3GPP TSG-RAN WG2 #110-e DocNum

Electronic meeting, 1st June - 11th June 2020

Agenda Item: 6.12.1

Source: Ericsson

Title: [Post109bis-e][961][MDTSON] SON open issues (Ericsson)

Document for: Discussion, Decision

# Introduction

This document captures the important open issues amongst the SON functions’ related reporting that were postponed during the RAN2#109e-bis meeting.

* [Post109bis-e][961][MDTSON] SON open issues (Ericsson)

 Scope: FFSs

 Intended outcome: Report

 Deadline: Next meeting

FFS:

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

2 RAN2 to further discuss the UE behavior related to the scenario when the UE has a new RA procedure related RA report to be added to the existing list but appending the new EPLMN list to the existing contents of plmn-IdentityList exceeds the maximum limit.

3 RAN2 to discuss how the UE sets the contents of rlfCause field in rel-16 RLF report when the UE declares RLF due to LBT failure.

4 RAN2 to discuss how the UE sets the contents of failureType field in SCGFailureInfomationNR message when the UE declares RLF due to LBT failure.

Cat-b-Proposal 10 RAN2 to discuss the inclusion of “Re-connection attempt cell CGI” of E-UTRAN cell to the NR RLF Report.

Cat-b-Proposal 11 Provided “Re-connection attempt cell CGI” of E-UTRAN cell in included in the NR RLF Report, RAN2 to discuss the inclusion of TAC of the re-connection attempt cell.

Cat-b-Proposal 12 RAN2 to discuss the inclusion of “Re-connection attempt cell CGI” of NR cell to the NR RLF Report.

Cat-b-Proposal 13 Provided “Re-connection attempt cell CGI” of E-UTRA/NR cell in included in the NR RLF Report, RAN2 to discuss the inclusion of “reconnectionTimeSinceFailure” besides E-UTRAN/NR attempt cell ID to the NR RLF Report.

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

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

# Discussion

## RAReport

### SSB based CFRA related:

This section is related to the following FFS.

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

There are two fields included as part of the perRAInfoList, first being contentionDetected-r16 and the second being dlRSRPAboveThreshold-r16.

#### Inclusion of contentionDetected-r16 flag for SSB based CFRA

When the UE uses the contention free random access, there will be no contention detection or contention resolution. Also, during the last meeting all the companies had agreed that the UE is not needed to include contentionDetected-r16 flag for SSB based CFRA.

1. For SSB based RA attempt based on contention free random-access resources contentionDetected-r16 is not included in PerRAInfoList-r16.

Companies are invited to provide their opinion on the above proposal.

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| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Agree |  |
| CATT | Agree |  |
| Qualcomm | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Samsung | Agree |  |
| ZTE | Agree | We think this flag is also no needed when RApurpose is requestForOtherSI. |
| vivo | Agree |  |
| Nokia, Nokia Shanghai Bell | Agree |  |

**Summary:**

Number of companies agreeing: 8/8

Number of companies not agreeing: 0/8

1. For SSB based RA attempt based on contention free random-access resources contentionDetected-r16 is not included in PerRAInfoList-r16.

#### Inclusion of dlRSRPAboveThreshold-r16 flag for SSB based CFRA

When the UE uses the CFRA resources as part of the reconfiguration-with-sync procedure or for the beam failure recovery procedure, then the UE is allowed to use the CFRA resources only if the corresponding DL SSB RSRP is above the configured threshold. However, if the UE is PDCCH ordered to perform CFRA, then the UE does not check the DL SSB quality before using the CFRA resources.

Based on this, there can be different possibilities for including the dlRSRPAboveThreshold-r16 flag for SSB based CFRA.

* Option-1:

The UE does not include the dlRSRPAboveThreshold-r16 flag for SSB based CFRA for all scenarios.

* Option-2:

The UE does not include the dlRSRPAboveThreshold-r16 flag for SSB based CFRA if the CFRA is not associated to PDCCH ordered RA and the UE includes the dlRSRPAboveThreshold-r16 flag for SSB based CFRA if the CFRA is associated to PDCCH ordered RA.

So the companies are requested to provide their views on the following proposal.

1. RAN2 to select one of the two options.
	1. Option-1: The UE does not include the dlRSRPAboveThreshold-r16 flag for SSB based CFRA for all scenarios.
	2. Option-2: The UE does not include the dlRSRPAboveThreshold-r16 flag for SSB based CFRA if the CFRA is not associated to PDCCH ordered RA and the UE includes the dlRSRPAboveThreshold-r16 flag for SSB based CFRA if the CFRA is associated to PDCCH ordered RA.

