**3GPP TSG RAN WG1 #122 R1-2506228**

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

**Agenda Item: 9.4**

**Source: Moderator (AT&T)**

**Title: Summary of UE features for enhancements of network energy savings for NR**

**Document for:** **Discussion/Decision**

# Introduction

This document presents the summary of email discussion [122-R19-UE\_features] during RAN1 #122. According to the Chair’s Notes:

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| [122-R19-UE\_features] Email discussion on Rel-19 UE features – Ralf (AT&T), Naoya (DOCOMO), Ralf (AT&T)* To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc
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The following was discussed during RAN1 #122 within the scope of [122-R19-UE\_features]. All proposals are based on the latest RAN1 UE features list for Rel. 19 in [1].

# Summary of Contributions Submitted to RAN1 #122

The following is the moderator’s summary of contributions submitted to RAN1 #122 in this agenda item.

## On-demand SSB SCell operation

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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) |  | 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 |

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| Company | Summary |
| Nokia [2] |  |
| CATT [3] | If UE supports both of FG 61-1 and FG 61-3, in order to improve the indication flexibility of deactivation for the on-demand SSB indicated by RRC in Case #1, UE should support MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #1. Hence, the following note should be included in the column of Note:* 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.

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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) | ~~FFS~~ | 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 | ~~FFS: supported deactivation mechanisms~~Note: ~~RRC based deactivation mechanism~~ it is up to RAN2 whether/how to update this FG for RRC based deactivation~~[~~Note: If UE supports ~~one of~~ both of FG 61-1 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 |

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| Huawei/HiSilicon [4] |  |
| Vivo [5] | Regarding the note in FG 61-1, 61-2 and 61-2a, remove the bracket of the note.***Proposal 2: Remove the bracket of the Note for FG 61-1, 61-2 and 61-2a.*** |
| Xiaomi [6] | A controversial issue is how to handle deactivation, despite of RRC-based OD-SSB operation or MAC CE based OD-SSB operation. Two mechanisms were agreed in RAN1#119 meeting to deactivate OD-SSB, which as shown as below:* Option 1: Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication
* Option 2: Configuration/indication of the number N of on-demand SSB bursts to be transmitted after on-demand SSB is indicated

Option 1 is MAC CE based deactivation while option 2 is RRC based deactivation. From this perspective, at least option 2 can be regarded as the default mechanism for OD-SSB deactivation, which has been captured as a component for FG-61 series. Regarding to option 1, we don’t see any barriers to support it if UE support MAC CE based OD-SSB operation.***Observation 1: There is no barriers for a UE to support MAC CE based OD-SSB deactivation if it supports MAC CE based OD-SSB operation.*** In RAN1#120bis meeting, it was agreed that UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.

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| **Agreement**For a cell supporting on-demand SSB SCell operation, for Case #1 (i.e., No always-on SSB on the cell)* UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.
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***Observation 2: For OD-SSB deactivation, the following restriction needs to be captured in the note column for each feature group.**** ***UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.***

Given OD-SSB operation is only allowed on SCell, DL NR-RN CA capability is the prerequisite of FG 61-1 to FG 61-4.***Observation 3: Basic NR DL CA operation is the prerequisite of OD-SSB operation.***

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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) | FG 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 |

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| Samsung [7] | In RAN1#121, RAN1 has agreement regarding RRC based activation and MAC CE based adaptation and deactivation (highlighted in the following). To reflect such agreement, the notes in FG 61-1, 61-2, and 61-2a shall be removed, and the corresponding separate UE features shall be added.

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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) |  | 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 |
| 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 |

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| ZTE Corporation/Sanechips [8] |  |
| OPPO [9] | We first would like to provide some background information on the OD-SSB deactivation. In fact during RAN1#120bis meeting, the OD-SSB deactivation by either RRC or MAC-CE was discussed for case#1 and due to the absence of always-on SSB, the network needs to maintain the OD-SSB transmission as long as the SCell is active. In this sense, techncially speaking, for case#1, there is not allowed to deactivate OD-SSB by either RRC or MAC-CE. For this reason, we would suggest to remove ‘deactivation’ from FG61-1 and FG61-3. **Agreement from RAN1#120bis**For a cell supporting on-demand SSB SCell operation, for Case #1 (i.e., No always-on SSB on the cell)* UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.

**Proposal: Suggest to remove ‘deactivation’ from FG61-1 and FG61-3 to align with RAN1 agreement.** |
| LG Electronics [10] |

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| 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) | Note: it is up to RAN2 whether/how to update this FG for RRC based deactivation |

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| Apple [11] |

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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) |  | 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 | Optional with capability signaling |
| 61. Netw\_Energy\_NR\_enh | 61-1a | MAC-CE based OD-SSB transmission adaptation for explicit deactivation of OD-SSB in Case #1 | 1. Support of MAC-CE based OD-SSB transmission adaptation for explicit deactivation of OD-SSB in Case #1 for RRC based OD-SSB activation | 61-1 | Yes | No | UE does not support MAC-CE based OD-SSB transmission adaptation for implicit deactivation of OD-SSB in Case #1 for RRC based OD-SSB activation  | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

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| Ericsson [12] | Note column: Update as follows.* + - ~~[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]~~
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| Qualcomm Incorporated [13] |  |

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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 2. Supported time domain relation between on-demand SSB and always-on SSB |  | 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 | 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 |

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| Company | Summary |
| Nokia [2] |  |
| CATT [3] | If UE supports both of FG 61-2 and FG 61-4, in order to improve the indication flexibility of deactivation for the on-demand SSB indicated by RRC in Case #2 for same center frequency, UE should support MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #2 for same center frequency. Hence, the following note should be included in the column of Note:* Note: If UE supports 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.

