**3GPP TSG RAN WG2 Meeting #120R2-22xxxxx**

**Toulouse, 14 - 18 Nov, 2022**

**Source:** Huawei, HiSilicon

**Title:** Report of [POST119bis][304][NES] TP on cell selection/reselection and SSB/SIB-less (Huawei)

**Agenda Item:** xxx

**WID/SID:** FS\_Netw\_Energy\_NR– Release 18

**Document for:** Discussion and decision

# 1 Introduction

This document is the report of the following discussion:

* [POST119bis][304][NES] TP on cell selection/reselection and SSB/SIB-less (Huawei)

- Provide TP for the solutions discussed as per agreements in these meeting for cell/selection reselection and SSB and SIB-less. The TP should be detailed enough describing the solutions and highlight some of the agreements/impacts.

- Identify remaining questions/details/RAN2 impacts that are required to be discussed for next meeting to conclude the SI. These will be from the rapporteur point of view and can be used for information purposes to guide contributions to next meeting

 Deadline: Friday Nov. 3rd, 2022 for TP

 Deadline: Friday Oct. 28th, 20220 for open issues (NOTE this is on top of inactive week, so discussions are not expected).

Please provide your comments on the open issue list before the end of Friday 2022-10-21 if it is not convenient for you to reply during the inactive period. The rapporteur will anyway collect all comments provided before Oct 28th.

Please provide your comments to the TP before Tuesday 2022-11-02 08:00 UTC. Thanks!

# 2 Draft TR

Based on below agreements RAN2 made online, we provide a draft TR on cell (reselection) and SSB/SIB-less in the [folder](https://www.3gpp.org/ftp/Email_Discussions/RAN2/%5BRAN2%23119bis-e%5D/%5BPOST119bis%5D%5B304%5D%5BNES%5D%20TP%20on%20cell%20selection%EF%BC%8Freselection%20and%20SSB%EF%BC%8FSIB-less%20%20%28Huawei%29).

**Agreements:**

1. There is a need to allow NES cells to prevent legacy UEs from camping. FFS the definition of NES cells.
2. Whether to bar legacy UEs is configurable by NES cells in Idle/Inactive mode and the network should be able to allow NES-capable UEs to camp on the NES cell. Options to bar UEs to be considered are 1) UseIntra/InterFreqExcludedCellList (FFS on the exact mechanism and spec impact) and 2) use cellBarred or cell reservation fields in MIB/SIB.
3. The network should be able to configure NES capable UEs to (de)prioritize NES cells. mechanism such as can be considered for both frequency and cell levels cell selection/reselection (de)prioritization. FFS on whether the existing mechanism is sufficient.
4. For SSB/SIB-less solution, RAN2 starts with multi-carrier case
5. RAN2 assumes that the SSB-less solution for inter-band CA in connected mode we can consider to use the intra-band CA mechanism as a baseline/starting point. FFS whether there are other impacts for RAN2 according to other WGs discussion
6. For SIB-less/SSB-less, capture the solutions in more details over the email discussion and clarify the definition on anchor cell. (e.g. 1) non-anchor NES cell doesn’t transmit SSB and SI 2) non-anchor cell doesn’t transmit SIB) FFS for paging in both mechanisms.

**Please do not insert / make comments in the TR document, which will be hard for Rapporteur to track and respond your comments.**

**Q1: Companies are invited to share their detailed comments on the draft TR for cell (re)selection in the table below.**

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| **Company** | **Detailed comments** | **Rapporteur response** |
| vivo | 1. For legacy intra-band CA, a UE can not only acquires time/frequency synchronization for the SCell based on SSB on SpCell, but also other SCell. This happens when the SCell transmitting reference SSB is the SpCell of other UEs.

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| ***absoluteFrequencySSB***......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...... |

Therefore, if we are to support UE the inter-band CA case, it seems that the reference SSB can also be on an inter-band SCell, which is missed in the draft TR. Although we think the maximum NES gain is achieved by transmitting SSB only on SpCell, but we suggest to add SCell in the 1st paragraph since the spec has already supported it:The SCell without SSB in intra-band CA is considered as baseline, i.e., for a serving cell without transmission of SS/PBCH blocks, a UE acquires time and frequency synchronization with the serving cell based on receptions of SS/PBCH blocks on the SpCell or the SCell, of the cell group for the serving cell. | [Rapp] Thanks, adopted. |
| Ericsson | * To maintain consistency with the agreements and to avoid specifying the details at this stage we suggest replacing “SIB1” with “SIB”, i.e., the following change:
	+ “Use the *cellBarred* or cell reservation fields in MIB/SIB”
* Regarding the FFS on the definition of NES cells, we think that whether there is a need to introduce the terminology “NES Cell” could be decided later after the NES techniques are better understood. We suggest using “a cell that uses a NES technique” in the meantime instead of “NES cell”. The reason is that the terminology “NES Cell” is quite general and unifies multiple NES techniques, which may not be appropriate in cases in which we need to distinguish between different NES techniques.
 | [Rapp]* First suggestion is adopted.
* On “NES cell”, I changed the EN to the following:

*Editor's note: FFS ~~the definition of~~ whether to keep the terminology of “NES cells” and its definition, or change it to “a cell that uses an NES technique”.* |
| Vodafone | * I agree with Ericsson explanation, but my conclusion would be the opposite one. We should keep NES cell, NES capable UEs, etc. for now. Once it is more clear what all these techniques mean we can come back.
* “There is a need to allow NES cells to prevent legacy UEs from camping. NES cells should be able to configure whether to bar legacy UEs, and allow NES-capable UEs to camp on.” I think it has to be formulated in a different way: A mechanism to bar legacy UEs and allow NES capable UEs to camp on NES cell should be provided…

