3GPP TSG-RAN WG2 #109e-bis R2-20xxxxx

Electronic meeting, 20th April - 30th April 2020

Agenda Item: 6.12.4

Source: Ericsson

Title: [AT109bis-e][802] Open issues on SON (Ericsson)

Document for: Discussion, Decision

# Introduction

This document captures the important open issues amongst the SON functions’ related reporting that needs to be agreed in the RAN2#109-e meeting.

* [109bis-e][802] Open issues on SON (Ericsson)

Scope: Continue the discussion on SON open issues based on R2-2003800. Focus on the following proposals coloured in red.

 Intended outcome: Summary with the following sets which should be identified

 §  Set of proposals with full consensus, if any (agreeable over email)

 §  Set of proposals with almost full consensus to discuss in the follow up conference call

 §  Set of open issues and proposals to postpone to next meeting

 Deadline: 28/04/2019 22:00 UTC

# Discussion

## RAReport

### 4 step RA vs 2 step RA

Both Ericsson [1] and ZTE [17] have contributed on this topic.

* Ericsson proposal: Currently captured RAReport contents are applicable only for 4-step random access procedure.
* ZTE main proposal: It is suggested RAN2 to confirm the understanding that for R16 RA report, 2-step RA related information will still be recorded without differentiating the RA type, and no further enhancement on PUSCH related information will be used.
	+ ZTE sub-proposal 1: The maximum RA resource configuration can be included in one RA report entry/RLF report is 3 in case 2-step RA is supported.
	+ ZTE sub-proposal 2: It is suggested to change *Msg1-FDM*, *Msg1-FrequencyStart* and *Msg1-SubcarrierSpacing* to *prach-FDM*, *prach-FrequencyStart*, and *prach-SubcarrierSpacing* to make the terminologies in RA report more general for both 4-step/2-step RACH.

Based on the above, it seems like different companies have different approach.

1. RAN2 to agree on one of the following proposals:
	1. Currently captured RAReport contents are applicable only for 4-step random access procedure.
	2. RAN2 to confirm the understanding that for R16 RA report, 2-step RA related information will still be recorded without differentiating the RA type, and no further enhancement on PUSCH related information will be used.

Based on the above, we request companies to provide their preferred options.

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| **Company name** | **Preferred option(s)** | **Additional comments** |
| Qualcomm | Option “a” |  |
| Intel | a | Step 2 RA can be further discussed in future release. |
| Ericsson | a | Our preference is to only focus on 4-step RA in Rel.16, and leave any 2-step handling to the Rel.17 WI which explicitly includes 2-step RACH optimization for MDT/SONIf the Rel.16 RA report can include both the 2-step info and the 4-step info, it will be confusing for the network to distinguish the 2-step RA performances from the 4-step RA. Hence it will not be possible for the network to properly optimize neither the 4-step RACH nor the 2-step RACH configurations when both are configured. |
| OPPO | a | Rel-17 SON WID include the 2-step RACH related SON objective. No need to standardize anything related to that in this release. |
| CATT | a | It’s easy for us to do 2-step extension in R17, not so urgent in R16 to do this. |
| Nokia, Nokia Shanghai Bell | Option a |  |
| Huawei, HiSilicon | a | 2-step RACH related discussion can be moved to R17. |
| CMCC | a | 2-step RACH could be discussed in R17. |
| vivo | a | 2-step RA should be separately discussed |
| MediaTek | a |  |
| ZTE | a | The intention not to push 2stepRA is to avoid enhancements at late stage as current RA info can also include the PRACH part of 2stepRA as well. But we fine to discuss in R17 since it is the majorities’ view. |

If the option-b is selected, then RAN2 is requested to further discuss and agree on the following proposals.

1. (Provided option-b is selected for the previous question) The maximum RA resource configuration can be included in one RA report entry/RLF report is 3 in case 2-step RA is supported.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
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1. (Provided option-b is selected for the previous question) Change *Msg1-FDM*, *Msg1-FrequencyStart* and *Msg1-SubcarrierSpacing* to *prach-FDM*, *prach-FrequencyStart*, and *prach-SubcarrierSpacing* to make the terminologies in RA report more general for both 4-step/2-step RACH

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
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### SSB based RA Attempt: [S481]

Samsung [12] quotes the following observations from TS 38.321 for SSB based RA attempt:

* Observation 4: Both contention free and contention based SSB based is supported.
* Observation 5: SSB based contention free random access is performed only if there is at least one SSB with SS-RSRP above *rsrp-ThresholdSSB* is available amongst the SSBs for which contention free random access resources are configured

According to observation 5, for SSB based RA attempt based on contention free random access resources, *contentionDetected-r16* and *dlRSRPAboveThreshold-r16* is always TRUE. So Samsung proposes [12] that there is no need to report *contentionDetected-r16* and *dlRSRPAboveThreshold-r16* for SSB based RA attempt based on contention free random access resources.

* Samsung proposal : For SSB based RA attempt based on contention free random access resources contentionDetected-r16 and dlRSRPAboveThreshold-r16 are not included in PerRAInfoList-r16.
1. For SSB based RA attempt based on contention free random access resources contentionDetected-r16 and dlRSRPAboveThreshold-r16 are not included in PerRAInfoList-r16.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes | Agree with Samsung observation.  |
| Ericsson | Yes | In ASN.1, this implies that those 2 fields are made optional in PerRAAttemptInfoList-r16 since that is used for CBRA and CFRA. Changes to procedural text are also expected. |
| OPPO | Yes |  |
| CATT | Yes | Without these IEs, the function can still work in implicit way. |
| Nokia, Nokia Shanghai Bell  | Yes |  |
| Huawei, HiSilicon | No | contentionDetected-r16 can be removed, but dlRSRPAboveThreshold-r16 should be included in case of unreasonable high threshold. |
| CMCC | Yes | These 2 fields are useless for contention free random access. |
| vivo | Yes |  |
| MediaTek | Yes |  |
| ZTE |  | I think the dlRSRPAboveThreshold-r16 is still needed in case of PDCCP order triggered RACH, which is also CFRA. In this case the SSB is assigned by network, and NW cannot guarantee the assigned SSB is always higher than configured threshold.Also, when RApurpose is set to requestforOtherSI (i.e., Msg1-based SI request), there is on contention resolution performed and therefore the contentionDetected-r16 is also no needed in such case. |

### Frequency domain information about PRACH occasion: [S482]

Based on the observations captured in Samsung [12] and ZTE [17] contributions, the UE could use RA resources belonging to more than one frequency locations. Therefore, RAN2 has agreed that “RA report and RLF report shall be able to include more than one RA resource configuration”.

The way in which multiple RA resource configurations can be captured in the RA report and/or RLF report has been provided by ZTE [17] and also by Samsung [12]. However, the solution proposed by ZTE is more generic than the one proposed by Samsung. This should be discussed further during the meeting.

1. RAN2 to agree on the following method to encode more than one RA resource configuration (refer [17] for ASN.1 changes):
	1. Each RA resource configuration used can be included in the RA report with one identifier, e.g. ra*-Resource-Index* , and UE only needs to set the *ra-Resource-Index* for each successive RA attempt within the same beam

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes/May be | It seems ok but will need to see CR how the UE set the ra-Resource-Index. At the moment, it is a bit unclear.  |
| Ericsson | No | The issue is only affecting few msg1 -related parameters for CFRA and beam failure recovery. So our preference is to just add these missing parameters in the RA/RLF report as proposed by Samsung in [12]. |
| OPPO | No | We understand the intention. But CR in [17] seems not correct. On a particular SSB corresponding to a particular PerRASSBInfo-r16, UE could try both of CFRA and CBRA. The RA resource configuration (msg1) of them could be different (corresponding to different RO). In such case, include only 1 ra-Resource-Index-r16 seems not enough. To make it clear, in each perRAAttemptInfoList-r16, a ra-Resource-Index-r16 should be included. But this will lead to huge signaling overhead. So we suggest consider not to capture RA resource related IE in the RA report  |
| CATT | Yes | From technology perspective, we think the proposal from ZTE is more generic and good for future proof. |
| Nokia, Nokia Shanghai Bell  | Yes  |   |
| Huawei, HiSilicon | Yes |  |
| CMCC | May be | No strong view. |
| vivo | Yes |  |
| MediaTek | No |  |
| ZTE |  | We agree with CATT, considering we will need to support 2stepRA in next release, and there could be more than two RA resource used in one procedure, we think a generic structure is preferred and more future proofing.  |

### Indication for CFRA/CBRA: [S485]

Samsung provides the following observations in [12].