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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 | ~~FFS~~ | 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: ~~RRC based deactivation mechanism~~ it is up to RAN2 whether/how to update this FG for RRC based deactivation~~FFS: supported deactivation mechanisms~~**~~[~~**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 |

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| Huawei/HiSilicon [4] |  |
| Vivo [5] | Regarding the note in FG 61-1, 61-2 and 61-2a, remove the bracket of the note.***Proposal 2: Remove the bracket of the Note for FG 61-1, 61-2 and 61-2a.*** |
| Xiaomi [6] | A controversial issue is how to handle deactivation, despite of RRC-based OD-SSB operation or MAC CE based OD-SSB operation. Two mechanisms were agreed in RAN1#119 meeting to deactivate OD-SSB, which as shown as below:* Option 1: Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication
* Option 2: Configuration/indication of the number N of on-demand SSB bursts to be transmitted after on-demand SSB is indicated

Option 1 is MAC CE based deactivation while option 2 is RRC based deactivation. From this perspective, at least option 2 can be regarded as the default mechanism for OD-SSB deactivation, which has been captured as a component for FG-61 series. Regarding to option 1, we don’t see any barriers to support it if UE support MAC CE based OD-SSB operation.***Observation 1: There is no barriers for a UE to support MAC CE based OD-SSB deactivation if it supports MAC CE based OD-SSB operation.*** In RAN1#120bis meeting, it was agreed that UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.

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| **Agreement**For a cell supporting on-demand SSB SCell operation, for Case #1 (i.e., No always-on SSB on the cell)* UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.
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***Observation 2: For OD-SSB deactivation, the following restriction needs to be captured in the note column for each feature group.**** ***UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.***

Given OD-SSB operation is only allowed on SCell, DL NR-RN CA capability is the prerequisite of FG 61-1 to FG 61-4.***Observation 3: Basic NR DL CA operation is the prerequisite of OD-SSB operation.***

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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 2. Supported time domain relation between on-demand SSB and always-on SSB | FG 6-5 | Yes | No | UE does not support on-demand SSB SCell indication/deactivation indicated by RRC based signaling 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)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 |

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| Samsung [7] | In RAN1#121, RAN1 has agreement regarding RRC based activation and MAC CE based adaptation and deactivation (highlighted in the following). To reflect such agreement, the notes in FG 61-1, 61-2, and 61-2a shall be removed, and the corresponding separate UE features shall be added.

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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 2. Supported time domain relation between on-demand SSB and always-on SSB |  | 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 | 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 |
| 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 |

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| ZTE Corporation/Sanechips [8] |  |
| OPPO [9] |  |
| LG Electronics [10] |

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| 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 2. Supported time domain relation between on-demand SSB and always-on SSB | 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 |

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| Apple [11] |

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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 2. Supported time domain relation between on-demand SSB and always-on SSB |  | 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 | 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 | Optional with capability signaling |
| 61. Netw\_Energy\_NR\_enh | 61-2b | MAC-CE based OD-SSB transmission adaptation for explicit deactivation of OD-SSB in Case #2 for same center frequency | 1. Support of MAC-CE based OD-SSB transmission adaptation for explicit deactivation of OD-SSB in Case #2 for same center frequency for RRC based OD-SSB activation | 61-2 | Yes | No | UE does MAC-CE based OD-SSB transmission adaptation for explicit deactivation of OD-SSB in Case #2 for same center frequency for RRC based OD-SSB activation | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

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| Ericsson [12] | Note column: Update as follows. * + - ~~[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]~~
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| Qualcomm Incorporated [13] |  |

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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 frequency 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 frequency | 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 |

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| Company | Summary |
| Nokia [2] |  |
| CATT [3] | If UE supports both of FG 61-2a and FG 61-4a, in order to improve the indication flexibility of deactivation for the on-demand SSB indicated by RRC in Case #2 for different center frequency, UE should support MAC CE based deactivation mechanism to deactivate the on-demand SSB indicated by RRC in Case #2 for different center frequency. Hence, the following note should be included in the column of Note:* Note: If UE supports both of FG 61-2a and 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.

In addition, the words of “between always-on SSB and on-demand SSB” are missed in several descriptions for FG 61-2 and FG 61-2a, and they are added below.

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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 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: ~~RRC based deactivation mechanism~~ it is up to RAN2 whether/how to update this FG for RRC based deactivation~~FFS: supported deactivation mechanisms~~~~[~~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 |

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| Huawei/HiSilicon [4] |  |
| Vivo [5] | Regarding the note in FG 61-1, 61-2 and 61-2a, remove the bracket of the note.***Proposal 2: Remove the bracket of the Note for FG 61-1, 61-2 and 61-2a.*** |
| Xiaomi [6] | A controversial issue is how to handle deactivation, despite of RRC-based OD-SSB operation or MAC CE based OD-SSB operation. Two mechanisms were agreed in RAN1#119 meeting to deactivate OD-SSB, which as shown as below:* Option 1: Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication
* Option 2: Configuration/indication of the number N of on-demand SSB bursts to be transmitted after on-demand SSB is indicated

Option 1 is MAC CE based deactivation while option 2 is RRC based deactivation. From this perspective, at least option 2 can be regarded as the default mechanism for OD-SSB deactivation, which has been captured as a component for FG-61 series. Regarding to option 1, we don’t see any barriers to support it if UE support MAC CE based OD-SSB operation.***Observation 1: There is no barriers for a UE to support MAC CE based OD-SSB deactivation if it supports MAC CE based OD-SSB operation.*** In RAN1#120bis meeting, it was agreed that UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.

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| **Agreement**For a cell supporting on-demand SSB SCell operation, for Case #1 (i.e., No always-on SSB on the cell)* UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.
 |

***Observation 2: For OD-SSB deactivation, the following restriction needs to be captured in the note column for each feature group.**** ***UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.***

Given OD-SSB operation is only allowed on SCell, DL NR-RN CA capability is the prerequisite of FG 61-1 to FG 61-4.***Observation 3: Basic NR DL CA operation is the prerequisite of OD-SSB operation.***

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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 frequency 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 frequency | 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 |

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| Samsung [7] | In RAN1#121, RAN1 has agreement regarding RRC based activation and MAC CE based adaptation and deactivation (highlighted in the following). To reflect such agreement, the notes in FG 61-1, 61-2, and 61-2a shall be removed, and the corresponding separate UE features shall be added.