I am not sure what it means: “There is a need to allow”. Even today it is not forbidden, it is just not standardized. | [Rapp]On the second suggestion, I think the first sentence does not emphasize the solution, it only emphasize the demand. Maybe I can revise it as:*For backward compatibility, there is a need to allow NES cells to prevent legacy UEs from camping.* |
| Qualcomm | * Agree with Ericsson on the first point about not restricting the new “NES cell barring” field to SIB1. Just saying SIB is enough as how exactly it is done would be more of a stage 3 detail.
* Also agree with Ericsson on not introducing the “NES-cell” terminology. Since in the end, there would be many possible techniques of which a cell can deploy/not deploy so an “NES cell” would not have a clear definition. For the purposes of the context, it is a cell that uses some NES techniques that may sometimes require barring legacy UEs from access.
* “The NW should be able to configure NES-capable UEs to prioritize/de-prioritize NES cells” . We think we should hold off using prioritization or deprioritization language for cell selection. Prefer replacing this with “The NW should be able to configure NES-capable UEs on NES cell-(re)selection mechanism”. In our view, NES-cell selection to be studied can be more general in nature than copying exiting frequency prioritization, thus prefer to keep the language general.
 | [Rapp]The first two comments have been addressed.On the 3rd suggestion, “The NW should be able to configure NES-capable UEs on NES cell-(re)selection mechanism” is too general. We have already narrowed down the scope to cell prioritization/ de-prioritization during the meeting. If there are other (re)selection enhancement brought up by companies, we can discuss later. |
| Apple | 1. We agree with Ericsson's 1st point: to change "SIB1" to "SIB". Whether in SIB1 should be discussed in stage 3.2. On Ericsson's 2nd point, we prefer to align with wording of agreement (i.e. keep NES cell). First, we think we should try to use the original wording agreed online, to avoid opening the door to modify agreement on-fly; Secondly, we assume "NES cell" is a new terminology for Rel-18 NES (i.e. not a general cell with some NW energy saving via gNB implementation), and we will provide its definition anyway. 3. On QC's 3rd point, we also prefer to align with wording of agreement, especially after a lot of online arguments on motivation of prioritization vs deprioritization during cell reselections.  | [Rapp]Basically agree with the comments. But on the 2nd point, I revised the EN to keep the possibility of removing the terminology in the future. |
| Intel | 1. We also prefer to keep the NES cell2. Some editorial comments to the following sentence:“There is a need to allow NES cells to prevent legacy UEs from camping. NES cells should be able to configure whether to prevent bar legacy UEs, while and allowing N ES-capable UEs to camp on.” | [Rapp]Editorial comments are adopted:*NES cells should be able to configure whether to prevent~~bar~~ legacy UEs, while~~and~~ allowing NES-capable UEs to camp on.* |
| Interdigital | * Agree with Ericsson to replace "SIB1" with "SIB" per the agreements.
* Regarding QC's third point, we agree and also think the wording can be more general to avoid misunderstanding it as rigid prioritization. We suggest the following edit:

“The NW should be able to configure NES-capable UEs to incentivize achieving prioritization/de-prioritization of NES cells, the prioritization/de-prioritization can be handled per frequency and per NES cell.”* the TP mentions "de-prioritization can be handled per frequency or per NES cell." but the agreement was to consider re-selection for both per-frequency and per-cell level. Hence, we suggest changing "or" to "and" as suggested above, and as written in the agreement.
* On the suggestion to remove the FFS on "NES cell" definition. We don't see the harm in keeping the editor’s note, per the agreed FFS.
 | [Rapp]On QC’s third point, I prefer to respect the agreements achieved during the meeting. If other (re)selection enhancements are brought up by companies and approved, we can add them in the TR later.On the per-frequency/cell (de)prioritization, the sentence is revised as follows in the updated TR:*The NW should be able to configure NES-capable UEs to prioritize/de-prioritize a specific NES cell or NES cells on a specific frequency~~, the prioritization/de-prioritization can be handled per frequency or per NES cell~~.* |
| Nokia | Regarding “NES cell” terminology we agree on ambiquity expressed above. Maybe we could just add in a NOTE that current understanding of NES cell is a cell utilizing NES technique(s). Terminology “prioritization” is not correct for intra-frequency – it could be misunderstood as cell reselection prioritity related behaviour but there is no such a thing for intra-frequency reselection. I hope this is clear from the wording in the TR – we could consider bit of rewording to ensure not to confuse with cell reselection priority e.g. using instead of “prioritize” e.g.“prefer” | [Rapp]On “NES cell”, I changed the EN to the following:*Editor's note: FFS ~~the definition of~~ whether to keep the terminology of “NES cells” and its definition, or change it to “a cell that uses an NES technique”.*On “prioritization”, I think intra-frequency prioritization can be realized at least by adding positive cell specific offsets. The sentence is now modified as follows:*The NW should be able to configure NES-capable UEs to prioritize/de-prioritize a specific NES cell or NES cells on a specific frequency~~, the prioritization/de-prioritization can be handled per frequency or per NES cell~~.* |
| CATT | - NES cell terminology: we think the proposal by Nokia is a good way forward.- Reorder (6.1.1 comes after 6.2)?- Possible solutions may include but are not limited to- Agree with Ericsson to replace "SIB1" with "SIB" per the agreements.- Regarding comments on per frequency or per NES cell from other companies, we prefer to keep as it was in the Chairlady’s notes, i.e.The NW should be able to configure NES-capable UEs to prioritize/de-prioritize NES cells, ~~the prioritization/de-prioritization can be handled per frequency or per NES cell~~ such mechanism can be considered for both frequency and cell levels cell selection/reselection (de)prioritization. | [Rapp]“6.1.1” is changed to “6.X.1”On the last comment, I revised it to the following:*The NW should be able to configure NES-capable UEs to prioritize/de-prioritize a specific NES cell or NES cells on a specific frequency~~, the prioritization/de-prioritization can be handled per frequency or per NES cell~~.* |
| OPPO | On NES cell terminology, we are fine with the revised version by Rapporteur.On prioritize/de-prioritize, we prefer to remove “NES cells” before “on a specific frequency”. Our understanding of the online agreement is to allow frequency-level adaption, but it also seems to be cell-level adaption if we keep “NES cells” there.  |  |

