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequencies~~y~~ between always-on SSB and on-demand SSB2. Supported on-demand SSB deactivation mechanisms: - Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication- Implicit deactivation via *od-ssb-nrofBurst* of on-demand SSB bursts to be transmitted after on-demand SSB is indicated | 61-4 | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE in Case #2 for different center frequencies~~y~~ between always-on SSB and on-demand SSB | Per band | n/a | n/a | n/a | Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

**Proposal: Adopt the following changes highlighted in chromatic fonts, while keeping the yellow highlighting, if any, as shown**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-5 | SIB1 request for idle/inactive UEs | 1. Reception of SIB1 request configuration associated with SIB1 request for a cell2. Transmission of PRACH on the uplink to request SIB1 of the cell3. Reception of SIB1 ~~[~~in a window~~]~~ ~~[at least]~~ upon SIB1 request |  | No | No | UE does not camp on the cell | n/a | n/a | n/a | n/a | A UE indicates support of this FG if it transmits a SIB1 request | Optional without capability signaling |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-6 | SSB burst periodicity adaptation for SCell operation | Support of adaptation of SSB burst periodicity for SCell by DCI format 2\_9 | 6-5 | Yes |  | UE does not support adaptation of SSB burst periodicity for SCell | Per band | n/a | n/a | n/a | Note: the SSB for this FG is not cell defining SSB | Optional with capability signaling |

**Proposal: Introduce the following Rel. 19 UE FGs (yellow highlighting, if any, shows text that’s not yet agreed)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-8 | MAC-CE based adaptation and deactivation of on-demand SSB indicated by RRC based signaling | Support MAC CE based adaptation/deactivation mechanism to adapt/deactivate the on-demand SSB indicated by RRC | one of {{61-1 and 61-3} or {61-2 and 61-4} or {61-2a and 61-4a}} | Yes |  | MAC CE based adaptation/deactivation mechanism to adapt/deactivate the on-demand SSB indicated by RRC is not supported | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

**Proposal: Introduce the following Rel. 19 UE FGs (yellow highlighting, if any, shows text that’s not yet agreed)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-9a | RRC based activation of SSB transmission and MAC-CE based on-demand SSB adaptation/deactivation in Case #1 | Support of RRC based activation of on-demand SSB transmission with MAC-CE based on-demand SSB adaptation/deactivation in Case #1 | 61-1 and 61-3 | Yes |  | RRC based activation of on-demand SSB transmission with MAC-CE based on-demand SSB adaptation/deactivation in Case #1 is not supported |  | Per band | n/a | n/a | n/a |  | Optional with capability signaling |
| 61. Netw\_Energy\_NR\_enh | 61-9b | RRC based activation of SSB transmission and MAC-CE based on-demand SSB adaptation/deactivation in Case #2 for same center frequency | Support of RRC based activation of on-demand SSB transmission with MAC-CE based on-demand SSB adaptation/deactivation in Case #2 for same center frequency | 61-2 and 61-4 | Yes |  | RRC based activation of on-demand SSB transmission with MAC-CE based on-demand SSB adaptation/deactivation in Case #2 for same center frequency is not supported |  | Per band | n/a | n/a | n/a |  | Optional with capability signaling |
| 61. Netw\_Energy\_NR\_enh | 61-9c | RRC based activation of SSB transmission and MAC-CE based on-demand SSB adaptation/deactivation in Case #2 for different center frequency | Support of RRC based activation of on-demand SSB transmission with MAC-CE based on-demand SSB adaptation/deactivation in Case #2 for different center frequency | 61-2a and 61-4a | Yes |  | RRC based activation of on-demand SSB transmission with MAC-CE based on-demand SSB adaptation/deactivation in Case #2 for different center frequency is not supported |  | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

R1-2505192 Network Energy Saving Enhancement UE features Nokia

R1-2505337 Discussions on UE features for Rel-19 NES CATT

R1-2505358 UE features for Rel-19 NES Huawei, HiSilicon

R1-2505397 UE features for enhancements of network energy savings for NR vivo

R1-2505446 Discussion on UE features for enhancements of network energy savings for NR Xiaomi

R1-2505563 UE features for enhancements of network energy savings for NR Samsung

R1-2505601 Discussion on NES features ZTE Corporation, Sanechips

R1-2505707 Discussion on UE features for enhancements of network energy savings for NR OPPO

R1-2505850 Discussion on UE features for enhancements of NES LG Electronics

R1-2505896 Views on UE features for Rel-19 NES Apple

R1-2505994 UE features for R19 NES Ericsson

R1-2506198 UE features for Rel-19 NES Qualcomm Incorporated

R1-2506228 Summary of UE features for enhancements of network energy savings for NR Moderator (AT&T)