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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 frequency 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 frequency | 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 |
| 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 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 different center frequency 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 frequency | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

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| ZTE Corporation/Sanechips [8] |  |
| OPPO [9] |  |
| LG Electronics [10] |

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| --- | --- | --- | --- |
| 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 frequency between always-on SSB and on-demand SSB | Note: it is up to RAN2 whether/how to update this FG for RRC based deactivation |

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| Apple [11] |

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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 frequency 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 frequency | 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 | Optional with capability signaling |
| 61. Netw\_Energy\_NR\_enh | 61-2c | MAC-CE based OD-SSB transmission adaptation for explicit deactivation of OD-SSB in Case #2 for different center frequency | 1. Support of MAC-CE based OD-SSB transmission adaptation for explicit deactivation of OD-SSB in Case #2 for different center frequency for RRC based OD-SSB activation | 61-2a | Yes | No | UE does MAC-CE based OD-SSB transmission adaptation for explicit deactivation of OD-SSB in Case #2 for different center frequency for RRC based OD-SSB activation | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

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| Ericsson [12] | Note column: Update as below. * + - ~~[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]~~
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| Qualcomm Incorporated [13] |  |

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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 | 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 |

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| --- | --- |
| Company | Summary |
| Nokia [2] | **Proposal 1:** Remove square brackets around “adaptation” in FGs 61-3 and 61-4

|  |  |  |
| --- | --- | --- |
| 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 |

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| CATT [3] | According to the following agreement in RAN1#121[2], subject to UE capability, it is supported that MAC CE based signalling to indicate adaptation of on-demand SSB transmission on the SCell. Such indication of adaptation of on-demand SSB transmission on the SCell should be applicable to the following cases:* Case #1 (No always-on SSB on the cell);
* Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency between always-on SSB and on-demand SSB;
* Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequencies between always-on SSB and on-demand SSB.

Hence, the brackets for the word of “adaptation” should be removed in the column of components for FG 61-3/61-4/61-4a:

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| **Agreement**For a cell supporting on-demand SSB SCell operation, the following combinations are supported.* For OD-SSB transmission activation (OD-Tact) and OD-SSB transmission adaptation (OD-TA),
	+ Case A1: RRC-based OD-Tact without N (i.e., *od-ssb-nrofBurst*) configured + MAC CE-based OD-TA;
		- Subject to UE capability
	+ Case B1: MAC CE-based OD-Tact without N configured + MAC CE-based OD-TA;
	+ Case B2: MAC CE-based OD-Tact with N configured + MAC CE-based OD-TA.
* For OD-SSB transmission deactivation (OD-TD),
	+ Case X1: RRC-based OD-Tact without N configured + MAC CE-based OD-TD;
		- Subject to UE capability
	+ Case Y1: MAC CE-based OD-Tact or OD-TA without N configured + MAC CE-based OD-TD;
	+ Case Y2: MAC CE-based OD-Tact or OD-TA with N configured + implicit OD-TD;
	+ Case Y3: MAC CE-based OD-Tact or OD-TA with N configured + MAC CE-based OD-TD.
* **Conclusion**: There is no RAN1 consensus to support RRC activation of OD-SSB transmission configuring *od-ssb-nrofBurst.*
* Note: “Implicit OD-TD” above implies that the on-demand SSB is deactivated based on the value for *od-ssb-nrofBurst* according to NW indication.
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In addition, the words of “between always-on SSB and on-demand SSB” are missed in several descriptions for FG 61-4 and FG 61-4a, and they are added below.

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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 indication- Implicit deactivation via ~~Number N~~ *od-ssb-nrofBurst* of on-demand SSB bursts to be transmitted after on-demand SSB is indicated~~]~~ | FFS | 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 |

 |
| Huawei/HiSilicon [4] | Regarding the prerequisite FGs, RRC based signalling and MAC CE based signalling should be independent FGs with each other. No prerequisite FGs are needed for FG 61-3/61-4. **Proposal 1: Update FG 61-3/61-4/61-4a as shown in red in Table 1 for on-demand SSB SCell operation (MAC CE based signalling).**

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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~~ | 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 |

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| Vivo [5] | Regarding FFS for prerequisite feature groups of FG 61-3 and 61-4, there is no need to have any prerequisite feature group so that it is preferred to remove FFS.***Proposal 1: Remove the FFS for prerequisite feature groups of FG 61-3 and 61-4.*** |
| Xiaomi [6] | A controversial issue is how to handle deactivation, despite of RRC-based OD-SSB operation or MAC CE based OD-SSB operation. Two mechanisms were agreed in RAN1#119 meeting to deactivate OD-SSB, which as shown as below:* Option 1: Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication
* Option 2: Configuration/indication of the number N of on-demand SSB bursts to be transmitted after on-demand SSB is indicated

Option 1 is MAC CE based deactivation while option 2 is RRC based deactivation. From this perspective, at least option 2 can be regarded as the default mechanism for OD-SSB deactivation, which has been captured as a component for FG-61 series. Regarding to option 1, we don’t see any barriers to support it if UE support MAC CE based OD-SSB operation.***Observation 1: There is no barriers for a UE to support MAC CE based OD-SSB deactivation if it supports MAC CE based OD-SSB operation.*** In RAN1#120bis meeting, it was agreed that UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.

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| **Agreement**For a cell supporting on-demand SSB SCell operation, for Case #1 (i.e., No always-on SSB on the cell)* UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.
 |

***Observation 2: For OD-SSB deactivation, the following restriction needs to be captured in the note column for each feature group.**** ***UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.***

Given OD-SSB operation is only allowed on SCell, DL NR-RN CA capability is the prerequisite of FG 61-1 to FG 61-4.***Observation 3: Basic NR DL CA operation is the prerequisite of OD-SSB operation.***

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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~~FG 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 |

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| Samsung [7] | RAN1 specification has explicitly defined UE behavior on adaptation of OD-SSB based on MAC CE, hence, the bracket around “adaptation” in FG 61-3, 61-4, and 61-4a shall be removed. Meanwhile, MAC CE based activation, adaptation, and deactivation shall be a basic FG, and not based on other FGs as prerequisite, hence, the FFS in FG 61-3 and 61-4 shall be removed.