**Q2: Companies are invited to share their detailed comments on the draft TR for SSB-less and SIB-less in the table below.**

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| **Company** | **Detailed comments** | **Rapporteur response** |
| vivo | Question: Does the EN imply that paging may also be on the NES cell (i.e. non-anchor cell)?*Editor's note: FFS whether paging enhancements, e.g. no paging transmission, is applied to the scenarios where SSB and or SIB is not transmitted on the NES cells.* | [Rapp] Yes, the scenario is not excluded. |
| Ericsson | * In Q2 above, we believe that the rapporteur intended to write “**TR for SSB-less and SIB-less**” instead of “**TR for SIB-less and SIB-less**”.
* Regarding SSB-less TR (i.e., Section 6.1.2 SCell without SSB in inter-band CA), it is not clear why only synchronization with PCell and PSCell is mentioned. We think that the synchronization can be obtained based on receptions of SS/PBCH blocks on any serving cell (i.e., the SpCell or the SCell) as already specified in the ***FrequencyInfoDL field description*** in 38.331. Therefore, in order to maintain the compatibility with the existing 38.331 specifications we propose the following change:
	+ “synchronization with the serving cell based on receptions of SS/PBCH blocks on the SpCell or the SCell of the cell group.”
* Regarding SIB-less TR (i.e., Section 6.1.3 NES Cell without SIB), we suggest replacing “NES Cell without SIB” with “Cell without SIB” in the title and the other relevant places in the document. We suggest this change because the terminology of “cell without SIB” does not necessarily have to be tied to the “NES cell”. Furthermore, in this way, the terminology will be more consistent with the terminology in Section 6.1.2 where we do not tie “Cell without SSB” with “NES cell”. Therefore, we propose the following changes:
	+ “6.1.3 Cell without SIB”
	+ ”necessary information for NES-capable UEs to access via an cell without SIB.”
	+ “An cell without SIB can omit the transmission of SIB”
	+ “the Random Access procedure is performed on the anchor cell, or one of the cell(s) without SIB.”
	+ “*Editor's note: FFS the details on how to support cell without SIB or without SSB and SIB.”*
	+ “*Editor's note: FFS whether paging enhancements, e.g. no paging transmission, is applied to the scenarios where SSB and or SIB is not transmitted on some of the serving cells for the purpose of NES.”*
* We also suggest reformulating the first sentence in Section 6.1.3.x as “from the perspective of the network” seems redundant. We therefore suggest the following change:
	+ “ Cell without SIB is only applicable in multi-carrier scenario, where there is an anchor cell and one or multiple cell(s) without SIB.”
* We suggest removing Sections 6.1.2.y and 6.1.3.y (i.e., “Assistance information from UE side”) since at the moment it seems that the assistance information is not relevant for SSB/SIB-less techniques. If we conclude differently in later stages, we can extend the TRs and add corresponding sections with relevant content if needed.
 | [Rapp] * Thanks, Q2 is modified.
* TP is modified. The timing can also be based on another SCell.
* Since there are other companies think “NES cell” should be kept, and there is already an EN saying it is FFS whether to keep the terminology of “NES cell”, it is not removed for the moment.
* The reason for adding “from the perspective of network” is because during offline discussion [AT119bis][302][NES] some company asked whether “multi-carrier” is from NW perspective or UE perspective. It’s ok for me to remove it if no others think there is still ambiguity.
* Ok, they are removed for now.
 |
| Vodafone | At this stage I would prefer to keep NES cells.To other parts of 6.1.3.x Higher layer procedureswhich need to be update in my view* Agree with E/// suggestion to remove “from the NW perspective”
* Anchor cell is a cell where NES-capable UE assumes SSB, system information and paging are transmitted. The system information transmitted by anchor cell also includes the necessary information for NES-capable UEs to access via an NES cell without SIB.

