**3GPP TSG RAN WG2 #119bis-e *draft R2-22xxxxx***

**Online, 10 - 19 Oct, 2022**

**Source:** Huawei, HiSilicon

**Title:** Report of [Offline-302][IoT NTN] RRC corrections (Huawei)

**Agenda Item:** 8.3.2

**Document for:** Discussion and decision

# Introduction

This document is a report of the following offline discussion:

* [AT119bis][302][NES] Cell Selection/Reselection and SSB/SIB-less (Huawei)

- Discuss and agree aspects of cell selection/reselection based on contributions submitted to meeting (including both legacy and NES capable devices)

- Discuss and agree on aspects of SSB adaptation/SIB-less based on contributions submitted to meeting (both SSB/SIB-less and adaptation are included)

Deadline: to be set by rapporteur so agreeable proposals can be ready by Monday morning for review.

Since time is limited, in this offline we will focus on the issues proposed by multiple companies and more likely to achieve some progress. The situation in the post119-e email discussion is also taken into account [1].

Please share your comments before Friday 2022-10-14 10:00 UTC.

Please note that for the sake of progress, we will use the same principle for all NES candidate techniques, i.e., we focus on RAN2 impacts for these techniques and do not debate on whether this is RAN1-led or RAN2-led techniques. This is exactly what we have done for DTX/DRX discussion.

1. Contact Information

To make it easier to find the contact delegate for potential follow-up questions, delegates are encouraged to provide their contact information in the following table:

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| --- | --- | --- |
| **Company** | **Name** | **Email** |
| Huawei, HiSilicon | Lili Zheng | zhenglili4@huawei.com |
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# Discussion

## Cell selection/reselection

During the post119-e email discussion, the solution of cell selection/reselection was summarized as follows:

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| Introduction | NES cells can be (de-)prioritized for NES capable UEs or legacy UEs during cell selection/reselection, optionally, UE is made aware of cell state (NES or non-NES). |
| Scenario | Single-carrier, multi-carrier; UEs in Idle/Inactive |
| NES gain | Reduced time domain SSB symbols if the cell is in NES state. Legacy UEs can avoid reselecting to an NES cell. |
| Impact to legacy UEs | 1. In case legacy mechanism (frequency priority, or adding frequency/cell-specific offsets) is used, there is no impact on legacy UEs
2. In case cell state (NES, or non-NES, or other states) is introduced, legacy UEs are not aware. The NES cells can be barred to legacy UEs for backward compatibility.
 |
| UE assistance needed | No |
| RAN2 impact | Cell selection/reselection enhancement etc. |

Some companies indicated that the solution itself does not provide NES gain, but it can assist other solution to minimize negative impacts to legacy UEs.

Based on companies’ contributions submitted to RAN2 #119bis-e, there is plenty of discussion on the following:

1. Legacy UEs: prevent legacy UEs camping on NES cells
2. NES capable UEs: (de)prioritization (including per-frequency, or per cell)

For legacy UEs, it is proposed in [2][3][5][10][11][12][19][27] to prevent legacy UEs camping on NES cells for backward compatibility. From the rapporteur’s observation, for some NES techniques, the legacy UEs cannot camp on the NES cells automatically, e.g., SSB-less, cells potentially using NES WUS. Therefore, this discussion should be based on the assumption that there is a need to have additional enhancement to prevent legacy UEs camping on NES cells when legacy UEs can identify these NES cells as usual.

**Q1: Do you agree that there is a need to prevent legacy UEs from camping on NES cells, when legacy UEs can identify these NES cells as normal cells?**

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| **Company** | **Yes/No** | **Comments** |
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The solutions proposed are mainly divided into the below two directions:

* Option 1: Use Intra/InterFreqExcludedCellList [2][4]

This is basically using the legacy frequency list or black cell list to indicate whether those NES frequencies or cells are disabled. It would be good that proponents can clarify the exact specification impact as this seems already supported by legacy mechanism.

* Option 2: Use *cellBarred* in MIB and add a new *cellBarred-NES* in SIB1[3]

This is basically to reuse the legacy mechanism adopted for NTN and IAB-MT.