According to TS 38.331 for SON/MDT, a SSB-based RA procedure can have both contention based RA attempt(s) and contention free RA attempt(s). However, when receiving RA report from UE, gNB cannot find whether each SSB-based RA attempt is contention based or contention free. Therefore, it is required to indicate whether each SSB-based RA attempt is contention based or contention free. If Proposal 2 is applied, this indication can be achieved implicitly. Specifically, if neither *contentiondDetected* nor *dlRSRPAboveThreshold* is included in *PerRAAttemptInfo*, gNB can find this attempt is contention free RA. If both *contentiondDetected* and *dlRSRPAboveThreshold* are included, gNB can find this attempt is contention based RA. As another solution, an explicit 1 bit indicator can be introduced for this purpose.

* Samsung proposal: RAN2 to discuss whether an explicit indicator is required to indicate whether each SSB-based RA attempt is contention based or contention free.

Rapporteur’s input:

Based on what discussed during the online session, the lack of the fields contentionDetected-r16 and dlRSRPAboveThreshold-r16 in the RAReport can be used as an implicit indication that the RA resource used by the UE is a CFRA resource. Therefore, rapporteur proposes to have some discussions on the proposal:

1. RAN2 to discuss whether:
	1. An explicit indicator is required to indicate whether each SSB-based RA attempt is contention based or contention free
	2. This information can be implicitly derived from other report contents.

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| **Company name** | **Preferred option(s)** | **Additional comments** |
| Qualcomm | Option “b” |  |
| Intel | b |  |
| Ericsson | b. | This information can be derived from the absence or presence of contentionDetected/dlRSRPAboveThreshold. Therefore, option a. seems redundant. |
| OPPO  | b |  |
| CATT | b |  |
| Nokia, Nokia Shanghai Bell | b |  |
| Huawei, HiSilicon | b |  |
| CMCC | b |  |
| vivo | b |  |
| MediaTek | b |  |
| ZTE | a | Referring to the comment in Proposal 4, the absence of contentionDetected flag could be for Msg1 SI request, which is CBRA, not CFRA. We think option a is preferable. |

###  [S472][S473] Logging PLMN Info in RA Report

In [16], Samsung brings up the issue of the PLMN inclusion in the varRA-Report. There are two proposals associated to the same. One is upon successful RA completion, the list of current EPLMNs replaces the existing contents of plmn-IdentityList. The other being, if the RPLMN is included in plmn-IdentityList stored in VarRA-Report, the plmn-IdentityList should be set to include the new list of EPLMNs stored by the UE (i.e. includes the RPLMN), after clearing the existing information included in VarRA-Report.

* Samsung proposal 1: Upon successful RA completion, the list of current EPLMNs replaces the existing contents of plmn-IdentityList.
* Samsung proposal 2: If the RPLMN is included in plmn-IdentityList stored in VarRA-Report, the plmn-IdentityList should be set to include the new list of EPLMNs stored by the UE (i.e. includes the RPLMN), after clearing the existing information included in VarRA-Report.
1. Upon successful RA completion, the list of current EPLMNs replaces the existing contents of plmn-IdentityList.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| Ericsson | No | In our understanding, the intention of current procedural text is to let the UE keep appending the PLMNs to which RA reports refer to. With the proposed change instead the UE will override the previously included list of PLMNs, which is not the original intended behavior.  |
| OPPO | Yes |  |
| CATT | No | Upon successful RA completion, if the RPLMN is already included in plmn-IdentityList stored in VarRA-Report, there is no need to use current EPLMNs to replace the existing contents of plmn-IdentityList;Otherwise the UE should do the replacement work, we think proposal 8 already cover the concern. |
| Nokia, Nokia Shanghai Bell | No | “replacing” the EPLMN should not be allowed to avoid potential risk that report will go to not intended PLMN/network/gNB. As discussed online, “appending” should be intended behaviour  |
| Huawei, HiSilicon | No | Share similar view as Nokia. |
| CMCC | No | Agree with Ericsson. |
| vivo | yes |  |
| MediaTek | yes |  |
| ZTE | No | First we want to clarify in the procedure part “ 2>if the list of EPLMNs has been stored by the UE:” means the EPLMNs stored in VarRA-Report right? If so, we suggest to included ”in the VarRA-Report” in the sentence to avoid misunderstanding. We agree with Ericsson the intention is to append the EPLMN list not to replace. But we’d like to clarify what’s the behavior if the PLMN List in VarRA-report is full? Does UE stop appendix the PLMN List or the oldest entry will be replaced to allow the new PLMNs to be included? In our understanding to stop include new EPLMN list once the PLMN list is full is more reasonable. |

On the Samsung proposal-2, the following should be discussed

1. If the RPLMN is not included in plmn-IdentityList stored in VarRA-Report, the plmn-IdentityList should be set to include the new list of EPLMNs stored by the UE (i.e. includes the RPLMN), after clearing the existing information included in VarRA-Report.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| Ericsson | Yes | That is needed for the case in which the UE selects a new PLMN which is not in the list of previously stored PLMNs |
| OPPO | Yes |  |
| CATT | Yes |  |
| Nokia, Nokia Shanghai Bell | May be | Maybe its matter of modelling, but should the UE ever end up with the case that VarRA-report does not contain the plmn-IdentityList? In any case the plmn-IdentityList should be set to include the ~~new~~ list of EPLMNs stored by the UE (i.e. includes the RPLMN). Furthermore, we need to decide what are the secure moments when the PLMN List is recorded: is it  “after clearing the existing information included in VarRA-Report” or after “completion of RA procedure”?.  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |
| vivo | Yes |  |
| MediaTek | yes |  |
| ZTE | Yes |  |

### [S475] Setting RA-Related Information in RA-Report and RLF-Report

In [16], Samsung brings up the possibility of introducing a new IE to represent the RA related resources in the RLF report and the RA report.

* Samsung proposal: RAN2 to clarify to set the RA-Related Information in RA-Report and RLF-Report, in order to avoid repeatedly indicating the parameters across RA-Report and RLF-Report.
1. RAN2 to clarify to set the RA-Related Information in RA-Report and RLF-Report, in order to avoid repeatedly indicating the parameters across RA-Report and RLF-Report.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| Ericsson | Maybe | We see this more as a beautification of specification for which we probably do not need to spend time. |
| OPPO | Maybe |  |
| CATT | No strong view |  |
| Nokia, Nokia Shanghai Bell | May be | Is the intention to revert back the agreement that RA-report is included in RLF-report? Given the agreement on having RA-report within RLF\_report was conscious, we believe that was acceptable to have contents repeated. Its ok to re-confirm the intentions and achieve common understanding  |
| Huawei, HiSilicon | May be |  |
| CMCC | No strong view |  |
| vivo | Yes |  |
| MediaTek | No strong view |  |
| ZTE | No for now | We prefer to come back to this after we decide how to indicate multiple RA resource information. |

### RAReport availability indication

In [20], Nokia discusses the need for an RAReport availability indication in the RRCSetupComplete, RRCResumeComplete, RRCReconfigurationComplete or RRCReestablishmentComplete messages.

* Nokia Proposal 1: Support availability indicator for stand-alone RA-report.
* Nokia Proposal 2: Support availability indicator (e.g. ra-ReportAvailable) in RRCSetupComplete, RRCResumeComplete, RRCreestablishmentComplete and RRCReconfigurationComplete messages.

Rapporteur’s input:

The network gets to know the availability of RAReport at the UE via the actual RA procedure that the UE has completed recently. For example, upon transitioning from RRC inactive, the UE performs the Resume procedure the UE executes the RA procedure. Therefore, receiving a RRCResumeComplete message from the UE is an implicit indication to the RAN node that the UE has RAReport available and the RAN node can fetch it from the UE. Therefore, the rapporteur thinks that this is not required but it would be good to hear companies’ opinion on this topic.