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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~~ | 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 |

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| ZTE Corporation/Sanechips [8] | In RAN1#121, one of the remaining issues is on the component 1 of FG 61-3, FG 61-4 and FG 61-4a, where the wording ‘adaptation’ is still highlighted in yellow and in bracket [1]. The intention is to include the all expected cases for transmitting a MAC CE in component 1, including MAC CE activating on-demand SSB, MAC CE deactivating on-demand SSB, and MAC CE adapting/re-activating/updating on-demand SSB. From our perspective, we think it is not necessary to keep the wording ‘adaptation’, since the wording ‘activation’ also includes the case of MAC CE adapting/re-activating/updating on-demand SSB. In TS 38.213 [2], semi-persistent scheduling and Type 2 configured grant can be activated, re-initialized or released by DCI signaling, and the for the ‘activation’, it has already included the case of activated by DCI and re-initialized by DCI signaling. 1. Delete ‘adaptation’ in the component 1 (i.e., deactivation mechanism) in FG 61-3, FG 61-4 and FG 61-4a as:
	* 1. Support MAC CE 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 frequency between always-on SSB and on-demand SSB (in FG 61-3)

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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 indication- Implicit deactivation via ~~Number N~~ *od-ssb-nrofBurst* of on-demand SSB bursts to be transmitted after on-demand SSB is indicated~~]~~ |  | 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} |

 |
| OPPO [9] | We first would like to provide some background information on the OD-SSB deactivation. In fact during RAN1#120bis meeting, the OD-SSB deactivation by either RRC or MAC-CE was discussed for case#1 and due to the absence of always-on SSB, the network needs to maintain the OD-SSB transmission as long as the SCell is active. In this sense, techncially speaking, for case#1, there is not allowed to deactivate OD-SSB by either RRC or MAC-CE. For this reason, we would suggest to remove ‘deactivation’ from FG61-1 and FG61-3. **Agreement from RAN1#120bis**For a cell supporting on-demand SSB SCell operation, for Case #1 (i.e., No always-on SSB on the cell)* UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.

**Proposal: Suggest to remove ‘deactivation’ from FG61-1 and FG61-3 to align with RAN1 agreement.** |
| LG Electronics [10] |

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| 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
 | Component 2 candidate value: {explicit deactivation, explicit and implicit deactivation} |

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| Apple [11] |

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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, Apple: if the same processing time for adaptation as for activation is confirmed (proposal 4 in R1-2505877), we are fine to include adaptation in this feature; otherwise, this needs to be separate feature] 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 indication
	+ Implicit deactivation via *od-ssb-nrofBurst* of on-demand SSB bursts to be transmitted after on-demand SSB is indicated
 |  | 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 |

 |
| Ericsson [12] | Pre-requisite: None.Update Component 1 as follows: Support MAC CE based signalling to indicate activation, ~~[adaptation,]~~, adaptation and deactivation of on-demand SSB transmission on the SCell in Case #1 (No always-on SSB on the cell) |
| Qualcomm Incorporated [13] |

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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 indication- Implicit deactivation via *od-ssb-nrofBurst* of on-demand SSB bursts to be transmitted after on-demand SSB is indicated | ~~FFS~~ | 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 |

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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 frequency2.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 | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE 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)Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

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| Company | Summary |
| Nokia [2] | **Proposal 1:** Remove square brackets around “adaptation” in FGs 61-3 and 61-4

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| 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 frequency2.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 |

 |
| CATT [3] | According to the following agreement in RAN1#121[2], subject to UE capability, it is supported that MAC CE based signalling to indicate adaptation of on-demand SSB transmission on the SCell. Such indication of adaptation of on-demand SSB transmission on the SCell should be applicable to the following cases:* Case #1 (No always-on SSB on the cell);
* Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency between always-on SSB and on-demand SSB;
* Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequencies between always-on SSB and on-demand SSB.

Hence, the brackets for the word of “adaptation” should be removed in the column of components for FG 61-3/61-4/61-4a:

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| --- |
| **Agreement**For a cell supporting on-demand SSB SCell operation, the following combinations are supported.* For OD-SSB transmission activation (OD-Tact) and OD-SSB transmission adaptation (OD-TA),
	+ Case A1: RRC-based OD-Tact without N (i.e., *od-ssb-nrofBurst*) configured + MAC CE-based OD-TA;
		- Subject to UE capability
	+ Case B1: MAC CE-based OD-Tact without N configured + MAC CE-based OD-TA;
	+ Case B2: MAC CE-based OD-Tact with N configured + MAC CE-based OD-TA.
* For OD-SSB transmission deactivation (OD-TD),
	+ Case X1: RRC-based OD-Tact without N configured + MAC CE-based OD-TD;
		- Subject to UE capability
	+ Case Y1: MAC CE-based OD-Tact or OD-TA without N configured + MAC CE-based OD-TD;
	+ Case Y2: MAC CE-based OD-Tact or OD-TA with N configured + implicit OD-TD;
	+ Case Y3: MAC CE-based OD-Tact or OD-TA with N configured + MAC CE-based OD-TD.
* **Conclusion**: There is no RAN1 consensus to support RRC activation of OD-SSB transmission configuring *od-ssb-nrofBurst.*
* Note: “Implicit OD-TD” above implies that the on-demand SSB is deactivated based on the value for *od-ssb-nrofBurst* according to NW indication.
 |