Not sure UE can assume. Probably we could formulate it in a following way:* Anchor cell is a cell where NES-capable UE receives SSB, system information and paging. The system information received over anchor cell includes all necessary information for NES-capable UE to access via NES cell without SIB.
* An NES cell without SIB ~~can~~ omits the transmission of SIB, or omits the transmission of both SSB and SIB.
* For NES-capable UEs in RRC\_IDLE/RRC\_INACTIVE, the Random Access procedure is either performed on an anchor cell, or on NES cell(s) without SIB, based on the system information transmitted by the anchor cell. When UEs in RRC\_IDLE/RRC\_INACTIVE performs Random Access on a cell and enters RRC\_CONNECTED, all subsequent data transmission occur on this cell.
 | [Rapp]* The reason for adding “from the perspective of network” is because during offline discussion [AT119bis][302][NES] some company asked whether “multi-carrier” is from NW perspective or UE perspective. It’s ok for me to remove it if no others think there is still ambiguity.
* Using “UE can assume” is to follow the description of NB-IOT multi-carrier (in 36.300):

***Anchor carrier****: in NB-IoT, a carrier where the UE assumes that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.** Editorial fixes are adopted.
* My understanding is that for an NES cell, there will only be one anchor cell. I think HO is not forbidden by this sentence (this sentence is only about entering RRC\_CONNECTED from RRC\_IDLE/INACTIVE), but it is not included either. Further discussion is needed for HO and whether SDT can be used.
 |
| Qualcomm | SCell without SSB:* Agree with Ericsson on not using “NES cell” terminology. Again, since many NES techniques are in discussion, we don’t have a specific definition. Just prefer describing what the cell does SSB-less, SIB-less, etc., since it is the case now that NES-cell can mean many things.
* RAN2 assumes that the SSB-less solution for inter-band CA in connected mode we can consider to use the intra-band CA mechanism as a baseline/starting point. FFS whether there are other impacts for RAN2 according to other WGs discussion
* Omit “Assistance information from UE side” section as it is not relevant right now.
* Prefer clarifying that the final support for those mechanisms will depend on the other WGs, not just RAN2 impacts.
* The wording make it seem like RAN2 needs to only study things if indicated by other WGs, however, even in it’s current state we thing the issues identified by Apple in the last email discussion should be captured by the TR, such as, RACH resource selection, timing of Pcell and Scell, RRM evaluation, RLM, etc. Currently, the wording assumes there is consensus that interband SSB is a simple extension of intraband which is not true, so companies’ RAN2 concerns should be captured if Interband SSB is to be included.

For Scell without SIB:* For similar reasons as mentioned about, NES-cell terminology should be avoided.
* “An NES cell without SIB can omit the transmission of SIB, or omit the transmission of both SSB and SIB.” This is still an open question in this email discussion so prefer to omit until opinions are discussed, same for the first editors not. Support is still FFS not just “how to support”
* Prefer to remove editors note on paging enhancements. This was not thoroughly discussed and no clear understanding on the SSB-less vs SIB-less vs SSB/SIB-less so there is no rush to agree that something needs to be done about paging.
* Also agree to remove “From perspective of the network” as it is redundant.
 | [Rapp]* On the terminology of NES Cell, since there are other companies think “NES cell” should be kept, and there is already an EN saying it is FFS whether to keep the terminology of “NES cell”, it is not removed for the moment.
* On adding extra RAN2 impacts for SCell without SSB: these cannot be simply added to the TR without careful discussion and conclusion. In our understanding, there is no measurement and RACH on the SCell if SSB is omitted. For timing information, it needs evaluation from RAN4, and we already have the following EN:

*Editor's note: impacts in RAN2 may need further analysis pending on other WGs progress.** I cannot remove the basic introduction to SIB-less and the EN for paging, as they are all captured in the meeting agreements:

For SIB-less/SSB-less, capture the solutions in more details over the email discussion and clarify the definition on anchor cell. (e.g. 1) non-anchor NES cell doesn’t transmit SSB and SI 2) non-anchor cell doesn’t transmit SIB) FFS for paging in both mechanisms.  |
| Apple | **On SSB-less TR:**1. It is clear that at least Rapporteur, vivo and Ericsson have 3 different understandings on timing mechanism of intra-band SSB-SCell (i.e. whether timing is from SpCell or SCell). Thus we don't think RAN2 have sufficient technique discussion on this issue to capture this detail. Actually, we think the wording of current agreement is already outcome of compromise. Thus, we suggest to align with wording of online agreement:"It is assumed that The mechanism of SCell without SSB in intra-band CA ~~is~~can be considered as baseline of SCell without SSB for inter-band CA in connected mode~~, i.e., for a serving cell without transmission of SS/PBCH blocks, a UE acquires time and frequency synchronization with the serving cell based on receptions of SS/PBCH blocks on the PCell, or on the PSCell, of the cell group for the serving cell."~~**On SIB-less TR:**1. For 1st paragraph, we agree with Ericsson's suggested change. Meanwhile, we think it is necessary to clarify anchor cell is in different carrier from SIB-less cell (otherwise, how can reader connect SIB-less solution with multi-carrier scenario?). Thus, we suggest below change:“ Cell without SIB is only applicable in multi-carrier scenario, where there is an anchor cell and one or multiple cell(s) without SIB in different carrier(s).” 2. For 2nd paragraph, we think the last sentence should be removed. This sentence is only valid for SIB-less scenario rather than SSB-less scenario. Specially:* In SIB-less scenario, SIB-less cell's (part) SIB is “piggybacked” in anchor cell’s SIB
* In SSB-less scenario, SSB-less cell share the same SIB of anchor cell like multi-carrier operation of NB-IoT, i.e. the UE can only camp in anchor cell.