1. Support availability indicator for stand-alone RA-report.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Not needed. It should be consistent with LTE RACH report. |
| Intel | No | We don’t think it is needed. |
| Ericsson | No | The RA-report in Var-RAReport only includes successfully completed RA. So obviously if the UE is connected to this cell it should have such info available and the network can get to know this information implicitly based on that. |
| OPPO | No |  |
| CATT | May be | We show some sympathy for this proposal, but it’s still work well even without this indicator. |
| Nokia, Nokia Shanghai Bell | Yes | We believe it was simply overlooked aspect in LTE. All the complementary elements (separate request in UEInformationRequest, separate RA-report encoding in ASN.1) are are ready to use the report as stand-alone one. The only missing part is availability indicator   |
| Huawei, HiSilicon | No |  |
| CMCC | No | It’s ok to have existing implicit indication. |
| vivo | No |  |
| MediaTek | No |  |
| ZTE | No | No necessary. We think current procedure is sufficient. |

1. Support availability indicator (e.g. ra-ReportAvailable) in RRCSetupComplete, RRCResumeComplete, RRCreestablishmentComplete and RRCReconfigurationComplete messages.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | It should be consistent with LTE RACH report. |
| Intel | No | We don’t think it is needed. |
| Ericsson | No | As per our comment to previous question. |
| OPPO | No |  |
| CATT | May be | See the answer in P10 |
| Nokia, Nokia Shanghai Bell | Yes | Same reasoning above |
| Huawei, HiSilicon | No |  |
| CMCC | No |  |
| vivo | No |  |
| MediaTek | No |  |
| ZTE | No |  |

### Procedural text correction

In [22], Nokia proposes to correct the procedural text related to resetting of the RAReport by the UE. The proposal is to reset the contents of VarRA-Report after 48 hours of last successful random access procedure related information is added to the *VarRA-Report* only if the UE has already stored up to *maxRAReport* number of RAReports.

1. Agree RRC changes to fix the issue described in Observation 2 as in the attached Annex of [22].

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | UE should reset the contents of VarRA-Report after 48 hours of last successful random-access procedure related information is added to the *VarRA-Report* irrespective of whether UE has already stored up to *maxRAReport* number of RAReports.For example, if maxRAReport is never reached, UE will keep maintaining the *VarRA-Report*. I believe that should not be the case. In my point of view, 48 hour has the significance that after 48 hour the logged reported becomes less significant.  |
| Intel |  | We think that after 48 hours, it should be reset regardless. |
| Ericsson | May be | We have some sympathy with the chipset vendors as a UE that has only 7 RA reports will never be able to reset its RAReport related memory. However, the current agreement states that the UE shall reset the varRAReport contents after 48 hours only if all 8 RAReports are filled. |
| OPPO | No | Agree with Qualcomm |
| CATT | May be | Show some sympathy for Qualcomm view |
| Nokia, Nokia Shanghai Bell | Yes | We agree with Qualcomm’s interpretation. But besides the very last change indicated by Qualcomm (in the TP in [22]), webelieve the remaining changes from [22] are needed.  |
| Huawei, HiSilicon | May be | Share the same view as Ericsson. |
| CMCC | No | Agree with Qualcomm |
| vivo |  | Agree with Intel |
| MediaTek | May be |  |
| ZTE | Maybe | We have some sympathy on Qualcomm’s view. |

## RLF Report

### Bluetooth/WLAN/Sensor configuration for respective Bluetooth/WLAN/sensor measurements in RLF report

In [1], Ericsson brings up the issue of Bluetooth/WLAN/sensor measurements to be included in the RLF report. In the current procedural text, it is stated that the UE shall use the WLAN/Bluetooth/Sensor measurement configuration as provided in otherConfig for subsequent measurement reporting. However, RLF report is not part of the measurement report framework but still upon sending the RLF report the UE includes the available WLAN, Bluetooth, Sensor measurements whose configuration was received in the *otherConfig*. Based on this Ericsson [1] proposes to clarify that the UE can use the WLAN, Bluetooth and sensor configuration as received in otherConfig to obtain the respective measurements for subsequent measurement report and also the RLF report.

* Ericsson proposal: Clarify that the WLAN, Bluetooth, Sensor configuration received in the *otherConfig* is used for deriving the respective WLAN, Bluetooth and sensor measurements to be included in any subsequent measurement report and any subsequent RLF report.
1. Clarify that the WLAN, Bluetooth, Sensor configuration received in the *otherConfig* is used for deriving the respective WLAN, Bluetooth and sensor measurements to be included in any subsequent measurement report and any subsequent RLF report.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| Nokia, Nokia Shanghai Bell | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |
| Vivo | Yes  |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |

### LTE-NR handover failure related RLF report

This topic has been brought up by Ericsson and ZTE.

#### LTE previous PCell inclusion in NR RLF report

When there is an inter-RAT handover from LTE to NR and if the UE fails, then the UE should be able to record the RLF report in NR RRC format as the failed cell is an NR cell. However, in the current NR RRC specification, the UE can store only an NR cell in the *previousPCellId*. Based on this, Ericsson proposes [1] the inclusion of an LTE cell as previous PCell in the RLF report. For the capability indication associated to inter-RAT handover related RLF report, Ericsson proposes [1] to follow the method of supporting similar feature in LTE i.e., the UE does not have any explicit capability bit for this and this is an optional feature without capability bit. Ericsson has provided the CRs associated to this topic in [3] and [4].

* Ericsson proposal 1: Include the possibility to have an LTE cell as the *previousPCellId* in the *RLF-Report* in NR RRC specification.
* Ericsson proposal 2: The support of inter-RAT MRO report associated RLF reporting in LTE to NR handover scenario is an optional feature without UE capability bit.

In [18], ZTE also brings up the same topic and also proposes the following (only previousEUTRA-PCellId part of the proposal is treated here and the selectedEUTRA-PCellId is added to the corresponding section). Additionally, ZTE proposes to include the TAC information of the previous EUTRA PCell as well.

* ZTE proposal 1: To introduce previousEUTRA-PCellId IE in NR RLF report to support the agreed Intra-system inter-RAT MRO and Inter-system MRO scenarios.
* ZTE proposal 2: TAC is included in previousEUTRA-PCellId IE, for better routing to forward the RLF report or for the optimizer to take subsequent action easier.
1. Include the possibility to have an LTE cell as the previousPCellId in the RLF-Report in NR RRC specification.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | May be | Not strong opinion on this |
| Intel | No | If there is no NR cell ID included, then the network should know it is LTE cell. PCI only will not be so beneficial anyway.  |
| Ericsson | Yes | This is needed to support inter-RAT MRO related optimization wherein the UE might fail an inter-RAT handover from EUTRA to NR.  |
| OPPO | No strong opinion |  |
| CATT | Yes | Agree with Ericsson |
| Nokia, Nokia Shanghai Bell  | Wait for RAN3 | We would like to emphasize the scenario in case of inter-RAT MRO might not be correctly described. The failed cell will not be the LTE cell, but the NR cell. It can be assumed that LTE is of better coverage than NR, therefore NR to LTE only fails if handover is triggered too late (keep the UE as long as possible in high capacity conditions) and UE fails in NR. The previousCellID does not matter, since it could be other NR cell from previous intra-NR handover.. It is rather needed that LTE can inform the NR cell about too late inter-RAT HO.In addition, we would like to note RAN3 is discussing the gaps in RLFreport contents and are about to conclude what are missing contents of RLFreport for its best routing in the NW |
| Huawei, HiSilicon | Wait for RAN3 | It seems that RAN3 is discussing similar issue so it may be good to wait for their progress. |
| CMCC | Yes | We see some benefits. |
| vivo | Yes | Agree with Ericsson |
| MediaTek | No strong view |  |
| ZTE | Yes | Agree with Ericsson, the intention is to support inter RAT MRO. In LTE we introduce previousUTRA cell and selectedUTRA cell to support inter-RAT MRO case, we think since current MRO support both HO between NR and LTE, similar enhancement is needed. |

1. The support of inter-RAT MRO report associated RLF reporting in LTE to NR handover scenario is an optional feature without UE capability bit.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | May be | Not strong opinion on this |
| Intel | yes |  |
| Ericsson | Yes | This is the way, it is handled for EUTRA inter-RAT MRO reporting with respect to legacy RATs |
| OPPO | No strong opinion |  |
| CATT | Yes |  |
| Nokia, Nokia Shanghai Bell | May be |  |
| Huawei, HiSilicon | May be |  |
| CMCC | Yes |  |
| vivo | No strong view |  |
| MediaTek | No strong view |  |
| ZTE | Yes |  |

1. TAC is included in previous EUTRA PCell.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | May be | Not strong opinion on this |
| Intel | No |  |
| Ericsson | Yes | TAC information is needed to route the RLF report from the failed cell to the previous source cell in case X2/Xn connection is not available. |
| OPPO | No strong opinion |  |
| CATT | Yes | Agree with Ericsson |
| Nokia, Nokia Shanghai Bell | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |
| vivo | No strong view |  |
| MediaTek | No strong view |  |
| ZTE | Yes | Share the same view as Ericsson. |

#### NR previous PCell inclusion in LTE RLF report

Similarly, when there is an inter-RAT handover from NR to LTE and if the UE fails, then the UE should be able to record the RLF report in LTE RRC format as the failed cell is an LTE cell. However, in the current LTE RRC specification, the UE can store only an LTE/UTRA cell in the previousPCellId/*previousUTRA-CellId*. Ericsson proposes [1] the inclusion of an NR cell as previous PCell in LTE RLF report. With this change the UE can store the RLF report and report it to the LTE cell in which the UE pops up. Associated to this, Ericsson has provided the CRs [5] and [6].