In addition, the words of “between always-on SSB and on-demand SSB” are missed in several descriptions for FG 61-4 and FG 61-4a, and they are added below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 SSB~~[~~3. 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* ~~Number N~~ of on-demand SSB bursts to be transmitted after on-demand SSB is indicated~~]~~ | FFS | 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 |

 |
| Huawei/HiSilicon [4] | Regarding the prerequisite FGs, RRC based signalling and MAC CE based signalling should be independent FGs with each other. No prerequisite FGs are needed for FG 61-3/61-4. **Proposal 1: Update FG 61-3/61-4/61-4a as shown in red in Table 1 for on-demand SSB SCell operation (MAC CE based signalling).**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 frequency2.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~~ | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE 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)Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

 |
| Vivo [5] | Regarding FFS for prerequisite feature groups of FG 61-3 and 61-4, there is no need to have any prerequisite feature group so that it is preferred to remove FFS.***Proposal 1: Remove the FFS for prerequisite feature groups of FG 61-3 and 61-4.*** |
| Xiaomi [6] | A controversial issue is how to handle deactivation, despite of RRC-based OD-SSB operation or MAC CE based OD-SSB operation. Two mechanisms were agreed in RAN1#119 meeting to deactivate OD-SSB, which as shown as below:* Option 1: Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication
* Option 2: Configuration/indication of the number N of on-demand SSB bursts to be transmitted after on-demand SSB is indicated

Option 1 is MAC CE based deactivation while option 2 is RRC based deactivation. From this perspective, at least option 2 can be regarded as the default mechanism for OD-SSB deactivation, which has been captured as a component for FG-61 series. Regarding to option 1, we don’t see any barriers to support it if UE support MAC CE based OD-SSB operation.***Observation 1: There is no barriers for a UE to support MAC CE based OD-SSB deactivation if it supports MAC CE based OD-SSB operation.*** In RAN1#120bis meeting, it was agreed that UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.

|  |
| --- |
| **Agreement**For a cell supporting on-demand SSB SCell operation, for Case #1 (i.e., No always-on SSB on the cell)* UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.
 |

***Observation 2: For OD-SSB deactivation, the following restriction needs to be captured in the note column for each feature group.**** ***UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.***

Given OD-SSB operation is only allowed on SCell, DL NR-RN CA capability is the prerequisite of FG 61-1 to FG 61-4.***Observation 3: Basic NR DL CA operation is the prerequisite of OD-SSB operation.***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 frequency2.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~~FG 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 | 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 |

 |
| Samsung [7] | RAN1 specification has explicitly defined UE behavior on adaptation of OD-SSB based on MAC CE, hence, the bracket around “adaptation” in FG 61-3, 61-4, and 61-4a shall be removed. Meanwhile, MAC CE based activation, adaptation, and deactivation shall be a basic FG, and not based on other FGs as prerequisite, hence, the FFS in FG 61-3 and 61-4 shall be removed.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 frequency2.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~~ | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE 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)Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

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| ZTE Corporation/Sanechips [8] | In RAN1#121, one of the remaining issues is on the component 1 of FG 61-3, FG 61-4 and FG 61-4a, where the wording ‘adaptation’ is still highlighted in yellow and in bracket [1]. The intention is to include the all expected cases for transmitting a MAC CE in component 1, including MAC CE activating on-demand SSB, MAC CE deactivating on-demand SSB, and MAC CE adapting/re-activating/updating on-demand SSB. From our perspective, we think it is not necessary to keep the wording ‘adaptation’, since the wording ‘activation’ also includes the case of MAC CE adapting/re-activating/updating on-demand SSB. In TS 38.213 [2], semi-persistent scheduling and Type 2 configured grant can be activated, re-initialized or released by DCI signaling, and the for the ‘activation’, it has already included the case of activated by DCI and re-initialized by DCI signaling. 1. Delete ‘adaptation’ in the component 1 (i.e., deactivation mechanism) in FG 61-3, FG 61-4 and FG 61-4a as:
	* 1. Support MAC CE 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 (in FG 61-4)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 frequency2.Supported time domain relation between on-demand SSB and always-on SSB~~[~~3. 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* ~~Number N~~ of on-demand SSB bursts to be transmitted after on-demand SSB is indicated~~]~~ |  | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE 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)Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} |

 |
| OPPO [9] |  |
| LG Electronics [10] |

|  |  |  |  |
| --- | --- | --- | --- |
| 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 frequency2.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 | 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} |

 |
| Apple [11] |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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, Apple: if the same processing time for adaptation as for activation is confirmed (proposal 4 in R1-2505877), we are fine to include adaptation in this feature; otherwise, this needs to be separate feature] 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 frequency2.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 |  | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE 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)Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

 |
| Ericsson [12] | Pre-requisite: None.Update Component 1 as follows: Support MAC CE based signalling to indicate activation, ~~[adaptation,]~~, 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 |
| Qualcomm Incorporated [13] |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 frequency2.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~~ | Yes |  | UE does not support on-demand SSB transmission on the SCell indicated via MAC CE 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)Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

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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 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 different center frequency 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 frequency | Per band | n/a | n/a | n/a | Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| CATT [3] | According to the following agreement in RAN1#121[2], subject to UE capability, it is supported that MAC CE based signalling to indicate adaptation of on-demand SSB transmission on the SCell. Such indication of adaptation of on-demand SSB transmission on the SCell should be applicable to the following cases:* Case #1 (No always-on SSB on the cell);
* Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency between always-on SSB and on-demand SSB;
* Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequencies between always-on SSB and on-demand SSB.

