3GPP TSG-RAN WG2 Meeting #109bis-e Tdoc R2-2003927

Electronic meeting, 20th – 30th April 2020

Agenda Item: 7.1.7

Source: Ericsson

Title: Report on [AT109bis-e][412][eMTC] Standalone deployment – open issues

Document for: Report

# 1 Introduction

The following was agreed in online session during RAN2#109bis-e:

- RAN2 intends to address the case for a non-BL UE to be able to select non-standalone cell to camp over standalone cell on the same frequency even when the coverage is better for the latter.

This is P1 in the summary and the offline discussion document. This document has been updated with new questions where companies may provide further input on the topic.

This is a report based on discussions during RAN2#109bis-e on Standalone deployment for eMTC, the current version includes summary material submitted before the meeting start and the questions to companies are implemented on top of the summary discussion:

**[AT109bis-e][412][eMTC] Standalone deployment - Open issues (Ericsson)**

Scope: Remaining open issues on standalone deployment.

Intended outcome: Report including a list of proposals categorized as agreeable, need further discussion etc.. The outcome can be provided in R2-2003927.

Deadline: Friday, Apr. 24th 10:00 UTC

**From summary document** [**R2-2003792**](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003792.zip)**:**

Latest agreements related to this AI from RAN2#109-e are following:

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| RAN2#109\_e agreements:In standalone deployment, if a UE considers itself to be in enhanced coverage with S criteria of normal coverage fulfilled, absolute priorities for cell reselection are used (i.e. UE does not switch to ranking as it would when in enhanced coverage due to S-criteria). |

The following documents have been submitted to RAN2#109bis-e in AI 7.1.7 Stand-alone deployment:

[R2-2003354](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003354.zip) Remaining issues for LTE-M standalone deployment Ericsson discussion LTE\_eMTC5-Core

[R2-2003771](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003771.zip) Finalization of TP for cell selection at standalone cell Nokia, Nokia Shanghai Bell discussion Rel-16 Late

This document summarizes these two tdocs and proposes a way forward to conclude this discussion topic.

# 2 Discussion

The following is currently captured in TS 36.304:

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| If cell selection criteria S in normal coverage is fulfilled for a cell, UE [may] consider itself to be in enhanced coverage if *SystemInformationBlockType1* cannot be acquired but UE is able to acquire *MasterInformationBlock, SystemInformationBlockType1-BR* and *SystemInformationBlockType2*. |

The highlighted text above has been discussed in a number of earlier meetings, but no conclusion has been reached yet. Some companies prefer "may" and some companies prefer "shall" in the highlighted location.

In [R2-2003771](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003771.zip) arguments for "may" are presented in a summary from an earlier email discussion (during RAN2#109-e)

* There can be situations where UE is unable to acquire SIB1 but is able to acquire SIB1-BR other than Standalone operation, thus mandatory behavior would impact other use cases as well.
* UE should not be mandated to camp in enhanced coverage in standalone cell as there may be lower ranked cells providing normal coverage operation, which could be preferable for the UE.

In [R2-2003354](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003354.zip) and [R2-2003771](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003771.zip) the following arguments are presented for mandating camping in enhanced coverage / i.e. use "shall" instead:

* The condition in above specification text is only valid for standalone case.
	+ [R2-2003354](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003354.zip): The discussed text is only applicable in standalone cell as in normal cell the condition is in contradiction with itself.
	+ [R2-2003771](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003771.zip): Proposes to further clarify the discussed text to make it applicable only to standalone.
* TS 36.300 specifies that UEs should consider to be in enhanced coverage if functionality related to enhanced coverage is used.
* The discussed specification text doesn't mandate the UE to camp in standalone cell when other (lower ranked) cells are available, in more detail:
	+ [R2-2003354](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003354.zip): Based on agreement in RAN2#109-e, absolute priorities can be used for inter-frequency cases. Additionally, conditions in 5.3.1 in TS 36.304 makes it possible for UE to exclude cells for re-selection if SIB1 is not found.
	+ [R2-2003771](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003771.zip): The discussed text only refers to whether UE considers itself to be in enhanced coverage in standalone cell, UE can choose normal cell during re-selection regardless.