* Ericsson proposal 1: Include the possibility to have an NR cell as the *previousPCellId* in the *RLF-Report* in LTE RRC specification.
* Ericsson proposal 2: The support of inter-RAT MRO report associated RLF reporting in NR to LTE handover scenario is an optional feature without UE capability bit.

In [18], ZTE also brings up the same topic and also proposes the following (only previousNR-PCellId part of the proposal is treated here and the selectedNR-PCellId is added to the corresponding section). Additionally, ZTE proposes to include the TAC information of the previous NR PCell as well.

* ZTE proposal 1: To introduce previousNR-PCellId IE in LTE RLF report to support the agreed Intra-system inter-RAT MRO and Inter-system MRO scenarios.
* ZTE proposal 2: TAC is included in previousNR-PCellId IE, for better routing to forward the RLF report or for the optimizer to take subsequent action easier.
1. Include the possibility to have an NR cell as the previousPCellId in the RLF-Report in LTE RRC specification.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | May be | Not strong opinion on this |
| Intel | No | For the same reason in the previous discussion. |
| Ericsson | Yes | Same reasonings as above |
| OPPO | No strong opinion |  |
| CATT | May be | From technology perspective, we think the intention is correct, but it’s not important enough to change LTE spec for this topic. |
| Nokia, Nokia Shanghai Bell | Wait for RAN3 | If the handover fails due to weak NR conditions, the UE will most likely reconnect to LTE, and RLF-report will be reported in LTE, too.  |
| Huawei, HiSilicon | Wait for RAN3 |  |
| CMCC | May be |  |
| vivo | No strong view |  |
| MediaTek | No strong view |  |
| ZTE | Yes | For the comments given in Proposal 14. |

1. The support of inter-RAT MRO report associated RLF reporting in NR to LTE handover scenario is an optional feature without UE capability bit.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | May be | Not strong opinion on this |
| Intel | Yes |  |
| Ericsson | Yes | Same reasonings as above |
| OPPO | No strong opinion |  |
| CATT | **May be** |  |
| Nokia, Nokia Shanghai Bell | **May be** |  |
| Huawei, HiSilicon | **May be** |  |
| CMCC | **May be** |  |
| vivo | No strong view |  |
| MediaTek | No strong view |  |
| ZTE | Yes |  |

1. TAC is included in previous NR-PCell.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | May be | Not strong opinion on this |
| Intel | No |  |
| Ericsson | Yes | Same reasonings as above |
| OPPO | No strong opinion |  |
| CATT | **May be** |  |
| Nokia, Nokia Shanghai Bell | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | **May be** |  |
| vivo | No strong view |  |
| MediaTek | No strong view |  |
| ZTE | Yes |  |

### Cross RAT RLF reporting related

#### RAT specific indicator related:

In [23], Huawei brings up possibility of including separate indicators for LTE RLF reporting and NR RLF reporting to an NR node.

* Huawei proposal: Introduce separate indicators to indicate whether the RLF report being reported by the UE is the NR RLF report or the LTE RLF report.

Rapporteur’s input:

As this topic was discussed during RAN2#109e-meeting. As the current reporting structure allows for the RAN node to identify the failed PCell by using the NR RRC decoding, the RAN node will be able to initiate the RLF report forwarding procedure as per RAN3 specifications. Therefore, there is not much benefit foreseen in having as additional indicator for indicating whether the UE has NR RLF report or LTE RLF report.

1. Introduce separate indicators to indicate whether the RLF report being reported by the UE is the NR RLF report or the LTE RLF report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Network can easily differentiate and determine whether the RLF report being reported by the UE is the NR RLF report or the LTE RLF report. |
| Intel | No | This can be figure out by network implementation. |
| Ericsson | No | We introduced the failedPCell to be encoded using NR RRC so that the current signaling allows for fetching of the LTE RLF report by a gNB that does not support the LTE RRC decoding. Once this feature is available, we do not see any reason why a gNB further needs to know whether the fetched RLF report belongs to LTE or NR. The procedure to be performed by this gNB is the same i.e., forward the received RLF report to the failed PCell which it can perform already. |
| OPPO | No | Agree with Qualcomm and Ericsson |
| CATT | No | Agree with Qualcomm and Ericsson |
| Nokia, Nokia Shanghai Bell | No | Current 38.331 supports the feature with a single indicator and the reporting based on that is feasible, thus we believe nothing is broken   |
| Huawei, HiSilicon | May be |  |
| CMCC | No |  |
| vivo | No | Agree with QC, there is no need for indicators to indicate whether the RLF report being reported by the UE is the NR RLF report or the LTE RLF report. |
| MediaTek | No |  |
| ZTE | No |  |

### Missing TAC for reestablishmentCellID in RLF report

In [1], Ericsson proposes the inclusion of TAC information for reestablishment cell. In the current RLF report the UE includes the CGI of the reestablishment cell. As discussed during RAN2 109e meeting for the failedPCell and previousPCell of RLF report, there is an advantage of including the TAC information along with the CGI information to identify this cell uniquely within the PLMN. This is also useful for the source cell if it wants to optimize handover parameters towards both failed cell and reestablishment cell (too early handover and handover to wrong cell scenarios). Based on this, Ericsson proposes [1] to add the TAC information of the reestablishment cell in the RLF report. Ericsson also provides the CR for this in [11].

* Ericsson proposal: Use CGI-Info-LoggingDetailed-r16 instead of CGI-Info-Logging-r16 to encode reestablishmentCellId-r16 in rlfReport-r16
1. Use CGI-Info-LoggingDetailed-r16 instead of CGI-Info-Logging-r16 to encode reestablishmentCellId-r16 in rlfReport-r16.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | May be | Not sure why CGI is not enough to uniquely identify cell? |
| Ericsson | Yes | If the source cell of the handover wants to use the re-establishment cell for handover parameter optimization (e.g., handover to wrong cell scenarios) then the source cell needs to identify the re-establishment cell uniquely in the RLF report. For this reason, we propose to include the TAC of the re-establishment cell in the RLF report.  |
| OPPO | May be | Share similar concern with Intel. In TS 38.331, the IE field description of cellIdentity included in CGI-Info-logging is indicated as follows: Unambiguously identify a cell within a PLMN and it belongs the first *PLMN-IdentityInfo* IE of *PLMN-IdentityInfoList* in *SIB1*. It seems CGI-Info-logging is enough to identify a cell unambiguously. But we are ok if others support. |
| CATT | No | The RLF report will not be transferred to re-establishment cell if re-establishment cell is neither failed cell or previous cell, in this case, TAC of re-establishment cell is not useful as all even for routing purpose; else if re-establishment cell is either failed cell or previous cell, in this case, TAC is already included in failed cell or previous cell logging detail. So only the cell ID of re-establishment cell is needed to assist network to identify too late or too early HO. |
| Nokia, Nokia Shanghai Bell | Yes |  |
| Huawei, HiSilicon | No | The TAC of the source/target cell is used for the routing of RLF report in case of AMF. For the reestablishment cell, there is no need for the network to know the TAC. The reestablishment cell can be uniquely identified by CGI. |
| CMCC  | Yes |  |
| Vivo | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes | Share the same view as Ericsson.  |

### Issues under class – 2

In [1], Ericsson brings up the issue of RLF report contents when the RLF is declared due to LBTFailure.

If there is an RLF due to consistent LBT failure then the UE declares RLF. The UE starts performing the updating of the contents of VarRLF-Report as part of the post RLF procedure. As part of this procedure, the UE needs to fill the field rlf-Cause based on the trigger for declaring RLF which should have been LBTFailure.

5> set the rlf-Cause to the trigger for detecting radio link failure;

However, the contents of the ASN.1 does not allow the inclusion of LBTFailure as a rlf-cause. Based on this, Ericsson [1] proposes to add LBTFailure as an rlf-cause both in the RLF report and the SCGFailureInformationNR message. Ericsson has provided the corresponding CRs in [7] and [8].