**Q2: Which is the preferred option to bar legacy UEs:**

* **Option 1: Use Intra/InterFreqExcludedCellList [2][4]**
* **Option 2: Use *cellBarred* in MIB and add a new *cellBarred-NES* in SIB1 (similar to NTN) [3]**

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| **Company** | **Option** | **Comments (including technical views, specification impacts etc.)** |
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For NES capable UEs, it is proposed in [4][5][6][8][12] to discuss (de)prioritization of NES cells. However, there is no general rule that NES cells should always be prioritized for NES capable UEs, or always deprioritized. Further, it is mentioned by [8] that UEs’ cell reselection prioritization should be under network’s control, and reselection prioritization for NES can be handled per frequency, but not per cell. [6] also wants to clarify whether it is per frequency or per cell.

**Q3: For NES capable UEs, whether there is a need to prioritize or deprioritize the cell reselection for NES cells? If so, whether it is frequency level or cell level?**

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| **Company** | **Need for (de)prioritize NES cells (Yes/No)** | **Frequency level or cell level** | **Detailed Comments if any** |
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In [6][8], it is proposed to have (de)prioritization per frequency or per cell. [8] mentions that in MBS, the UE can prioritize the frequency which provides the service(s) of UE’s interest, and the similar solution can be adopted for NES. On the other hand, it is proposed in [7] that in the current spec, there are already several ways of re-distribute the UEs from a particular frequency layer to other frequency layers:

* Change the Frequency Priority
* Change the settings of offset values within Reselection Criteria, so that reselections would happen faster
* Provide/priorities particular frequencies within RRC Release
* Even the use of specific slicing for energy savings might be considered, resulting in reselections to a particular frequency layer

The above is about frequency (de)prioritization. Similarly, we already have cell offset, or the allowed/excluded list today, and if some cells are in NES state, this can be adjusted by these parameters.

Therefore, companies are invited to share their views on whether any enhancement is needed for cell (de)prioritized.

**Q4: if the answer to Q3 is Yes, whether there is any need to enhance the existing mechanism?**

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| **Company** | **Need for enhancements (Yes/No)** | **Comments (please be clear whether there is specification impacts)** |
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## SSB/SIB-less

During the post119-e email discussion, we discussed SSB/SIB-less and the solution was summarized as follows:

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| Introduction | Some NES Cells do not transmit SSB and/or SIB, UE receives SSB and/or SIB from a different cell (e.g. anchor cell).“anchor cell” refers to the cell transmitting SSB and SIB. |
| Scenario | Multi-carrier (FFS inter-frequency or intra-frequency), FFS single carrier; UEs in all states (Connected/Idle/Inactive) |
| NES gain | Reduced time domain symbols for SSB/SIB-less NES cell. Possibly increased power consumption for anchor cell when the anchor cell broadcasts system information for other NES cells. |
| Impact to legacy UEs | legacy UEs can access from anchor cell |
| UE assistance needed | No |
| RAN2 impact | extended SIB for anchor cell, cell selection/reselection, RACH, etc |

Several companies commented during email discussion that multi-carrier case should be prioritized. Among the contributions submitted to RAN2 #119bis-e, there are also proposals for prioritizing the multi-carrier case [17][18][21] [22][24].

**Q5: For SSB/SIB-less solution, do you agree that RAN2 starts with multi-carrier case?**

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| **Company** | **Yes/No** | **Comments** |
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### SSB-less

In [14][16][17][24], it is mentioned that SSB-less SCell is already supported for intra-band CA in the current spec, and it is proposed to extend it to inter-band case.

Cited from 38.331:

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| ***FrequencyInfoDL* field descriptions** |
| <skip> |
| ***absoluteFrequencySSB***Frequency of the SSB to be used for this serving cell. SSB related parameters (e.g. SSB index) provided for a serving cell refer to this SSB frequency unless mentioned otherwise. The cell-defining SSB of the PCell is always on the sync raster. Frequencies are considered to be on the sync raster if they are also identifiable with a GSCN value (see TS 38.101-1 [15]). If the field is absent, the SSB related parameters should be absent, e.g. *ssb-PositionsInBurst*, *ssb-periodicityServingCell* and *subcarrierSpacing* in *ServingCellConfigCommon* IE. If the field is absent, the UE obtains timing reference from the SpCell or an SCell if applicable as described in TS 38.213 [13], clause 4.1. This is only supported in case the SCell for which the UE obtains the timing reference is in the same frequency band as the cell (i.e. the SpCell or the SCell, respectively) from which the UE obtains the timing reference.For cells supporting RedCap, on handover, corresponds to the cell-defining SSB. |
| <skip> |

Cited from 38.306:

| ***scellWithoutSSB***Defines whether the UE supports configuration of SCell that does not transmit SS/PBCH block. This is conditionally mandatory with capability signalling for intra-band CA but not supported for inter-band CA. | FS | CY | N/A | N/A |
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In is further analysed in [16] that to support SSB-less SCell for inter-band case, RAN2 impacts include

* introduce a new UE capability to indicate the support of inter-band SCell without SSB; and
* small clarification in the specification (e.g. to extend the field description of the *absoluteFrequencySSB* IE to inter-band case).