The following proposals are provided in the tdocs submitted for RAN2#109bis-e based on the arguments:

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| [R2-2003354](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003354.zip), Ericsson | [**Proposal 1:** Change "[may]" in TS 36.304 to "shall"](#_Toc37363730)[**Proposal 2:** RAN2 to discuss whether further clarification is needed in TS 36.304 for cases where neighboring cells are on same frequency and other cell provides normal coverage operation or for cases with different frequencies but same priority.](#_Toc37363731) |
| [R2-2003771](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003771.zip), Nokia | **Proposal 1**: Modify “may” to shall in the TP related to cell selection behavior for standalone cell.**Proposal 2**: RAN2 to discuss additional clarification to the above TP to indicate its applicability only for standalone case. |

To conclude this discussion, address the remaining concerns and finalize the specification(s) accordingly, the first two proposals are to confirm RAN2's intention regarding the wanted UE behaviour i.e. that it would be possible to camp in non-standalone cell in normal coverage instead of camping in standalone cell even when the coverage is better for the latter, and that the text from TS 36.304 discussed above applies only to the standalone case:

1. RAN2 intention is that non-BL UE should be able to select non-standalone cell to camp over standalone cell on the same frequency even when the coverage is better for the latter.

Company views on Proposal 1 (note there is question related to possible changes later):

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| **Company** | **Agree with intention in P1?** | **Comments** |
| Huawei, HiSilicon | Yes and no | Not necessarily a design target, but a natural consequence - UE should just follow the cell reselection criteria and cell suitability. UE may fail SIB1 reception and succeed SIB1-BR reception in a non-standalone cell In this case UE may consider the cell not suitable and select another suitable cell. It is impossible for UE to know whether this is a „real“ failure, or if the cell is standalone, unless we introduce an indication in MIB – so we have to make this an optional behaviour whether UE considers itself in enhanced coverage, or treats the cell as not suitable.  |
| Nokia | No | During cell selection, UE start checking the suitability of cells starting from UE having highest receive level. If the strongest cell ( standalone cell) satisfies the cell selection criteria it should camp onto the cell instead of attempting to select another cell which is non standalone. SIB1-BR includes information about LTE control region usage for standalone cell. This information can be used to know whether the cell is standalone or not. |
| Ericsson | Yes  | Agree with HW that this is more of a consequence of the standalone cell case. However, we disagree with the interpretation that in the case UE would fail SIB1 reception, but does succeed in SIB1-BR reception should still consider itself to be in normal coverage – in this case the UE would need to use enhanced coverage functionality to access the cell, and as specified in TS 36.300 23.7b:*"A UE in enhanced coverage is a UE that requires the use of enhanced coverage functionality to access the cell.*"In any case, if this happens, we think the UE should be able to select a cell for normal coverage operation in case operating in enhanced coverage is not preferred. For same frequency case priorities are not used, so we are OK to further clarify this in the specification.We'd also note that in TS 36.304 5.3.1 UE may already choose not to re-select a cell where SIB1 cannot be acquired – we think this can be used by the UE to re-select to a cell providing normal coverage instead during the cell re-selection process.  |
| Intel | Yes and No | Agree with Huawei that the UE can consider itself in enhanced coverage, or treats the cell as not suitable, or even camp on the cell in normal coverage. We do not see a need to restrict the UE behaviour.  |
| Qualcomm | Yes | Have same understanding as Ericsson.In any case, it is up to implementation whether non-BL UE attempts to find cells for normal LTE service first and if none found then attempt for cells support BR mode or it selects the strongest cell that support as long as UE can operate in normal or BR mode. |

**Rapporteur**: Above Proposal 1 has been agreed in RAN2#109bis-e.

The following has not been agreed, thus companies are asked to provide their views:

1. RAN2 understands that the new condition introduced in TS 36.304 applies only when camping in a standalone cell.

Company views on Proposal 2, if you think otherwise please elaborate and please explain if you think changes are needed in the current formulation to capture the understanding:

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| **Company** | **Agree with P2?** | **Comments** |
| Huawei, HiSilicon | no | We think it also be applied in general, e.g. for non-BL UE. |
| Nokia | Yes | In our understanding the new condition added was meant to specify the cell selection for UE in standalone cell. Additional clarification can be added for the same. |
| Ericsson | Yes | The text is intended for only standalone case and in our interpretation it also only applies to standalone case.If SIB1 cannot be acquired, the cell is either standalone cell or the coverage is not good enough – in the latter case it is contradictory that UE would consider itself to be in normal coverage, but unable to acquire SIB1. Thus we think the condition already applies only to standalone. If this is not clear enough, we can consider further clarifiyng the text.  |
| Intel | no | Again, we do not see the need to restrict the UE behavior. Furthermore, the UE does not know whether the cell is standalone or non-standalone. So it is irrelevant |
| Qualcomm | No | As the non-BL UE can not know whether cell is standalone or not then the rules in 36.304 should apply to any case where UE is unable to decode SIB1. |

**Rapporteur**: The text was introduced for standalone case – but it has been brought up this can happen in normal cells as well in case SIB1 cannot be found, i.e. it would not be limited just to standalone cell as UE would not know whether cell is standalone or not. No change seems to be necessary, UE could either re-select to another cell or camp in enhanced coverage if it so chooses.

Considering P1 has been agreed, we have discussed two alternatives: Either use "may" and remove the brackets from the current specification text, or change the verb to "shall" as suggested in the submitted tdocs.

In Rapporteur understanding, if "may" would be used, the following would be the behaviour from UE side (the following discussion considers now only the standalone cell case):

* When UE cannot acquire SIB1, but can acquire MIB, SIB1-BR and SIB2:
	+ Either UE considers to be in enhanced coverage and camps in the cell
		- UE operates in the cell in enhanced coverage.
		- Absolute priorities apply to cell re-selection according to agreement in RAN2#109-e.
	+ Or UE doesn't want to be in enhanced coverage but considers to be in normal coverage
		- UE cannot operate in the cell and based on not being able to acquire SIB1 considers the cell unsuitable and continues with cell (re-)selection to camp on another cell.

From network side, it would not be possible to guide UE behaviour in this case regarding re-selection, but the behaviour would be up to UE implementation.

Regarding paging, in standalone cell paging would always be using MPDCCH in any case, and in neighbouring cells depending on the paging strategy either on PDCCH or MPDDCH (on non-standalone cells). Therefore, there is not impact in paging.

In rapporteur understanding, agreement on P1 would be fulfilled for UE which considers to be in normal coverage, as the UE would consider the cell to be unsuitable thus UE would not camp in the cell but continue cell (re)selection procedure to some other cell, therefore, it is possible to select possible neighbouring cell on the same frequency (which provides normal coverage operation).

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| **Company** | **Do you agree with the above interpretation on "may" case?** | **Comments (e.g. different understanding, anything else needed to make it work?)** |
| Intel | Yes for using “may“, but our interpretation is different | Our understanding is as follow:* If cell selection criteria S in normal coverage is fulfilled for a cell, and
* If UE cannot acquire SIB1, but can acquire MIB, SIB1-BR and SIB2:
	+ Either UE camps in the cell in enhanced coverage mode
		- Absolute priorities apply to cell re-selection as in legacy eMTC operation (UE fulfilling normal coverage S criteria in enhanced coverage mode applies absolute priorities based cell reselection since Rel-13).
	+ Or UE doesn't want to camp in the cell in enhanced coverage mode (i.e. want to stay in or switch to wideband mode)
		- UE cannot operate in the cell based on not being able to acquire SIB1 considers the cell unsuitable and continues with cell (re-)selection to camp on another cell.