* Ericsson proposal 1: Include lbtFailure as an option in rlfCause in RLF report.
* Ericsson proposal 2: Include lbtFailure as a failureType in SCGFailureInfomationNR in LTE RRC specification.
1. Include lbtFailure as an option in rlfCause in RLF report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | I think its new topic and not discussed in the previous meeting. Also, it is not clear that what to report id rlf\_cause is lbtFilure. Should be discussed in release 17. |
| Intel | No | Agree with QC |
| Ericsson | Yes | This needs to be included in the rlf-Cause, otherwise the UE choses some other value in the rlf-Cause of the RLF-Report and this will result in wrong parameter optimization on the network side. So, the current procedural text and ASN.1 results in misleading the network optimization. |
| OPPO | No | Postpne to R17 is preferred |
| CATT | **May be** | No strong view |
| Nokia, Nokia Shanghai Bell | No | Optimization |
| Huawei, HiSilicon | No | Suggest to put it to R17 |
| CMCC | No | Should be discussed in release 17. |
| MediaTek | No |  |
| ZTE | May be | Consistent LBT failure can lead to RLF, which is different from RA problem and BFR, in such case it would beneficial to let NW know the correct rlf cause to perform necessary optimization. But we are ok to discuss it in R17. |

1. Include lbtFailure as a failureType in SCGFailureInfomationNR in LTE RRC specification.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | I think its new topic and not discussed in the previous meeting. Also, it is not clear that what to report id rlf\_cause is lbtFilure. Should be discussed in release 17. |
| Intel | No |  |
| Ericsson | Yes | Same reasons as above. |
| OPPO | No |  |
| CATT | **May be** | No strong view |
| Nokia, Nokia Shanghai Bell | No | New proposal, never discussed |
| Huawei, HiSilicon | No | Suggest to put it to R17 |
| CMCC | No | Should be discussed in release 17. |
| Vivo | No | This can be later investigated, if necessary |
| MediaTek | No |  |
| ZTE | May be  | Fine to discuss it in R17. |

### Creation of new section under 5.3.10

In [1], Ericsson proposes the creation of a new section.

In the SCGFailure scenario, the UE includes the failureType field in the SCGFailureInformationNR or SCGFailureInformation messages and how the UE is supposed to set the contents of failureType field is explicitly captured in section 5.7.3.3 of TS 38.331.

When the UE declares RLF on MCG, the UE is expected to fill rlf-Cause field in the RLFReport. However, the current procedural text does not provide explicit indication as to how this field is populated. It is strange that the SCGFailure scenario has all the detailed procedural text but not the RLF on MCG. Based on this, Ericsson proposes [1] to add a new section for ‘RLF cause determination for MCG RLF ’. Ericsson has provided a TP for the same in [1].

* Ericsson proposal: Create a new section titled ‘RLF cause determination for MCG RLF’ under section 5.3.10 and include procedural text related to how the UE shall populate the rlf-Cause field in RLFReport.
1. RAN2 to agree on one of the following:
	1. Create a new section titled ‘RLF cause determination for MCG RLF’ under section 5.3.10 and include procedural text related to how the UE shall populate the rlf-Cause field in RLFReport.
	2. Refer to section 5.7.3b.3 for rlf-cause classification and add missing rlf causes in the procedural text.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Preferred option(s)** | **Additional comments** |
| Qualcomm | No | Should avoid repetitions. As mentioned by ZTE previous comment that “there is subsection on 5.7.3b.4 for MCG failure time determination.” We agree with ZTE.  |
| Intel | b |  |
| Ericsson | b | We are fine with referring to section 5.7.3b.3 and make it clear as to how the UE sets the field ‘rlf-cause’ |
| OPPO | No strong opinion |  |
| CATT | b | More readable |
| Nokia, Nokia Shanghai Bell | No | Agree with Qualcomm |
| Huawei, HiSilicon | No | Agree with Qualcomm. |
| CMCC | b | More clear is preferred. |
| vivo | No | Agree with Qualcomm |
| MediaTek | No | Agree with Qualcomm |
| ZTE | b | As indicated by Ericsson, in 5.7.3b.3 it is to set the value of failureType while in RLF report it is to set RLF cause, and it is preferable to capture something to make the procedure more clear. |

### Handover vs Reconfiguration with sync terminology related

Docomo [14], brings up the issue of the usage of handover terminology in RLF report related procedural texts. To align the terminology with the rest of the NR RRC specification, Docomo proposes to use the reconfiguration with sync terminology in RLF report related specification contents.

* Docomo proposal 1: RAN2 to confirm the appropriateness of using terminology of “handover failure” rel-16 38.331 spec.
* Docomo proposal 2: RAN2 to agree the one of the solutions:
	+ Solution1: Replace the terminology of “handover failure” with “Reconfiguration with sync failure” in rel-16 38.331 spec.
	+ Add a NOTE to clarify that in this release, “handover failure” indicates T304 expiry (reconfiguration with sync failure of MCG).
1. RAN2 to agree the one of the solutions:
	1. Solution1: Replace the terminology of “handover failure” with “Reconfiguration with sync failure” in rel-16 38.331 spec.
	2. Solution2: Add a NOTE to clarify that in this release, “handover failure” indicates T304 expiry (reconfiguration with sync failure of MCG).

|  |  |  |
| --- | --- | --- |
| **Company name** | **Preferred option(s)** | **Additional comments** |
| Qualcomm | Yes |  |
| Intel | a | Option b is also acceptable to us |
|  Ericsson | Solution 1 | As there are many places where we use the term handover failure, it is better to change it to ‘reconfiguration with sync failure’ instead of adding NOTE is all those places. |
| OPPO | b |  |
| CATT | Solution 1 | No strong view for solution 2 |
| Nokia, Nokia Shanghai Bell | Nothing or Option b  | “Handover” term use is not the first occurrence for RLFreporting. It appeared in other places of RRC (e.g. ASN.1 conditions, CHO, etc), therefore it may be more confusing to use “reconf with sync” as a failure field value. We prefer keeping this aligned with LTE  |
| Huawei, HiSilicon | b | The “handover failure” is a common terminology since in LTE and captured in other specifications. |
| CMCC | No strong view |  |
| vivo | a | Make the specification more consistent |
| MediaTek | Yes |  |
| ZTE | a or b | We are fine with both options. |

### [S477] Re-connection attempt cell in the RLF report

This topic has been discussed by Samsung, ZTE, CATT and CMCC.

In [16], Samsung discusses the re-connection attempt cell related topic in the RLF report context. Samsung provides the following explanation. For inter-RAT MRO between NR and LTE e.g. too late handover from NR to LTE, can gNB get the selected LTE cell from the Measurement result in NR RLF Report? If yes, then no problem to support inter-RAT MRO and inter-system MRO.

If no, then Samsung proposes two way forward:

a) Remove inter-system/inter-RAT MRO from RAN3 spec

b) UE includes the Re-connection attempt cell in RLF Report.

Considering RAN3 has spent a lot of effort and captured the feature in stage 2 and stage 3, Samsung believes that it is better to have this ready in Rel-16.

* Samsung proposal: RAN2 to clarify whether a gNB get the selected LTE cell from the Measurement result in NR RLF Report, if not, to include Re-connection attempt cell in UE RLF Report.

The same has been discussed by ZTE in [18].

* ZTE proposal 1: To introduce selectedEUTRA-PCellId IE in NR RLF report to support the agreed Intra-system inter-RAT MRO and Inter-system MRO scenarios.
* ZTE proposal 2: TAC is included in selectedEUTRA-PcellId IE, for better routing to forward the RLF report or for the optimizer to take subsequent action easier.
* ZTE proposal 3: To introduce selectedNR-PcellId IE in LTE RLF report to support the agreed Intra-system inter-RAT MRO and Inter-system MRO scenarios.
* ZTE proposal 4: TAC is included in selectedNR-PcellId IE, for better routing to forward the RLF report or for the optimizer to take subsequent action easier.

CATT and CMCC in [19] and they propose to support the inclusion of re-connection attempt cell in RLF report. CATT and CMCC have also provided the TP for the same in [19].