Since both scenarios will be discussed, we think it should be removed for now:"Anchor cell is a cell where NES-capable UE assumes SSB, system information and paging are transmitted. ~~The system information transmitted by anchor cell also includes the necessary information for NES-capable UEs to access via an NES cell without SIB.~~"2. We agree with QC's comment on 1st FFS: RAN2 has not concluded whether to support SIB-less and/or SSB-less solution. So, "how to support" is misleading. Thus, we suggest below change:*Editor's note: FFS ~~the details on~~ whether/how to support NES cell without SIB or without SSB and SIB.* | [Rapp]* On SSB-less:

I agree with vivo and Ericsson that the timing can also be based on SCell. The description is kept unless others have a different understanding.* On SIB-less:

Ok to add “in different carrier(s)”.I think the last paragraph of the 2nd paragraph applies to both scenarios, including the one where SSB is not transmitted by NES cell. In NB-IOT, non-anchor carrier does not transmit NPSS/NSSS, but the UE can still perform RACH on non-anchor carrier.The sentence is now changed to an EN.About changing “FFS the details on how to support” to “FFS whether/how to support”: I don’t think I need to add “FFS whether to support” to each of the technique in the TR. The recommendation will be concluded at the end of the SI anyway. |
| Intel | On the first sentence “The SCell without SSB in intra-band CA is considered as baseline”, it is unclear that it is referring to inter-band SCell. Hence we suggest to change it to “SCell without SSB in inter-band CA considers the existing intra-band CA as baseline”.On the title for 6.1.3, we think that currently it can only be ‘NES Cell without SSB and/or SIB’ as the NES/non-anchor cell can be either SSBless and SIBless or only SIBless.As the NES cell can be either SSBless and SIBless or only SIBless currently, it would be more accurate to change ‘NES cell without SIB’ to ‘NES cell without SSB and/or SIB’  | [Rapp]It is clear in the title of 6.1.2 that the whole clause is for SCell without SSB in inter-band CA.I tend to think “NES Cell without SIB” includes both scenarios (SSB is transmitted, and SSB is not transmitted), because SSB is not mentioned. |
| Interdigital | On SSB-less:- Agree with QC and Apple that this requires support from other WGs. R1 is sending an LS to R4 on feasibility aspects. We are fine with the wording suggested by Apple, as it better reflects the agreement. On SIB-less:- "The system information transmitted by anchor cell also includes the necessary information for NES-capable UEs to access via an NES cell without SIB." was not in any agreement, and thus we suggest removing it. | [Rapp] On SSB-less:We already have the EN saying that:*Editor's note: impacts in RAN2 may need further analysis pending on other WGs progress.*On SIB-less:The sentence is now changed to an FFS in the EN. |
| Nokia | On SSB-less:* Agree with comments from Apple

On SIB-less:* Better to start 6.1.3.x with Anchor cell definition paragraph – otherwise current first paragraph is not possible to comprehend.
* Based on Anchor cell definition this seems to assume this is limited to RRC\_IDLE/INACTIVE as in RRC\_CONNECTED UE gets system information in dedicated signaling – We should clarify that this anchro cell only applies to RRC\_IDLE/INACTIVE.
* Then we agree on InterDigital comment on removing “The system information transmitted by anchor cell also includes the necessary information for NES-capable UEs to access via an NES cell without SIB.". We have not agreed anything on this.
*
 | [Rapp]On SIB-less:I think starting the paragraph with scenario clarification is also sensible.There is no agreement that only RRC\_IDLE/INACTVE are covered. We have the following clarification in the chair notes:*[both idle/inactive and connected mode will be covered]*The sentence is now changed to an EN. I think having it facilitates companies’ understanding of the whole mechanism. |
| CATT | Share the same view with other companies, and we support Apple’s modifications.In addition, we would suggest adding to the end of the below EN, “*/feasibility assessment*”:*Editor's note: impacts in RAN2 may need further analysis pending on other WGs progress/feasibility assessment* | [Rapp]I think other WGs’ progress includes feasibility assessment already. If they conclude that this is not feasible, RAN2 will absolutely remove the corresponding parts. |
| OPPO | We are generally fine with the revised version by Rapporteur but have the following comments* We would like to keep “from the perspective of network” to make it clear and without ambiguity
* We share a similar view as QC and Apple on the 2nd EN(in v1) and suggest modifying it as “whether/how to support NES cell without SIB or without SSB and SIB.”, since other WG’s input may also affect the decision on whether to support.
 |  |

# 3 Remaining issues

### 3.1 Cell selection and reselection

According to the discussion during this RAN2 meeting, the agreements and FFSes are captured as below:

1. There is a need to allow NES cells to prevent legacy UEs from camping. FFS the definition of NES cells.
2. Whether to bar legacy UEs is configurable by NES cells in Idle/Inactive mode and the network should be able to allow NES-capable UEs to camp on the NES cell. Options to bar UEs to be considered are 1) UseIntra/InterFreqExcludedCellList (FFS on the exact mechanism and spec impact) and 2) use cellBarred or cell reservation fields in MIB/SIB.
3. The network should be able to configure NES capable UEs to (de)prioritize NES cells. mechanism such as can be considered for both frequency and cell levels cell selection/reselection (de)prioritization. FFS on whether the existing mechanism is sufficient.

Rapporteur identifies the following issues to be further addressed at next RAN2 meeting accordingly:

1. General aspects:
	1. The definition of NES cells need to be further discussed, which may have impacts on the barring mechanism and access for NES-capable UES.
2. How to bar the legacy UEs, there are two options on the table:
	1. Use Intra/InterFreqExcludedCellList
	2. Use cellBarred or cell reservation fields in MIB/SIB

For both solutions, it needs to further discuss the detailed solutions and the potential specification impacts. For a), the gap with existing mechanism should be further clarified; for b), whether to use the existing IAB like solution, or NPN like solution, can also be discussed.