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| **Company name** | **Preferred Option** | **Additional comments on consequences** |
| Ericsson | Option-2 |  |
| CATT | Option-2 | PDCCH ordered RA can be categorized into ‘ulUnSynchronized’ triggered RACH procedure and also belongs to CFRA, unlike other CFRA procedure, UE will not check DL SSB quality before using the CFRA resources, so it’s better to clarify that dlRSRPAboveThreshold-r16 flag is invalid if dlRSRPAboveThreshold-r16 flag is present but contentionDetected-r16 is not present in the field description. |
| Qualcomm | Option-2 |  |
| Huawei, HiSilicon | Option-2 |  |
| Samsung | Option 2 |  |
| ZTE | Option-2 | We think it is beneficial for NW to know whether the assigned SSB for PDCCH ordered RA is above the configured threshold or not, which can be used for NW to optimize the selection of SSB. |
| vivo | Option-2 |  |

**Summary:**

Number of companies supporting option-1: 7/7

Number of companies supporting option-2: 0/7

1. The UE does not include the dlRSRPAboveThreshold-r16 flag for SSB based CFRA if the CFRA is not associated to PDCCH ordered RA and the UE includes the dlRSRPAboveThreshold-r16 flag for SSB based CFRA if the CFRA is associated to PDCCH ordered RA.

### Logging PLMN Info in RA Report

This section addressed the following FFS.

RAN2 to further discuss the UE behavior related to the scenario when the UE has a new RA procedure related RA report to be added to the existing list but appending the new EPLMN list to the existing contents of plmn-IdentityList exceeds the maximum limit.

It has been agreed that the UE shall append the new EPLMNs to the existing contents of the plmn-IndentityList.

Keep the current procedural text as is wherein the UE appends the new EPLMNs to the existing contents of plmn-IdentityList

However, there was one open issue related to how to handle the scenario when the addition of new EPLMNs to the PLMN entries in the plmn-IndentityList exceeds the maximum number of PLMNs that can be stored in the field plmn-IndentityList. There was a solution proposed by one of the companies during the online session that the UE shall append the new EPLMNs to the PLMN entries in the plmn-IndentityList until the maximum number is reached and after that the UE need not perform such appending operation. Based on this proposal, the following options can be discussed.

* Option-1:

The UE shall append the new EPLMNs to the PLMN entries in the plmn-IndentityList until the maximum number is reached and after this limit is reached the UE shall stop the recording of the RAReports until the existing contents of VarRAReport is fetched by the network or the 48 hour time window expires.

* Option-2:

The UE shall append the new EPLMNs to the PLMN entries in the plmn-IndentityList until the maximum number is reached and after this limit is reached the UE shall only record the contents of the RAReport without recording the additional EPLMNs as part of the plmn-IndentityList.

Companies are requested to provide their views on the following proposal.

1. RAN2 to select one of the two options.
	1. Option-1: The UE shall append the new EPLMNs to the PLMN entries in the plmn-IndentityList until the maximum number is reached and after this limit is reached the UE shall stop the recording of the RAReports until the existing contents of VarRAReport is fetched by the network or the 48 hour time window expires.
	2. Option-2: The UE shall append the new EPLMNs to the PLMN entries in the plmn-IndentityList until the maximum number is reached and after this limit is reached the UE shall only record the contents of the RAReport without recording the additional EPLMNs as part of the plmn-IndentityList.

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| **Company name** | **Preferred Option** | **Additional comments on consequences** |
| Ericsson | Option-1 |  |
| CATT | Option-1 |  |
| Qualcomm | Option-1 | However, irrespective of the maximum number is reached or not, UE should be allowed to clear the existing content of VarRAReport after 48 hours if the network does not fetch it. A NOTE should be added that UE can clear the VarRAReport irrespective of the maximum number is reached or not if 48 hours have passed since last entry.  |
| Huawei, HiSilicon | Option-1 |  |
| Samsung | Option 1 |  |
| ZTE |  | The plmn-IndentityList in VarRA-Report can record up to 12 PLMNs, while the Maximum no. of equivalent PLMNs is up to 15. Considering that EPLMN stored in EPLMN won’t change frequently, it would be beneficial to increase the max plmn number in VarRA-Report to 15 too, so the case that the plmn number in VarRA-Report exceeds maximum allowed number would be rare. If above is agreed than either opt1/2 would be acceptable for us. Otherwise we prefer to opt2 since it is easy to reach the maximum number of plmn-IdentityList while RAreport is not full, which is a waste of RA report space.  |
| vivo | Option-1 |  |
| Nokia, Nokia Shanghai Bell | Option 1 | It is unreasonable to record contents for which reference id is unknown |

**Summary:**

Number of companies supporting option-1: 8/8

Number of companies supporting option-2: 0/8

1. The UE shall append the new EPLMNs to the PLMN entries in the plmn-IndentityList until the maximum number is reached and after this limit is reached the UE shall stop the recording of the RAReports until the existing contents of VarRAReport is fetched by the network or the 48 hour time window expires.