* CATT and CMCC proposal 1: Add “Re-connection attempt cell CGI” of E-UTRAN cell to the NR RLF Report.
* CATT and CMCC proposal 2: Include the TAC of re-connection attempt E-UTRAN cell.
* CATT and CMCC proposal 3: Add “Re-connection attempt cell CGI” of NR cell to the NR RLF Report.
* CATT and CMCC proposal 4: Add “reconnectionTimeSinceFailure” besides NR/E-UTRAN attempt cell ID to the NR RLF Report.
1. Add “Re-connection attempt cell CGI” of E-UTRAN cell to the NR RLF Report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Should be discussed in release 17. For release 16, we can Remove inter-system/inter-RAT MRO from RAN3 spec. |
| Intel | No | Agree should be defer to rel 17 |
| Ericsson | Yes | This is a most likely scenario in the first NR deployments wherein the Ues are retained in NR as long as possible before handing over to LTE, thus increasing the risk of too late inter-RAT handover. Then the UE re-connects to LTE cell but to which LTE cell the UE has re-connected to is lost. Therefore, one needs to have E-UTRA Re-connection attempt cell CGI in the NR RLF Report. |
| OPPO | No | Postpone to R17 |
| CATT | Yes | This feature is just following LTE spec, in LTE, the selected UTRAN Cell ID is included in LTE RLF report, so in NR RLF report, we try to add selected E-UTRAN Cell ID. In our understanding, this use case is a normal case anyway should be considered. |
| Nokia, Nokia Shanghai Bell | May be | We should follow RAN3 guidelines what contents are necessary to best route RLFreport |
| Huawei, HiSilicon | No | Suggest to put it to R17 |
| CMCC | Yes | Share the view with Ericsson and CATT. Ericsson explained quite clear this is needed for root cause analysis. We think this is an essential information for inter-RAT and inter-system MRO |
| vivo |  | Can be further discussed later in Rel-17 |
| MediaTek | No |  |
| ZTE | Yes | Shall the same view as Ericsson and CATT. |

1. Include the TAC of re-connection attempt E-UTRAN cell.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Should be discussed in release 17. For release 16, we can Remove inter-system/inter-RAT MRO from RAN3 spec. |
| Intel | No |  |
| Ericsson | Yes | Same reasonings as above |
| OPPO | No | Postpone to R17 |
| CATT | Yes | See answer for P26 |
| Nokia, Nokia Shanghai Bell | Yes |  |
| Huawei, HiSilicon | No |  |
| CMCC | Yes |  |
| vivo |  | Can be further discussed later in Rel-17 |
| MediaTek | No |  |
| ZTE | Yes |  |

1. Add “Re-connection attempt cell CGI” of NR cell to the NR RLF Report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Should be discussed in release 17. For release 16, we can Remove inter-system/inter-RAT MRO from RAN3 spec. |
| Intel | No |  |
| Ericsson | May be | This is not as critical as the inclusion of EUTRA related re-connection cell as the too late handover from LTE to NR is not going to very common. |
| OPPO | No | Postpone to R17 |
| CATT | Yes | For intra-system MRO, since NG-RAN node could be either gNB or eNB connected with 5GC, CGI of re-connection attempt NR cell is also needed. For example, RLF happens in ng-eNB1, and then UE attempts to re-connect to gNB2. In this case, it may be a ng-eNB1 to gNB2 handover too late. |
| Nokia | Yes | We should follow RAN3 guidelines what contents are necessary to best route RLFreport |
| Huawei, HiSilicon | No |  |
| CMCC | Yes |  |
| vivo |  | Can be further discussed later in Rel-17 |
| MediaTek | No |  |
| ZTE | Yes | This is for MRO and it is beneficial to also consider the re-connected NR cell. |

1. Add “reconnectionTimeSinceFailure” besides NR/E-UTRAN attempt cell ID to the NR RLF Report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Should be discussed in release 17. For release 16, we can Remove inter-system/inter-RAT MRO from RAN3 spec. |
| Intel | No |  |
| Ericsson | Yes | This information is required to make use of the reconnection cell ID related field. A UE that performs reconnection after a long time of declaring RLF is of no use for the MRO algorithm. Therefore, this timer related information is needed. |
| OPPO | No | Postpone to R17 |
| CATT | Yes | Agree with Ericsson |
| Nokia, Nokia Shanghai Bell | Yes | Needed by the network to determine the relevance of the reconnection attempt cell |
| Huawei, HiSilicon | No |  |
| CMCC | Yes | Agree with Ericsson and Nokia. |
| vivo |  | Can be further discussed later in Rel-17 |
| MediaTek | No |  |
| ZTE | Yes | This field is needed to assist the usage of re-connected NR cell. |

### Inclusion of RA related info in RLF report

In [21], Nokia proposes to modify the procedural text to allow for the inclusion of RA related information for failed RA procedures associated to RLF reports as well. Additionally, Nokia also proposes to include raPurpose for the RLF report. Nokia have also provided the associated TP in [21].

* Nokia proposal 1: Allow also logging of unsuccessful RA procedures in the NR UE RA Report.
* Nokia proposal 2: Add raPurpose to RLF Report.

Rapporteur’s input:

Proposal 1 seems to be not required as the unsuccessful RA procedures will lead to either RLF or CEF and each of these failures have their own RA related contents in the respective RLF report and CEF report. Rapporteur believes that the contents of section 5.7.10.4 is applicable only for successful RA procedures. However, rapporteur would like to hear from other companies on this topic

1. Allow also logging of unsuccessful RA procedures in the NR UE RA Report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | It needs to be discussed that in the case of unsuccessful RA, what should be reported.  |
| Intel | No | This seems to be further optimization. Can be discussed in rel 17 |
| Ericsson | No | This is already part of RLF report and CEF report wherein the UE stores the RA related information when the failure occurs due to random access related reasons. Therefore, we do not think the unsuccessful RA procedures should be part of RAReport. |
| OPPO | No |  |
| CATT | No | Better to discuss in R17 |
| Nokia, Nokia Shanghai Bell | Yes | Reasoning in [21] |
| Huawei, HiSilicon | No | For the RLF report, it aims at the optimization of the handover related parameters. We just need to include information to identify the mobility problem. This is not related to the detailed RA info. |
| CMCC | No |  |
| vivo | No |  |
| MediaTek | No |  |
| ZTE | No |  |

Proposal-2 is also seems unnecessary as the RLF report already contains the RLFCause which indicates the random access related RLF cause to be either beamFailureRecoveryFailure or randomAccessProblem. However, if the network wants to understand further within the RLF cause of ‘randomAccessProblem’, then the network would benefit from knowing the raPurpose.

1. Add raPurpose to RLF Report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | No | Same as previous discussion |
| Ericsson | May be | We have some sympathy with the proposal from Nokia. When the RLF is declared due to ‘randomAccessProblem’, the reason for performing this RA is not explicitly stated and this could be useful but we do not have strong opinion on this. |
| OPPO | No |  |
| CATT | May be | No strong view |
| Nokia, Nokia Shanghai Bell | Yes | Reasoning in [21] |
| Huawei, HiSilicon | No |  |
| CMCC | May be | No strong view |
| vivo | No strong view |  |
| MediaTek | No strong view |  |
| ZTE | No | We think randomAccessProblem and BFR is sufficient. |

## SCG failure related

### Missing *beamFailureRecoveryFailure* as a *rlf-Cause* in *SCGFailureInformation*

The *failureType* field included in the *SCGFailureInformation* does not include *beamFailureRecoveryFailure* as one of the causes. Ericsson proposed [1] to add the same in SCGFailureInfomation message of NR RRC specification and SCGFailureInformationNR message of LTE RRC specification. Ericsson has provided the corresponding CRs in [9] and [10].

* Ericsson proposal: Include *beamFailureRecoveryFailure* as a *failureType* in *SCGFailureInformation (NR RRC spec)* and *SCGFailureInformationNR (LTE RRC spec) messages*.
1. Include beamFailureRecoveryFailure as a failureType in SCGFailureInformation (NR RRC spec) and SCGFailureInformationNR (LTE RRC spec) messages.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| Ericsson | Yes | This is required to classify the SCGFailure reason correctly. Otherwise, the failureType indicated in SCGFailureInformation will be different from the actual cause of the SCG failure. |
| OPPO | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | No | In our understanding, the randomAccessProblem can indicate the beamfailureRecoveryFailure.  |
| CMCC | Yes |  |
| vivo | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |

### UE capability for location reporting in SCG failure

In [15], Docomo discussed different scenarios associated to location information inclusion in the SCG Failure Information message. Based on their analysis, they find an issue in the scenario of a rel-16 UE reporting the SCG failure information to a rel-15 eNB/gNB which does not support location information decoding. Since rel-15 eNB cannot decode the location information field in the message, it is up to eNB implementation to handle (e.g. ignore/discard the locationInfo field). While Docomo believe a desirable approach should be to make this function configurable i.e. if UE is configured to include locationInfo in SCGFailureInformation, then UE report it, otherwise unspecified eNB behavior would occur. To resolve this, Docomo proposes the following.