1. (de)prioritize NES cells by NES capable UEs
	1. Whether de-prioritization is sufficient for NES cells, or even prioritization of NES cells need to be supported
	2. The gap with existing mechanism, e.g. frequency priorities, cell offset to (de)prioritize cells
	3. Potential new mechanism description, and potential specification impacts

**Q3: Do companies agree to the above observation?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | Yes |  |
| Ericsson | Yes, with comments | We suggest rephrasing “gap with existing mechanisms” to “applicability of existing mechanisms” as in the current wording it is not clear what the “gap” refers to.1. Whether there is a need to introduce the terminology “NES Cell” could be decided later after the NES techniques are better understood. We suggest using “a cell that uses a NES technique” in the meantime instead of “NES cell”. The reason is that the terminology “NES Cell” is quite general and unifies multiple NES techniques, which may not be appropriate in cases in which we need to distinguish between different NES techniques.
2. We agree to further study options a) and b), but our understanding is that this was already agreed upon during the meeting.
3. Ok to study.
 |
| Vodafone | Yes with comments | 1. NES cells are ok for now as we also have NES capable UEs, etc.
2. On 2 and 3 I agree with E///
 |
| Qualcomm | See comment | 1. Agree with Ericsson on number 1. At the moment, there is no need for a precise definition of “NES-cell” as it would be another discussion which NES solutions make the cell an NES-cell.
2. For the general aspects, that can have impacts on barring and impact of

both NES-capable UEs AND legacy/NES not-capable UEs.1. Barring legacy UEs: We think that the options should not be mutually exclusive as we see that both are needed. Otherwise, fine to explore solutions for legacy barring.
2. We would like to see 3. “Deprioritizing” cells language relaxed a bit. We think that the NES-capable UE can already prioritize/deprioritize frequencies using legacy mechanism. For cell-selection, the UE then chooses the best cell-quality We think that in this case, like HO, the UE should be able to apply some more flexible rules than rigid prioritization to balance a. Cell with good radio quality, if not the best. b. NW-wide energy savings considerations. Otherwise, cell “prioritization” can cause a single mobile UE to wake up several non-anchor booster cells unnecessarily and cell “deprioritization” means the UE can camp on a bad quality anchor cell with the presence of a non-anchor/booster cell already fully awakened to serve other UEs. To summarize, we prefer adding a bullet: “4. Mechanisms on incentivize and disincentivize NES-capable UEs from camping on cells according to their NES states”

   |
| Apple | Yes with comments | 1. We agree with Ericsson and QC that definition of "NES cell" can be left to normative phase and it also depends on RAN1. At this stage, we tend to think the editor note on FFS its definition is sufficient for SI phase.2. Same understanding as Ericsson. OK to further study option A and B, but current agreements are sufficient for SI. The detailed mechanism mentioned by Rapporteur (e.g. IAB-like or NPN-like) should be discussed in normative phase.3. Agree. |
| Intel | Yes to all 3 points provided by rapporteur | We understand that there is a need to understand the definition of NES cell in order to decide whether there is a need for all the options are essential in 2) and whether 3) is needed |
| Interdigital | Yes, with comments | Points 1-2: AgreePoint 3: We have the same view as QC that “(de)-prioritization” wording can be misleading to the misunderstanding as absolute (de)-prioritization regardless of cell radio quality or regardless of cell NES states. We are fine with the wording suggested by QC. |
| Nokia | Yes with comments | Point 2 maybe has bit wrong terminology used – we don’t bar anything tiwht “excludedCellList” – we just exclude UE to consider those cells for reselection. This should be clarified. And in fact as people see then this “excludedClleList” is used for reselection as well – so that should be mentioned in point 3 as well.what is “the gap with existing mechanism” supposed to mean? Remove this unless there is clarification what is tried to achieve with this sentence |
| CATT | Yes with comments | Point 1: Agree with Ericsson and other companies, the definition of "NES cell" depends on the NES techniques and can be left to normative phase.Point 2: Current agreements are sufficient for SI.Point 3: Ok to study. |
| OPPO | Yes with comments | Point 1: We are fine to further discuss the definition of NES cells at the WI stage when the details are more clear and other WGs input has been achieved. Point 2: We think more details can be discussed in the WI stage, the current agreement is sufficient for SI.Point 3: Ok |
| Samsung | Yes | 1. We think all companies assume “NES Cell” = “a cell that uses a NES technique” Anyway, we are ok with either way.3. Fine to study. Detail can be discussed in the next meeting or WI phase |

### 3.2 SSB-less and SIB-less

Regarding SSB-less, which is used for inter-band CA case by allowing SCell without transmitting SSB, the corresponding agreement is as below:

1. For SSB/SIB-less solution, RAN2 starts with multi-carrier case
2. RAN2 assumes that the SSB-less solution for inter-band CA in connected mode we can consider to use the intra-band CA mechanism as a baseline/starting point. FFS whether there are other impacts for RAN2 according to other WGs discussion

As discussed online, without more inputs from other WGs, there is no need to continue discussing this at next RAN2 meeting. It will only be triggered if other WGs clearly indicated there is a need for RAN2 to investigate more. Therefore for this part, the rapporteur would not set any questions for the moment, but may be updated according to the progress from other WGs.

Regarding SIB-less/SSB-less, the agreements are as below:

1. For SIB-less/SSB-less, capture the solutions in more details over the email discussion and clarify the definition on anchor cell. (e.g. 1) non-anchor NES cell doesn’t transmit SSB and SI 2) non-anchor cell doesn’t transmit SIB) FFS for paging in both mechanisms.