Hence, the brackets for the word of “adaptation” should be removed in the column of components for FG 61-3/61-4/61-4a:

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| **Agreement**For a cell supporting on-demand SSB SCell operation, the following combinations are supported.* For OD-SSB transmission activation (OD-Tact) and OD-SSB transmission adaptation (OD-TA),
	+ Case A1: RRC-based OD-Tact without N (i.e., *od-ssb-nrofBurst*) configured + MAC CE-based OD-TA;
		- Subject to UE capability
	+ Case B1: MAC CE-based OD-Tact without N configured + MAC CE-based OD-TA;
	+ Case B2: MAC CE-based OD-Tact with N configured + MAC CE-based OD-TA.
* For OD-SSB transmission deactivation (OD-TD),
	+ Case X1: RRC-based OD-Tact without N configured + MAC CE-based OD-TD;
		- Subject to UE capability
	+ Case Y1: MAC CE-based OD-Tact or OD-TA without N configured + MAC CE-based OD-TD;
	+ Case Y2: MAC CE-based OD-Tact or OD-TA with N configured + implicit OD-TD;
	+ Case Y3: MAC CE-based OD-Tact or OD-TA with N configured + MAC CE-based OD-TD.
* **Conclusion**: There is no RAN1 consensus to support RRC activation of OD-SSB transmission configuring *od-ssb-nrofBurst.*
* Note: “Implicit OD-TD” above implies that the on-demand SSB is deactivated based on the value for *od-ssb-nrofBurst* according to NW indication.
 |

In addition, the words of “between always-on SSB and on-demand SSB” are missed in several descriptions for FG 61-4 and FG 61-4a, and they are added below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 2 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

 |
| Huawei/HiSilicon [4] | Regarding the prerequisite FGs, RRC based signalling and MAC CE based signalling should be independent FGs with each other. No prerequisite FGs are needed for FG 61-3/61-4. **Proposal 1: Update FG 61-3/61-4/61-4a as shown in red in Table 1 for on-demand SSB SCell operation (MAC CE based signalling).**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-4a | On-demand SSB SCell operation indicated via MAC CE in Case #2 for different 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 different center frequency 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 frequency | Per band | n/a | n/a | n/a | Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

 |
| Vivo [5] |  |
| Xiaomi [6] | A controversial issue is how to handle deactivation, despite of RRC-based OD-SSB operation or MAC CE based OD-SSB operation. Two mechanisms were agreed in RAN1#119 meeting to deactivate OD-SSB, which as shown as below:* Option 1: Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication
* Option 2: Configuration/indication of the number N of on-demand SSB bursts to be transmitted after on-demand SSB is indicated

Option 1 is MAC CE based deactivation while option 2 is RRC based deactivation. From this perspective, at least option 2 can be regarded as the default mechanism for OD-SSB deactivation, which has been captured as a component for FG-61 series. Regarding to option 1, we don’t see any barriers to support it if UE support MAC CE based OD-SSB operation.***Observation 1: There is no barriers for a UE to support MAC CE based OD-SSB deactivation if it supports MAC CE based OD-SSB operation.*** In RAN1#120bis meeting, it was agreed that UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.

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| --- |
| **Agreement**For a cell supporting on-demand SSB SCell operation, for Case #1 (i.e., No always-on SSB on the cell)* UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.
 |

***Observation 2: For OD-SSB deactivation, the following restriction needs to be captured in the note column for each feature group.**** ***UE does not expect the OD-SSB transmission indicated by RRC/MAC-CE to be deactivated while the SCell is activated.***

Given OD-SSB operation is only allowed on SCell, DL NR-RN CA capability is the prerequisite of FG 61-1 to FG 61-4.***Observation 3: Basic NR DL CA operation is the prerequisite of OD-SSB operation.***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-4a | On-demand SSB SCell operation indicated via MAC CE in Case #2 for different 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 different center frequency 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 frequency | Per band | n/a | n/a | n/a | Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

 |
| Samsung [7] | RAN1 specification has explicitly defined UE behavior on adaptation of OD-SSB based on MAC CE, hence, the bracket around “adaptation” in FG 61-3, 61-4, and 61-4a shall be removed. Meanwhile, MAC CE based activation, adaptation, and deactivation shall be a basic FG, and not based on other FGs as prerequisite, hence, the FFS in FG 61-3 and 61-4 shall be removed.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-4a | On-demand SSB SCell operation indicated via MAC CE in Case #2 for different 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 different center frequency 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 frequency | Per band | n/a | n/a | n/a | Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

 |
| ZTE Corporation/Sanechips [8] | In RAN1#121, one of the remaining issues is on the component 1 of FG 61-3, FG 61-4 and FG 61-4a, where the wording ‘adaptation’ is still highlighted in yellow and in bracket [1]. The intention is to include the all expected cases for transmitting a MAC CE in component 1, including MAC CE activating on-demand SSB, MAC CE deactivating on-demand SSB, and MAC CE adapting/re-activating/updating on-demand SSB. From our perspective, we think it is not necessary to keep the wording ‘adaptation’, since the wording ‘activation’ also includes the case of MAC CE adapting/re-activating/updating on-demand SSB. In TS 38.213 [2], semi-persistent scheduling and Type 2 configured grant can be activated, re-initialized or released by DCI signaling, and the for the ‘activation’, it has already included the case of activated by DCI and re-initialized by DCI signaling. 1. Delete ‘adaptation’ in the component 1 (i.e., deactivation mechanism) in FG 61-3, FG 61-4 and FG 61-4a as:
	* 1. Support MAC CE 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 frequency between always-on SSB and on-demand SSB (in FG 61-4a)

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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 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 different center frequency 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 frequency | Per band | n/a | n/a | n/a | Component 2 candidate value: {explicit deactivation, explicit and implicit deactivation} |

 |
| OPPO [9] |  |
| LG Electronics [10] |

|  |  |  |  |
| --- | --- | --- | --- |
| 61-4a | On-demand SSB SCell operation indicated via MAC CE in Case #2 for different 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 different center frequency 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 | Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} |

 |
| Apple [11] |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-4a | On-demand SSB SCell operation indicated via MAC CE in Case #2 for different center frequency | 1. Support MAC CE based signalling to indicate activation, [adaptation, Apple: if the same processing time for adaptation as for activation is confirmed (proposal 4 in R1-2505877), we are fine to include adaptation in this feature; otherwise, this needs to be separate feature] 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 frequency 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 frequency | Per band | n/a | n/a | n/a | Component 3 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

 |
| Ericsson [12] | Support MAC CE based signalling to indicate activation, ~~[adaptation,]~~, 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 frequency between always-on SSB and on-demand SSB |
| Qualcomm Incorporated [13] |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 61. Netw\_Energy\_NR\_enh | 61-4a | On-demand SSB SCell operation indicated via MAC CE in Case #2 for different 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 different center frequency 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 frequency | Per band | n/a | n/a | n/a | Component 2 candidate value: {explicit deactivation, explicit and implicit deactivation} | Optional with capability signaling |

 |

## On-demand SIB1 for idle/inactive mode UEs

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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 |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] | The remaining open issues relate to the component 3 of FG 61-5. To make it general, we don’t think the text with bracket is needed. In practice, the reception of SIB1 PDSCH is not necessarily limited to a window, where the real location of SIB1 PDSCH reception can be up to the Type-0 PDCCH scheduling by implementation. Thus, it is proposed to remove the texts with bracket in component 3 of FG 61-5.**Proposal 2**: Remove the texts with bracket in component 3 of FG 61-5.