**Q6: Do you agree with the following:**

**To extend the current SSB-less SCell from intra-band CA to inter-band CA, RAN2 impacts include** **a new UE capability and some essential field description clarification. The existing procedure defined for intra-band case can be re-used in general.**

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### SIB-less

Based on [16][17][18][24][27], the SIB-less solution can be summarized as: NES cell does not transmit SIB, and the anchor cell transmits SIB and other necessary information for UEs to access to NES cell directly.

RAN2 impacts mainly include

1. enhancements to System Information (of anchor cell) to include the necessary information to access via NES cell [16][18][27], the necessary information can be:
* SIB1 of NES cell [16][24]
* Common DL/UL parameters of NES cell [18]
* Measurement configuration of the NES cell; conditions for selecting the NES cell for access; radio resources of the NES cell [27]
1. RACH procedure on NES cell [16][22]

**Q7: Do you agree with the following:**

**For SIB-less solution, RAN2 understanding is that an NES cell does not transmit SIB, and the anchor cell transmits SIB and other necessary information for UEs to access to NES cell directly.**

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**Q8: Do you agree with the following:**

**For SIB-less solution, RAN2 will further study which are the necessary information for UE to access to NES cell, and the impacts on RACH procedure on NES cell.**

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# Conclusion

To be completed

# Reference

1. R2-2210792, Report of [POST119-e][313][NES] Details of solutions (Huawei), Huawei, HiSilicon

For Cell selection/Reselection

1. R2-2210129, Mobility and Access Control for NES, Nokia, Nokia Shanghai Bell
2. R2-2210255, Handling of Legacy UEs on a NES Capable Cell , Ericsson
3. R2-2210369, Network energy saving techniques, Qualcomm Incorporated
4. R2-2210019, Discussion on network energy savings, OPPO
5. R2-2209810, cell (re)selection and handover considering network energy saving, vivo
6. R2-2209886, Aspects on Network energy savings, VODAFONE Group Plc
7. R2-2210143, Discussion on Mobility issues, CMCC
8. R2-2210235, Aspects on Network Energy Saving Techniques, Fraunhofer IIS, Fraunhofer HHI
9. R2-2210337, UE awareness by gNB and coexistence with legacy UEs for NES, NEC Telecom MODUS Ltd.
10. R2-2210370, NES Proposed Common Signalling Techniques Assessment, Qualcomm Incorporated
11. R2-2210612, Cell Prioritization for NES, Samsung
12. R2-2210707, Discussion on Network Energy Saving in RAN2 study, NTT DOCOMO INC.

For SSB/SIB-less

1. R2-2210666, Techniques in various domains and UE assistance information for network energy saving ZTE corporation, Sanechips
2. R2-2210128, Common Channel Updates for NES, Nokia, Nokia Shanghai Bell
3. R2-2210418, Discussion on SSB-less and SIB1-less techniques for NES, Huawei, HiSilicon
4. R2-2210141, Discussion on time domain NES solutions, CMCC
5. R2-2209474, On solutions aiming at reducing periodic DL transmissions (1-4), CATT
6. R2-2209759, Discussion on Network energy saving for IDLE and INACTIVE UE - cell (re)selection and SSB-less, Apple
7. R2-2209811, Discussions on frequency domain techniques for network energy saving, vivo
8. R2-2210105, Consideration on network energy saving, Fujitsu
9. R2-2210226, SIB-less and UE wake up request signal, Sony
10. R2-2210283, Frequency domain NES aspects, InterDigital
11. R2-2210556, Considerations on Energy saving, KDDI Corporation
12. R2-2210653, SSB/SIB/Paging and Group HO, LG Electronics Finland
13. R2-2210772, Considerations on Network Energy Saving techniques, MediaTek Inc.
14. R2-2210665, Supporting access via NES cell, ZTE corporation, Sanechips