There are two directions on the table, one is for NES cells to omit transmission of both SSB and SIs, and the other is to maintain SSB transmission but not SIs.

From rapporteur’s observation, these two directions may have different energy saving gains, due to different amount of common signals transmission; on the other hand, different directions may be supported under different conditions, e.g. the UE needs to support CA etc. according to the agreement from SSB-less. In addition, quite a few companies mentioned NB-IoT solution of supporting multiple carrier. To ensure every company has the common understanding, it is better that in the next meeting, proponent companies could briefly describe the NB-IoT multi-carrier solution, and provide more detailed technical analysis on what is the common and different parts for SSB/SIB-less compared with NB-IoT solution.

Therefore, the rapporteur summarized the two directions as below with the aspects to be addressed summarized together:

1. The anchor cell transmit SIs for NES cells, and NES cells transmit neither SSBs nor SIs;
2. The anchor cell transmit SIs for NES cells, and NES cells transmit SSBs but not SIs.

Aspects to be addressed:

* the detailed solution and potential specification impacts for each direction;
* the benefits for energy saving and constraints for each direction;
* impact on the UE behaviour, e.g. whether the UE always camp on the anchor cell, or can also camp on the NES cells (this is rather dependent on specific directions), how the UE will determine which cell to perform RACH; the applicable RRC state, e.g. whether it only applies to idle mode, or also applies to connected mode;
* the gap with existing solutions, e.g. how much we can reuse from NB-IoT solution and what needs to be enhanced compared with NB-IoT

**Q4: Do companies agree to the above observation on SSB-less/SIB-less on the above two directions?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | Yes |  |
| Ericsson | Yes | Ok to study the identified directions. Regarding the definition of “the non-anchor cell”, we think that this can be revisited later once it is clear which direction(s) we will continue to consider. In the meantime, we can be more descriptive and say “non-anchor cell that does not transmit SSBs and SIs” for direction 1, and “non-anchor cell that does not transmit SIs” for direction 2.We suggest rephrasing “gap with existing solutions” to “applicability of existing solutions” as in the current wording it is not clear what the “gap” refers to. |
| Vodafone | See comments | * the benefits for energy saving and constraints for each direction;

VF: Is that something RAN2 is going to provide or is it something we think will come out of RAN1?* impact on the UE behaviour, e.g. whether the UE always camp on the anchor cell, or can also camp on the NES cells (this is rather dependent on specific directions), how the UE will determine which cell to perform RACH; the applicable RRC state, e.g. whether it only applies to idle mode, or also applies to connected mode;

VF:“Do you means NES capable UEs”? The question to me is rather why the UE should be able to camp on NES cell?* the gap with existing solutions, e.g. how much we can reuse from NB-IoT solution and what needs to be enhanced compared with NB-IoT

VF:NB-IOT solution was designed not to save Network power, but rather to enable some capacity enhancements for NB-IOT and of course we should look on how it was designed, but not assume it can be copied 1 by 1 to this SI. |
| Qualcomm | No (support only the first direction) | The first solution can be studied, however, we think there is a lot of things that still need to be covered1. For the SSB/SIB-less conditions, we would like to confirm that the content of the SIB1 for both anchor and non-anchor cells is identical (BWP, freq. information, etc.). Hence this can only work under some conditions on the anchor and non-anchor cells. We would like to add those conditions that should apply to the solution for things to study as an additional bullets. “Conditions on the SSB/SIB content to apply this solution”.
2. According to the agreement of SSB-less, the UE must support CA for this solution to work. Thus, proponents need that to compare this solution to simple Scell activation solution and clarify the pros/cons. We would also like to add this: “Improvements and changes from current CA baseline solutions, if any.”
3. To follow up, we understand this solution to be a solution where the UE must perform RACH on the anchor cell, if this is not the case, we would like clarification on how the cell for RACH is chosen aside from describing the RACH process to the non-anchor cell? Again, since a UE doing that mandatorily supports CA by agreement, we would like to clarify what improvements, if any, this brings over the baseline. We would like to add the following bullet for things to clarify next meeting: “Details of RACH procedures on the anchor or non-anchor cells including changes from the CA baseline, if any”.

For the other branch of an anchor cell that transmit SSB but not SIB1, we do not support studying this solution. In our point of view, the proponents did not demonstrate any details about that solution other than very high-level views, so we would like to deprioritize this scenario since it has not been properly discussed. The proponents can provide contributions explaining the solution other than just mentioning that the non-anchor cell does not transmit SI. Our unaddressed concerns with this solution:1. Expected NES if any. In this case if SIB content is different this just means that the anchor cell transmits SIB1 on behalf of every non-anchor cell in its vicinity, likely, with higher power too, so it looks like we just changed the SIB1 transmitter to one that uses higher power. Unclear how this leads to NES savings.
2. The RACH procedure between the UE and the non-anchor cell is still unclear.
3. The synchronization and collocation requirements between anchor and non-anchor cells.
4. Motivation to introduce this solution rather than simply using the CA baseline or even the first solution.