|  |  |  |  |
| --- | --- | --- | --- |
| 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 | A UE indicates support of this FG if it transmits a SIB1 request |

 |
| CATT [3] | In our view, if a UE has SIB1 request configuration of a cell and before transmitting UL WUS, it can detect whether on-demand SIB1 is transmitting and monitor Type 0 PDCCH for SIB1. The monitoring time window of Type 0 PDCCH is up to UE implementation. According to the above analysis, SIB1 reception does not necessarily have to be preceded by the sending of the SIB1 request. Therefore, the use of the phrase ‘at least’ can be considered acceptable.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

 |
| Huawei/HiSilicon [4] | For component 3 of FG 61-5, the core of this feature is to receive the demanded SIB1 within a window upon a UL WUS request, therefore the square bracket can be removed. Other way to receive SIB1, for example, up to UE to detect whether there is on-going SIB1 transmitted can be understood as part of this entire procedure but not necessarily being captured in the UE feature.**Proposal 2:** **Update FG 61-5 as shown in red in Table 2 for on-demand SIB1 for idle/inactive mode UEs.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

 |
| Vivo [5] | For component 3: regarding [in a window], the bracket can be removed since it is the fact that UE monitors PDCCH for SIB1 in a time window. Regarding [at least], it seems not necessary since this FG is about UE behavior related with SIB1 request.*Proposal 3: Remove the bracket of [in a window] and remove [at least] in 61-5.* |
| Xiaomi [6] | In RAN1#118 meeting, it was agreed that UE receives PDCCH scheduling OD-SIB1 within a time window. It is reasonable to explicitly capture it in component of FG 61-5.

|  |
| --- |
| **Agreement**At least for Case-2: For further work on type 0 PDCCH monitoring occasions for on demand SIB1, on the starting time and duration of the time window of type 0 PDCCH monitoring occasions, RAN1 to down select from the following two options:* Option 1: starting time and duration are indicated in RAR of the UL-WUS transmission
* Option 2: starting time and duration are indicated in the UL WUS configuration
 |

In RAN1#120bis meeting, the following agreement was achieved.

|  |
| --- |
| **Agreement**If a UE has SIB1 request configuration of a cell and before transmitting UL WUS,* If the UE detects a SSB where K\_SSB>=24 for FR1 or K\_SSB>=12 for FR2, select the following:
	+ Alt. 3: It is up to UE implementation on whether to monitor Type 0 PDCCH for SIB1 transmission
 |

The spirit of this agreement is that it is UE implementation whether it needs to receive SIB1 upon SIB1 request. In the other words, UE may or may not try to receive SIB1 outside SIB1 reception window.

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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 |

 |
| Samsung [7] | In RAN1#121, RAN1 has clarified the window for Type0-PDCCH reception, and the wording for FG 61-5 can be updated as follow. **Proposal 2: Support the following changes to FG 61-5 (all changes in red).**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 PDCCH 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 |

 |
| ZTE Corporation/Sanechips [8] | It should be described clearly that the OD-SIB1 transmission responded to the OD-SIB1 request is within the OD-SIB1 window.1. Support the description of Component 3 in UE feature for the on-demand SIB1 (61-5), i.e., ‘3. Reception of SIB1 in a window at least upon SIB1 request’

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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 |  | ~~FFS~~No | No | UE does not camp on the cell | ~~FFS~~n/a | ~~FFS~~n/a | ~~FFS~~n/a | ~~FFS~~n/a | A UE indicates support of this FG if it transmits a SIB1 request | Optional ~~[with/~~without~~]~~ capability signaling |

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| OPPO [9] |  |
| LG Electronics [10] |  |
| Apple [11] |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

 |
| Ericsson [12] | Component 3: The UE should be able to receive SIB1 upon request or by simply monitoring the SIB1 occasions. Suggest updating to “*Reception of SIB1 ~~[in a window] [at least]~~ at least upon SIB1 request*”. |
| Qualcomm Incorporated [13] |

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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 |

 |

## Adaptation of SSB transmissions

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |  | 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 |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| CATT [3] |  |
| Huawei/HiSilicon [4] |  |
| Vivo [5] |  |
| Xiaomi [6] | Given SSB adaptation is only allowed on SCell, DL NR-RN CA capability should be the prerequisite of FG 61-6.***Observation 4: Basic NR DL CA operation is the prerequisite of SSB adaptation.***

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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 | FG 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 |

 |
| Samsung [7] |  |
| ZTE Corporation/Sanechips [8] |  |
| OPPO [9] |  |
| LG Electronics [10] |  |
| Apple [11] |  |
| Ericsson [12] |  |
| Qualcomm Incorporated [13] |  |

## Adaptation of RACH transmissions

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| 61. Netw\_Energy\_NR\_enh | 61-7 | Adaptation of RACH in time domain based on additional RACH resources | 1. Support of adaptation of RACH in time domain based on additional RACH resources in RRC idle/inactive/connected mode2. Configuration of additional PRACH resources via higher layer signaling3. DCI-based indication of additional PRACH resources by DCI format 1\_0 with P-RNTI4. DCI-based indication of additional PRACH resources by DCI format 1\_0 with C-RNTI for PDCCH-ordered PRACH5. Support semi-static PRACH mask to identify the subset of additional resources |  | Yes |  | UE does not support adaptation of RACH in time domain based on additional RACH resources | Per band | n/a | n/a | n/a | A UE that transmits PRACH in additional RO based on configuration of additional PRACH resources via higher layer signaling supports this FG | Optional with capability signaling |