* Docomo proposal 1: RAN2 to discuss the configurability of including LocationInfo in SCGFailureInformation to avoid the interoperability issue.
* Docomo proposal 2: It is necessary to introduce UE capability signaling of reporting LocationInfo in SCGFailureInformation.

As the number of SCG failures are expected to be high in the first releases, Docomo proposes to make the location reporting in SCG failure mandatory supported with UE capability signaling.

* Docomo proposal 3: For rel-16 MR-DC, NR standalone support UE, mandatory support of location reporting function in SCG failure report with UE capability signaling

Docomo, also proposes that the location information included in the SCG failure messages shall be similar to that of RLF report related location information.

* Docomo proposal 4: RAN2 to agree the detailed location information in SCG failure report should be commonLocationInfo, wlan-LocationInfo and bt-LocationInfo and sensor-LocationInfo, if available.
1. RAN2 to agree the configurability of including LocationInfo in SCGFailureInformation to avoid the interoperability issue.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Network should be able to handle interoperability issue. |
| Intel | No | We don’t think it is needed. It can be based on network implementation |
| Ericsson | No | In our understanding, there is no inter-operability problem. The network can handle this. |
| OPPO | No | It is ok for network to discard the locationInfo field if not decodable |
| CATT | No |  |
| Nokia, Nokia Shanghai Bell | No | The UE should provide location information if MN configured location provision for the regular (MN )case |
| Huawei, HiSilicon | No |  |
| CMCC | No |  |
| Vivo | No |  |
| MediaTek | No |  |
| ZTE | No |  |

1. It is necessary to introduce UE capability signaling of reporting LocationInfo in SCGFailureInformation.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Network should be able to handle interoperability issue. |
| Intel | No |  |
| Ericsson | No |  |
| OPPO | No |  |
| CATT | No |  |
| Nokia, Nokia Shanghai Bell | May be |  |
| Huawei, HiSilicon | No |  |
| CMCC | No |  |
| Vivo | No |  |
| MedaTek | No |  |
| ZTE | No |  |

1. For rel-16 MR-DC, NR standalone support UE, mandatory support of location reporting function in SCG failure report with UE capability signaling.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | We don’t need UE signaling capability.  |
| Intel | No |  |
| Ericsson | No | There is no need to differentiate SCG failure related location reporting capability with the location reporting capability in general. Therefore, we prefer not to have one more UE capability bit for SCG failure related aspects. |
| OPPO | No |  |
| CATT | No |  |
| Nokia, Nokia Shanghai Bell | NO |  |
| Huawei, HiSilicon | No |  |
| CMCC | No |  |
| Vivo | No |  |
| MediaTek | No |  |
| ZTE | No |  |

1. RAN2 to agree the detailed location information in SCG failure report should be commonLocationInfo, wlan-LocationInfo and bt-LocationInfo and sensor-LocationInfo, if available.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| Ericsson | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| Nokia, Nokia Shanghai Bell | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |
| Vivo | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes |  |

###  [S478][S479] Further discussion on mobility history information

In [16], Samsung brings up the issue related to the procedural text correction related to UE history information.

* Samsung proposal 1: Upon entering NR while using E-UTRA, the UE includes the E-UTRA cell information and the time spent in the E-UTRA cell in variable VarMobilityHistoryReport.
* Samsung proposal 2: Upon entering NR while using previously out of service, the UE includes the time spent out of service in variable VarMobilityHistoryReport.

Samsung has also provided the TP for this in [16].

1. Upon entering NR while using E-UTRA, the UE includes the E-UTRA cell information and the time spent in the E-UTRA cell in variable VarMobilityHistoryReport.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | We should avoid changing the definition of time spent in a cell. How is time spent in EUTRA cell is defined? What about time needed to handover from EUTRA to NR cell. Is it considered as time spent in E-UTRA cell, NR cell, or OOS. We want consistency with 36.331. |
| Intel | Yes | This may be useful information for the network to estimate the UE speed etc with the E-UTRA cell information. |
| Ericsson | Yes | This is already agreed and the current proposal proposed by Samsung is only for fixing the procedural text which is wrong. We have already agreed that the VarMobilityHistoryReport shall include both time spent in an NR cell and also in an EUTRA cell. All the definitions of how to define ‘time spent in a cell’ is similar to that of EUTRA specification. |
| OPPO | May be |  |
| CATT | Yes | Agree with Ericsson |
| Nokia, Nokia Shanghai Bell | May be | We agree with Qualcomm that RAN2 should be clear and have common understanding on the timer definition |
| Huawei, HiSilicon | Yes | Share the same view as Ericsson. |
| CMCC | Yes but | Agree with Qualcomm and Nokia that RAN2 should have common understanding on the timer definition. |
| Vivo | No | Agree with QC |
| MediaTek | No | Agree with Qualcomm |
| ZTE | Yes | Share the same view as CMCC, we shall align the understanding on time spent.  |

1. Upon entering NR while using previously out of service, the UE includes the time spent out of service in variable VarMobilityHistoryReport.

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| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | No | Similar issue as discussed in previous proposal.  |
| Intel | No | Need to understand further what exactly to report. NW should be able to figure it out based on NW implementation. |
| Ericsson | Yes | This is already agreed and is also similar to LTE for out of service-related entry. |
| OPPO | No | Agree with Intel |
| CATT | Yes | If you combine P38 and P37, P38 also makes sense if P37 is agreed. |
| Nokia, Nokia Shanghai Bell | No | We need better understanding on the usability  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |
| Vivo | No |  |
| MediaTek | No |  |
| ZTE | Yes |  |

### Possibility of retrieving UE history information by the re-establishment cell

In [23], Huawei brings up the issue of re-establishment cell being deprived of the UE history information that is available at the UE and also at the source cell. In the contributrion, Huawei discusses a RAN2 based solution and a RAN3 based solution and propose to go towards the RAN3 based solution.

* Huawei proposal: It is proposed RAN2 to send a LS to RAN3 about the following:
	+ During RRC re-establishment, current standard cannot let the target gNB get the MHI
	+ One possible solution is to add the history information in the RETRIEVE UE CONTEXT RESPONSE message
1. It is proposed RAN2 to send a LS to RAN3 about the following:
	1. During RRC re-establishment, current standard cannot let the target gNB get the MHI
	2. One possible solution is to add the history information in the RETRIEVE UE CONTEXT RESPONSE message

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| Ericsson | Yes | We can send an LS to RAN3 on this. |
| OPPO | Yes |  |
| CATT | Yes |  |
| Nokia, Nokia Shanghai Bell | Yes |  |
| Huawei, HiSilicon | Yes |  |
| CMCC | Yes |  |
| vivo | Yes |  |
| MediaTek | Yes |  |
| ZTE | Yes, but  | We agree with above understanding, but we want to further clarify RAN2’s the intention to send this LS, does it mean RAN2 want RAN3 to add this kind information to RETREIVE UE CONTEXTRESPONSE or simply inform RAN3 to discuss it?  |

# Conclusion

TO BE UPDATED ON THE BASIS OF COMPANIES VIEWS

Based on the discussion in section 1 we propose the following:

Proposal 1 RAN2 to agree on one of the following proposals:

a. Currently captured RAReport contents are applicable only for 4-step random access procedure.

b. RAN2 to confirm the understanding that for R16 RA report, 2-step RA related information will still be recorded without differentiating the RA type, and no further enhancement on PUSCH related information will be used.

Proposal 2 (Provided option-b is selected for the previous question) The maximum RA resource configuration can be included in one RA report entry/RLF report is 3 in case 2-step RA is supported.

Proposal 3 (Provided option-b is selected for the previous question) Change *Msg1-FDM*, *Msg1-FrequencyStart* and *Msg1-SubcarrierSpacing* to *prach-FDM*, *prach-FrequencyStart*, and *prach-SubcarrierSpacing* to make the terminologies in RA report more general for both 4-step/2-step RACH

Proposal 4 For SSB based RA attempt based on contention free random access resources contentionDetected-r16 and dlRSRPAboveThreshold-r16 are not included in PerRAInfoList-r16.