## RLF report and SCG failure report related

### LBT Failure related *rlf-Cause* in RLF report

This section is related to the following FFS.

RAN2 to discuss how the UE sets the contents of rlfCause field in rel-16 RLF report when the UE declares RLF due to LBT failure.

Based on the current procedural text, when the UE declares RLF due to consistent LBT failure, the UE includes the RLF report.

2> upon T310 expiry in PCell; or

2> upon T312 expiry in PCell; or

2> upon random access problem indication from MCG MAC while neither T300, T301, T304, T311 nor T319 are running; or

2> upon indication from MCG RLC that the maximum number of retransmissions has been reached; or

2> if connected as an IAB-node, upon BH RLF indication received on BAP entity from the MCG; or

2> upon indication of consistent uplink LBT failures from MCG MAC:

 3> if the indication is from MCG RLC and CA duplication is configured and activated, and for the corresponding logical channel *allowedServingCells* only includes SCell(s):

4> initiate the failure information procedure as specified in 5.7.5 to report RLC failure.

3> else:

4> consider radio link failure to be detected for the MCG i.e. RLF;

4> discard any segments of segmented RRC messages received;

4> store the following radio link failure information in the *VarRLF-Report* by setting its fields as follows:

5> clear the information included in *VarRLF-Report*, if any;

5> set the *plmn-IdentityList* to include the list of EPLMNs stored by the UE (i.e. includes the RPLMN);

In such a scenario, while filling the contents of the RLF-Report, the UE needs to fill the field rlf-Cause which happens to be a choice amongst t310-Expiry, randomAccessProblem, rlc-MaxNumRetx and beamFailureRecoveryFailure. So, if the UE declares RLF due to LBT failure issues, then the UE cannot set the correct cause value. Therefore, to resolve this issue the rapporteur proposes to include lbtFailure as a rlf-Cause. Also, it can be stated that no additional LBT failure specific measurements will be added to RLF report in rel-16.

1. The UE includes *lbtFailure* as a rlf-Cause. No further LBT failure specific measurements are added to the RLF report in rel-16.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes | This inclusion is very simple and still gives the relevant information for the network to not use LBTFailure related RLFReports for other RLF related optimization. Therefore, we support this proposal.  |
| CATT | **May be** | No strong view |
| Qualcomm | May be | We can include lbtFailure as rlf-cause. However, further details should be discussed in Release-17. |
| Huawei, HiSilicon | No | Suggest to put it to R17 because it is not only about the addition of a new cause, but also some details, e.g. whether it is needed to have LBT specific measurements. |
| Samsung | Yes | In Rel-16, the consistent LBT failures can result in RLF, and the RLF cause is a mandatory field. The cause should be set to clearly indicate why the report is generated. |
| ZTE | Yes | We think it is beneficial for NW to know the RLF related information that is caused by LBT failure to perform more specific optimization if needed, and as Ericsson commented it is a simple fix.But if the new cause is not agreed than we shall capture in the specs that RLF report in R16 doesn’t support for RLF information collection caused by LBT failure to avoid misleading at NW’s side. |
| vivo | Yes | Agree with Ericsson. |
| Nokia, Nokia Shanghai Bell | May be | This is late addition, we have not discussed the feature in the WI timeframe. Technically it would be good to ensure consistency (in Rel-17) |

**Summary:**

Number of companies supporting the proposal: 4/8

Number of companies not supporting the proposal: 1/8

Number of companies with no strong opinion: 3/8

1. The UE includes *lbtFailure* as a rlf-Cause. No further LBT failure specific measurements are added to the RLF report in rel-16.

### LBT Failure related *failureType* in SCGFailureInformation

This section is related to the following FFS.

RAN2 to discuss how the UE sets the contents of failureType field in SCGFailureInfomationNR message when the UE declares RLF due to LBT failure

Based on the current procedural text, when the UE declares SCG failure due to consistent LBT failure, the UE includes the SCG failure report to the MN.