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| CATT [3] |  |
| Huawei/HiSilicon [4] |  |
| Vivo [5] |  |
| Xiaomi [6] |  |
| Samsung [7] |  |
| ZTE Corporation/Sanechips [8] |  |
| OPPO [9] |  |
| LG Electronics [10] |  |
| Apple [11] |  |
| Ericsson [12] |  |
| Qualcomm Incorporated [13] |  |

## Others

|  |  |
| --- | --- |
| Company | Summary |
| Nokia [2] |  |
| CATT [3] |  |
| Huawei/HiSilicon [4] |  |
| Vivo [5] |  |
| Xiaomi [6] |  |
| Samsung [7] |  |
| ZTE Corporation/Sanechips [8] |  |
| OPPO [9] |  |
| LG Electronics [10] | RAN1 agreed to support the combined RRC + MAC-CE signalling for OD-SSB, subject to UE capability. Therefore, we suggest to introduce new FG for UE to indicate whether combined signalling mechanism is supported for OD-SSB or not, and to delete corresponding NOTEs in FGs 61-1, 61-2, and 61-2a.In addition, square bracket around “adaptation” in FGs 61-3, 61-4, and 61-4a can be deleted.**Proposal #1: Introduce new FG to reflect the relevant RAN1 agreement that the combined RRC +**

|  |  |  |  |
| --- | --- | --- | --- |
| 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}} |

 |
| Apple [11] |  |
| Ericsson [12] | **(New) FG 61-8a: (RRC-based OD-Tact without N (i.e., od-ssb-nrofBurst) configured + MAC CE-based OD-TA for case #1)*** + FG name: RRC based activation of SSB transmission and MAC-CE based on-demand SSB adaptation/deactivation in Case #1
	+ Component 1: Support of RRC based activation of on-demand SSB transmission with MAC-CE based on-demand SSB adaptation/deactivation in Case #1
	+ Pre-requisite: 61-1 and 61-3
	+ Per-band
	+ Optional with capability signaling

**(New) FG 61-8b: (RRC-based OD-Tact without N (i.e., od-ssb-nrofBurst) configured + MAC CE-based OD-TA for case #2 and same center frequency)*** + FG name: RRC based activation of SSB transmission and MAC-CE based on-demand SSB adaptation/deactivation in Case #2 for same center frequency
	+ Component 1: 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
	+ Pre-requisite: 61-2 and 61-4
	+ Per-band
	+ Optional with capability signaling

**(New) FG 61-8c: (RRC-based OD-Tact without N (i.e., od-ssb-nrofBurst) configured + MAC CE-based OD-TA for case #2 and different center frequency)*** + FG name: RRC based activation of SSB transmission and MAC-CE based on-demand SSB adaptation/deactivation in Case #2 for different center frequency
	+ Component 1: 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
	+ Pre-requisite: 61-2a and 61-4a
	+ Per-band
	+ Optional with capability signaling
 |
| Qualcomm Incorporated [13] |  |

# Discussion Items during RAN1 #122

After review of contributions submitted to RAN1 #122 in this agenda item, the following topics were identified by the moderator for discussion during RAN1 #122.

**General comments**

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
|  |  |

## On-demand SSB SCell operation

After review of contributions submitted to RAN1 #122 in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

* **Alt. 1:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

|  |  |
| --- | --- |
| Company | Comments/Questions/Suggestions |
|  |  |

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

* **Alt. 1:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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:**

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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 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 |

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| Company | Comments/Questions/Suggestions |
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**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:**

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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 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 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 different center frequency 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 frequency | Per band | n/a | n/a | n/a |  | Optional with capability signaling |

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| Company | Comments/Questions/Suggestions |
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**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~~ | 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 |

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| Company | Comments/Questions/Suggestions |
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**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~~ | 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 |

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| Company | Comments/Questions/Suggestions |
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**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 |

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| Company | Comments/Questions/Suggestions |
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## On-demand SIB1 for idle/inactive mode UEs

After review of contributions submitted to RAN1 #122 in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**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 PDCCH 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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| Company | Comments/Questions/Suggestions |
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## Adaptation of SSB transmissions

After review of contributions submitted to RAN1 #122 in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

**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 | 61-6 | 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 |

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| Company | Comments/Questions/Suggestions |
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## Adaptation of RACH transmissions

Void

## New FGs

After review of contributions submitted to RAN1 #122 in this agenda item, the following is proposed by the moderator. Companies submitted the following views on the moderator’s proposals.

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

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

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

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

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| Company | Comments/Questions/Suggestions |
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# Conclusion

Agreements reached during RAN1 #122 as part of this agenda item are summarized in [ ].

# References

1. R1-2504673, Updated RAN1 UE features list for Rel-19 NR after RAN1 #121, Moderators (AT&T, NTT DOCOMO, INC.)
2. R1-2505192, Network Energy Saving Enhancement UE features, Nokia
3. R1-2505337, Discussions on UE features for Rel-19 NES, CATT
4. R1-2505358, UE features for Rel-19 NES, Huawei/HiSilicon
5. R1-2505397, UE features for enhancements of network energy savings for NR, vivo
6. R1-2505446, Discussion on UE features for enhancements of network energy savings for NR, Xiaomi
7. R1-2505563, UE features for enhancements of network energy savings for NR, Samsung
8. R1-2505601, Discussion on NES features, ZTE Corporation/Sanechips
9. R1-2505707, Discussion on UE features for enhancements of network energy savings for NR, OPPO
10. R1-2505850, Discussion on UE features for enhancements of NES, LG Electronics
11. R1-2505896, Views on UE features for Rel-19 NES, Apple
12. R1-2505994, UE features for R19 NES, Ericsson
13. R1-2506198, UE features for Rel-19 NE, Qualcomm Incorporated