Proposal 5 RAN2 to agree on the following method to encode more than one RA resource configuration (refer [17] for ASN.1 changes):

a. Each RA resource configuration used can be included in the RA report with one identifier, e.g. ra*-Resource-Index* , and UE only needs to set the *ra-Resource-Index* for each successive RA attempt within the same beam

Proposal 6 RAN2 to discuss whether:

a. An explicit indicator is required to indicate whether each SSB-based RA attempt is contention based or contention free

b. This information can be implicitly derived from other report contents.

Proposal 7 Upon successful RA completion, the list of current EPLMNs replaces the existing contents of plmn-IdentityList.

Proposal 8 If the RPLMN is not included in plmn-IdentityList stored in VarRA-Report, the plmn-IdentityList should be set to include the new list of EPLMNs stored by the UE (i.e. includes the RPLMN), after clearing the existing information included in VarRA-Report.

Proposal 9 RAN2 to clarify to set the RA-Related Information in RA-Report and RLF-Report, in order to avoid repeatedly indicating the parameters across RA-Report and RLF-Report.

Proposal 10 Support availability indicator for stand-alone RA-report.

Proposal 11 Support availability indicator (e.g. ra-ReportAvailable) in RRCSetupComplete, RRCResumeComplete, RRCreestablishmentComplete and RRCReconfigurationComplete messages.

Proposal 12 Agree RRC changes to fix the issue described in Observation 2 as in the attached Annex of [22].

Proposal 13 Clarify that the WLAN, Bluetooth, Sensor configuration received in the *otherConfig* is used for deriving the respective WLAN, Bluetooth and sensor measurements to be included in any subsequent measurement report and any subsequent RLF report.

Proposal 14 Include the possibility to have an LTE cell as the previousPCellId in the RLF-Report in NR RRC specification.

Proposal 15 The support of inter-RAT MRO report associated RLF reporting in LTE to NR handover scenario is an optional feature without UE capability bit.

Proposal 16 TAC is included in previous EUTRA PCell.

Proposal 17 Include the possibility to have an NR cell as the previousPCellId in the RLF-Report in LTE RRC specification.

Proposal 18 The support of inter-RAT MRO report associated RLF reporting in NR to LTE handover scenario is an optional feature without UE capability bit.

Proposal 19 TAC is included in previous NR-PCell.

Proposal 20 Introduce separate indicators to indicate whether the RLF report being reported by the UE is the NR RLF report or the LTE RLF report.

Proposal 21 Use CGI-Info-LoggingDetailed-r16 instead of CGI-Info-Logging-r16 to encode reestablishmentCellId-r16 in rlfReport-r16.

Proposal 22 Include lbtFailure as an option in rlfCause in RLF report.

Proposal 23 Include lbtFailure as a failureType in SCGFailureInfomationNR in LTE RRC specification.

Proposal 24 RAN2 to agree on one of the following:

a. Create a new section titled ‘RLF cause determination for MCG RLF’ under section 5.3.10 and include procedural text related to how the UE shall populate the rlf-Cause field in RLFReport.

b. Refer to section 5.7.3b.3 for rlf-cause classification and add missing rlf causes in the procedural text.

Proposal 25 RAN2 to agree the one of the solutions:

a. Solution1: Replace the terminology of “handover failure” with “Reconfiguration with sync failure” in rel-16 38.331 spec.

b. Solution2: Add a NOTE to clarify that in this release, “handover failure” indicates T304 expiry (reconfiguration with sync failure of MCG).

Proposal 26 Add “Re-connection attempt cell CGI” of E-UTRAN cell to the NR RLF Report.

Proposal 27 Include the TAC of re-connection attempt E-UTRAN cell.

Proposal 28 Add “Re-connection attempt cell CGI” of NR cell to the NR RLF Report.

Proposal 29 Add “reconnectionTimeSinceFailure” besides NR/E-UTRAN attempt cell ID to the NR RLF Report.

Proposal 30 Allow also logging of unsuccessful RA procedures in the NR UE RA Report.

Proposal 31 Add raPurpose to RLF Report.

Proposal 32 Include beamFailureRecoveryFailure as a failureType in SCGFailureInformation (NR RRC spec) and SCGFailureInformationNR (LTE RRC spec) messages.

Proposal 33 RAN2 to agree the configurability of including LocationInfo in SCGFailureInformation to avoid the interoperability issue.

Proposal 34 It is necessary to introduce UE capability signaling of reporting LocationInfo in SCGFailureInformation.

Proposal 35 For rel-16 MR-DC, NR standalone support UE, mandatory support of location reporting function in SCG failure report with UE capability signaling.

Proposal 36 RAN2 to agree the detailed location information in SCG failure report should be commonLocationInfo, wlan-LocationInfo and bt-LocationInfo and sensor-LocationInfo, if available.

Proposal 37 Upon entering NR while using E-UTRA, the UE includes the E-UTRA cell information and the time spent in the E-UTRA cell in variable VarMobilityHistoryReport.

Proposal 38 Upon entering NR while using previously out of service, the UE includes the time spent out of service in variable VarMobilityHistoryReport.

Proposal 39 It is proposed RAN2 to send a LS to RAN3 about the following:

a. During RRC re-establishment, current standard cannot let the target gNB get the MHI

b. One possible solution is to add the history information in the RETRIEVE UE CONTEXT RESPONSE message

# References

1. R2-2003075 – Open issues associated to SON functions, Ericsson, RAN2#109e-bis meeting.
2. R2-2003094 - [E051] On excluding the 2 step RA related RAReport, Ericsson, RAN2#109e-bis meeting.
3. R2-2003080– [E009] On LTE previousPCell inclusion in NR RLFReport, Ericsson, RAN2#109e-bis meeting.
4. R2-2003083 – [E009][E026] On UE capabilities for cross RAT RLF reporting and inter-RAT MRO related RLF reporting, Ericsson, RAN2#109e-bis meeting.
5. R2-2003081 – [E009] On NR previousPCell inclusion in LTE RLFReport, Ericsson, RAN2#109e-bis meeting.
6. R2-2003082 – [E009] On UE capabilities for inter-RAT MRO related RLF reporting, Ericsson, RAN2#109e-bis meeting.
7. R2-2003078 – [E008] On adding LBTFailure as RLF cause, Ericsson, RAN2#109e-bis meeting.
8. R2-2003079 – [E008] On adding LBTFailure as SCGFailure cause, Ericsson, RAN2#109e-bis meeting.
9. R2-2003089 – [E023] On including beamFailureRecoveryFailure in SCG failure information messages, Ericsson, RAN2#109e-bis meeting.
10. R2-2003090 – [E023] On including beamFailureRecoveryFailure in SCGFailureInformationNR message, Ericsson, RAN2#109e-bis meeting.
11. R2-2003077 – [E007] On including TAC information for re-establishment cell in RLFReport, Ericsson, RAN2#109e-bis meeting.
12. R2-2002562 - Corrections to RA Report\_S480\_S481\_S482\_S483\_S484\_S485, Samsung Electronics Co. Ltd, RAN2#109e-bis meeting.
13. R2-2002720 – Remaining aspects of UE history information, MediaTek Inc, RAN2#109e-bis meeting.
14. R2-2002760 – Discussion on terminology of handover failure in rel-16 SON MDT, NTT DOCOMO INC, RAN2#109e-bis meeting.
15. R2-2002761 – Discussion on UE capability for location reporting in SCG failure, NTT DOCOMO INC, RAN2#109e-bis meeting.
16. R2-2002827 - Remaining issues for NR SON: [S472] [S473] [S475] [S476] [S477] [S478] [S479] , Samsung, RAN2#109e-bis meeting.
17. R2-2002923 – [Z152] Correction to RACH report and RLF report, ZTE, RAN2#109e-bis meeting.
18. R2-2002924 –RLF report enhancement for MRO, ZTE, RAN2#109e-bis meeting.
19. R2-2003119 - Consideration on Adding the Re-connection Attempt Cell Identity, CATT, CMCC, RAN2#109e-bis meeting.
20. R2-2003162 - N016 on missing RA-report availability indicator, Nokia, Nokia Shanghai Bell, RAN2#109e-bis meeting.
21. R2-2003163 - N017, N019: RA-report also for failed RA procedures, Nokia, Nokia Shanghai Bell, RAN2#109e-bis meeting.
22. R2-2003164 - N018 Actions upon successful completion of random-access procedure, Nokia, Nokia Shanghai Bell, RAN2#109e-bis meeting.
23. R2-2003576 - Minor issues on SON, Huawei, RAN2#109e-bis meeting.