To summarize, the second solution in our view remains lacks both sufficient detail and motivation to be seriously considered.  |
| Apple | Yes with comments | We agree that Rapporteur's observation are fair enough. We just have a minor question on 2nd point on the benefit of NES gain. We suggest to make it clear what is baseline. We assume it should be anchor cell+SIB-less/SSB-less Cell instead of SSB-lees/SIB-less cell only, right? Because the power in anchor cell is expected to be increased.  |
| Intel | Ok to study |  |
| Interdigital | Yes | Okay to study the above two directions. |
| Nokia | Comments | So it the solutions applicable for RRC\_IDLE/INACTIVE and RRC\_CONNECTED. Why would Ran2 care about RRC\_CONNECTED solutions at all as already now NW can provide SIBs for all the serving cells. So it would really help to discuss what are the scenarios the solutions are targeting. Without that is impossible to discuss what we should study. |
| CATT | Yes | Ok to study. |
| OPPO | Yes with comments | We agree the aspects listed by the Rapporteur may be the ones that need to study. We would like to indicate that other WGs input also needs to be considered in RAN2’s study. In addition, we echo QC’s 2nd comments for the first direction, since we already have agreed with the CA solution for the SSB-less case.  |
| Samsung | Yes | Although we see that the first direction, i.e., SSB-less/SIB-less, may not be practical for typical inter-band scenario, we are fine to continue to study both directions. We fully agree with “Aspects to be addressed” provided by the rapporteur.  |

In addition to the above, it is also an open question on how to handle paging. To study paging, the rapporteur understands the major question is whether paging can be omitted in the NES cell and only sends in the anchor cell, which can further omit transmission from NES cells. It is worth mentioning that if these two cells are already within one RNA, this seems already possible. The question should also be addressed that in such a scenario, how to justify whether the UE camps on an anchor cell or an NES cell.

The above discussion may result in a few combinations of different components, e.g. whether SSB-less is combined with SIB-less, whether paging enhancements is conditioned with SIB-less. From rapporteur’s observation, it would be good whether the most reasonable combination needs to be considered, otherwise this may result in too many fragmented sub-directions.

In summary, the aspects to be addressed include:

* detailed solution description, benefits and potential specification impact;
* impact on UE behaviour on cell camping;
* gap with existing solutions
* potential relation with SSB-less and/or SIB-less solutions

**Q5: Do companies agree to the above observation on aspects to be address for potential paging enhancements?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | Yes | From the draft TR, it seems that the **possible cases for NES cell** include (since SSB/SIB/RA/Paging is always supported in anchor cell, we omit it for discussion):* Alt 1: SSB **can** be transmitted, paging **is not** supported on the NES cell; If the NES cell need not to transmit SSB (due to NW implementation), then it is same as Alt 2.
* Alt 2: SSB **is not** be transmitted, paging **is not** supported on the NES cell;
* Alt 3: SSB **can** be transmitted, paging **is** supported on the NES cell; If the NES cell need not to transmit SSB (due to NW implementation), then it is same as Alt 4.
* Alt 4: SSB **is not** be transmitted, paging **is** supported on the NES cell;

I’m not sure if I have listed all the alternatives. We agree with rapporteur that it would be good we reach a concensus on which sub-direction(s) to go for and then analyse the impacts. |
| Ericsson | Yes | It is ok to study how to handle paging in relation to SSB/SIB-less solutions. We think that paging enhancements are more conditioned with SSB-less than SIB-less solutions.  |
| Qualcomm  | No  | For the SIB-less solution, it is still unclear what is a non-anchor cell so discussing paging from the unspecified cell seems very premature and would just bring more questions than answers. In particular it is still unclear how the UE acquires synchronization and, in the case of, offloading the paging to the anchor cell, would the UE need to continuously synchronize with the anchor and non-anchor cell? This seems to already bring possibly limited energy savings at the cost of high UE power consumption. Also, we remark that earlier email discussion had already a solution about paging-less cell (Solution #8) which showed 10 No and 4 Yes due to the UE expected power consumption and unnecessary increasing complexity, lack of clear energy gains and the need to involve multiple WGs in such a study, so we prefer to omit Q5 and this section altogether.  |
| Apple | Yes with comments | It is OK to study how to handle paging. Otherwise, the solution will be incomplete. In addition, we have below comments:1. Similar to previous question, we prefer to make it clear what is baseline of NES gain. 2. We are a little confused with 4th aspect. If we understand Rapporteur's intention correctly, it can be reformulated as below:  |
|  |  | * ~~potential relation with~~ Whether a common solution can be applied to both SSB-less and~~/or~~ SIB-less solutions
 |
| Intel | No | SI and Paging monitoring and RACH should be discussed as part of the solution in Q4. |
| Interdigital | Yes | Paging configuration is in SIB1. Without SIB, Idle mode UE won't receive the paging configuration. It is therefore better to consider this part of the SIB-less cell assumptions. In general, we agree with the rapporteur to minimize the number of combinations on assumptions of which common signals can be present if SI is not transmitted.  |
| Nokia | Comments | We should not limit paging solutions to SSB/SIB-less cases – we should also study how to enhance paging in cell providing SIB(s) and SSBs. Limiting paging enhancements to SSBless scenario is way too premature at this stage. |
| CATT | Yes | In NB-IoT, both RACH and paging enhancements on non-anchor carriers were introduced. Thus, it’s ok to study and conclude if potential paging enhancement is needed with SSB/SIB-less solutions. |
| OPPO | See comments | We understand the paging issue should be discussed together with SSB/SIB-less solutions, there is no need to have a separate discussion. In addition, it seems a bit premature to discuss paging, since the basic mechanism of SSB/SIB-less is not clear enough.  |
| Samsung | Yes | Paging-less solution should have better performance with SSB-less or SIB-less solution. |

# 4 Conclusion

To be completed