This can be applied to both standalone as well as non-standalone cells. |
| Qualcomm |  | We have some confusion with using the term ‘*UE considers to be in enhanced coverage*‘ becuase UE is in normal coverage but decides to use BL channels. UE can only be considered to be in *enahnced coverage* when normal S criteria is not meet but enhanced criteria is meet. |
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| **Company** | **Do you have any other concerns on using "may", e.g. other implications we would need to consider?** |
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**Rapporteur**: Rapporteur understanding is assumed to be correct with the clarifications from Intel and QC regarding UE being in normal coverage or considering being in enhanced coverage.

1. When S-criteria for normal coverage is fulfilled in standalone cell, UE is in normal coverage considering e.g. cell re-selection. However, if UE wants to operate in the cell it camps in enhanced coverage.

In Rapporteur understanding, if "shall" would be used, the following would be the behaviour from UE side (the following discussion considers now only the standalone cell case):

* When UE cannot acquire SIB1, but can acquire MIB, SIB1-BR and SIB2:
	+ UE considers to be in enhanced coverage and camps in the cell
		- UE operates in the cell in enhanced coverage.
		- Absolute priorities apply to cell re-selection as well according to agreement in RAN2#109-e.

For cell re-selection, the UE could select to other cells according to absolute priorities, and to re-select neighbouring cells on same frequency (or same priority), section 5.2.4.6 in TS 36.304 applies. The network may configure Qoffsets,n  accordingly to e.g. make it more probable for the UEs to select a non-standalone cell even when absolute RSRP is better in the standalone cell, but this is up to network configuration.

Regarding paging, there would be no impact as for the "may" case as well, but from network standpoint the UE behaviour would be more controlled which may have impact on paging strategy.

In rapporteur understanding, agreement on P1 would be fulfilled for UE in limited manner and would be up to network configuration without any further clarification. One possible way to make it equal with "may" case would be to add specification text e.g. something like in TS 36.300 clause 23.7b for the intra-frequency case:

*A UE in enhanced coverage camps on a suitable cell where S criterion for UEs in enhanced coverage is fullfilled. The UE shall re-select to inter-frequency cells in which it is able to operate in normal coverage over cells in which it has to be in enhanced coverage.*

Or additional clarification in TS 36.304 to let the UE select normal coverage cell more freely.

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| **Company** | **Do you agree with the above interpretation on "shall" case?** | **Comments (e.g. different understanding, anything else needed to make it work?)** |
| Intel | No | As per our comment for the “may“ case |
| Qualcomm | No | See reply to previous question. |
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| **Company** | **Do you have any other concerns on using "shall", e.g. other implications we would need to consider?** |
| Qualcomm | UE considering itself to be in enhance coverage when S criteria is meet will confuse the reader especially whether priority based reselection applies or not. |
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**Rapporteur**: QC has similar view regarding considering to be in enhanced coverage as provided for "may" discussion above and related to Observation 1. Otherwise as there were no comments on the question, rapporteur understanding is assumed to be correct.

Based on above, please indicate your preference to update the specification text in TS 36.304:

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| **Company** | **Prefer "may" or "shall"** | **Comments** |
| Intel | “may“ | As per our interpretation |
| Huawei | „may“ | The current conditions also apply to the case where UE fails SIB1 reception on a non-standalone cell and we do not think it’s correct to force the non-BL UE supporting enhanced coverage to camp in enhanced coverage. A regular UE will simply bar the cell and reselect (for both standalone and non-standalone cases). It then 1. Becomes a disadvantage in this scenario to support enhanced coverage
2. Rel-16 non-BL UE in EC has worse performance in some scenarios than Rel-15.

For this reason it is better to let UE decide whether to camp on the EC/BL (like a BL UE) or to bar and reselect (like a regular UE) |
| Qualcomm | “may“ | If non-BL UE camps on a standalone cell becuase no cell is suitable for normal operation then such a UE should not really be considered as operating in CE mode. In a standalone cell a non-BL UE *behaves* as a BL UE hence wheter it is normal coverage or enhanced coverage depends on which cell suitability criteria is meet. That is a non-BL UE in a standalone cell cell with normal S criteria meet should following priority based cell reselection. |

**Rapporteur:** Three companies have replied in this document, additionally Ericsson commented earlier (email) that they will be OK with "may" if there is a majority.

Based on the discussion above, it seems all concerns we have discussed earlier are satisfied if we use "may" in the specification text, in particular:

* 1. Absolute criteria for cell-reselection are used in standalone cell when UE camps in the cell.
	2. It is possible for non-BL UEs to re-select to non-standalone cell offering normal coverage – as UE may consider the standalone cell unsuitable and continue with cell re-selection.
1. Update "[may]" to "may" TS 36.304. If UE satisfies S-criteria for normal coverage but is not able to acquire SIB1 (but is able to acquire MIB, SIB1-BR, SIB2) may consider the cell unsuitable and continue with cell re-selection.

# 3 Summary of the offline

The following is proposed to be agreed:

1. Update "[may]" to "may" TS 36.304. If UE satisfies S-criteria for normal coverage but is not able to acquire SIB1 (but is able to acquire MIB, SIB1-BR, SIB2) may consider the cell unsuitable and continue with cell re-selection.

# References

1. [R2-2003354](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003354.zip), "Remaining issues for LTE-M standalone deployment", Ericsson, RAN2#109bis-e
2. [R2-2003771](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003771.zip), "Finalization of TP for cell selection at standalone cell", Nokia, Nokia Shanghai Bell, RAN2#109bis-e
3. [R2-2003792](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003792.zip), "Summary of AI 7.1.7 Standalone operation", Ericsson, RAN2#109bis-e

# Appendix

**The following is the discussion from the initial summary document and offline discussion:**

A further point for discussion is whether above proposals require clarifications or changes in the specifications. Both [R2-2003354](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003354.zip) and [R2-2003771](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109bis-e/Docs//R2-2003771.zip) argue that Proposal 1 would be the current behaviour already, however based on earlier discussions it doesn't seem to be the view of all of the companies involved in the discussion, therefore it should be clarified online or over email discussion. Similarly, for Proposal 2 the tdocs provide arguments for this being the case already, but this should be clarified online or over email as well.

Based on above and the proposals in the submitted tdocs, the following is proposed for further discussion:

1. Update "[may]" to "shall" in TS 36.304. Further discuss whether outcome of discussion related Proposals 1 and 2 require clarifications in TS 36.304.

Company views on P3, note that the answer can be conditional on addressing e.g. issues raised in discussion for P1 and P2:

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| **Company** | **Is P3 (conditionally) agreeable?**  | **Comments** |
| Huawei, HiSilicon | no | We think the square brackets can be removed, and the case of being unable to acquire SIB1 should be made e.g. |
| Nokia | Yes with some clarification | Information in SIB1-BR related to standalone cell can be used to clarify the sentence when it is changed to „shall“ |
| Ericsson | Yes |  |
| Qualcomm | No | Agree with Huawei, keep may and remove brackets.But we don’t agree that if normal S criteria is meet then UE considers itself in CE mode. |

As a follow-up, conditional to the change in P3 and intention in P1, it should be considered what changes, if any, are needed in TS 36.304.

For P1, the companies who submitted tdocs seem to think there would not be changes needed, based on clause 5.3.1 in TS 36.304 and/or that the text would only apply when UE considers to be in enhanced coverage in standalone cell, i.e. not limit the UE in any way to select other cells in normal coverage. Please elaborate in the following if you disagree with these views:

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| **Company** | **If P3 is agreed, what changes are needed, if any, to implement the intention in P1?**  |
| Huawei, HiSilicon | We don’t think P3 can be agreed, because it is possible that UE fails SIB1 reception but succeeds SIB1-BR reception even in a non-standalone cell. The most straightforward way is to keep „may“ |
| Nokia | For the above situation we can add clarification that it is applicable for standalone cell. |
| Ericsson | We can further clarify 1) cell reselection to normal coverage cell and 2) applicability of the condition to standalone only, although we think this is the case already.< |
| Qualcomm | Don;t agree with P3. |