The UE shall:

1> upon T310 expiry in PSCell; or

1> upon T312 expiry in PSCell; or

1> upon random access problem indication from SCG MAC; or

1> upon indication from SCG RLC that the maximum number of retransmissions has been reached; or

1> if connected as an IAB-node, upon BH RLF failure indication received on BAP entity from the SCG;

1> upon indication of consistent uplink LBT failures from SCG MAC:

2> if the indication is from SCG RLC and CA duplication is configured and activated; and for the corresponding logical channel *allowedServingCells* only includes SCell(s):

3> initiate the failure information procedure as specified in 5.7.5 to report RLC failure.

2> else if MCG transmission is not suspended:

3> consider radio link failure to be detected for the SCG, i.e. SCG RLF;

3> initiate the SCG failure information procedure as specified in 5.7.3 to report SCG radio link failure.

2> else:

3> if the UE is in NR-DC:

4> initiate the connection re-establishment procedure as specified in 5.3.7;

3> else (the UE is in (NG)EN-DC):

4> initiate the connection re-establishment procedure as specified in TS 36.331 [10], clause 5.3.7;

As part of the procedure to fill the contents of the SCGFailureInformationNR message (EN-DC scenario), the UE has to fill the failureType field for which as per the procedural text, it is already possible to include the failureType as *scg-lbtFailure*.

1> else if the UE initiates transmission of the *SCGFailureInformationNR* message due to consistent uplink LBT failures:

2> set the *failureType* as *scg-lbtFailure*.

However, the TS 36.331 ASN.1 does not allow this.

 failureType-r15 ENUMERATED {

 t310-Expiry, randomAccessProblem,

 rlc-MaxNumRetx,

 synchReconfigFailureSCG, scg-reconfigFailure,

 srb3-IntegrityFailure, t312-Expiry-r16},

The rapporteur believes this should be fixed in the LTE RRC specification.

1. Add the option of *scg-lbtFailure* as an option for *failureType* in *SCGFailureInformationNR* message of TS 36.331.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes | This is a correction in the specification and not a new addition. Therefore, we support this.  |
| CATT | **May be** | No strong view |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | Similar view as for P4. Suggest to put it to R17 because it is not only about the addition of a new cause, but also some details, e.g. whether it is needed to have LBT specific measurements. |
| Samsung | Yes |  |
| ZTE | Yes | Share the same view as Ericsson. |
| vivo | Yes | Agree with Ericsson.  |
| Nokia, Nokia Shanghai Bell | May be |  |

**Summary:**

Number of companies supporting the proposal: 5/8

Number of companies not supporting the proposal: 1/8

Number of companies with no strong view: 2/8

Rapporteur would like to repeat that this is related to alignment of the procedural text and the ASN.1 and would like to give more time for opposing companies to check if they can agree on this.

1. Add the option of *scg-lbtFailure* as an option for *failureType* in *SCGFailureInformationNR* message of TS 36.331

### Inter-RAT RLF report related

This section addresses the following FFSs.

Cat-b-Proposal 10 RAN2 to discuss the inclusion of “Re-connection attempt cell CGI” of E-UTRAN cell to the NR RLF Report.

Cat-b-Proposal 11 Provided “Re-connection attempt cell CGI” of E-UTRAN cell in included in the NR RLF Report, RAN2 to discuss the inclusion of TAC of the re-connection attempt cell.

Cat-b-Proposal 12 RAN2 to discuss the inclusion of “Re-connection attempt cell CGI” of NR cell to the NR RLF Report.

Cat-b-Proposal 13 Provided “Re-connection attempt cell CGI” of E-UTRA/NR cell in included in the NR RLF Report, RAN2 to discuss the inclusion of “reconnectionTimeSinceFailure” besides E-UTRAN/NR attempt cell ID to the NR RLF Report.

In addition, there was an agreement on the inter-RAT RLF report.

RAN2 agrees to postpone the discussion of details of inter-RAT related NR RLF report contents until the LS on the same topic is received from RAN3.

RAN2 agrees to postpone the discussion of details of inter-RAT related LTE RLF report contents until the LS on the same topic is received from RAN3.

RAN3 has sent a LS to RAN2 [1] regarding inter-RAT RLF report contents. As part of this LS, the following contents need to be added (all the 7 contents of the LS is classified under different sub-categories).

1. NR RLF report additions
	1. CGI of the E-UTRA or NR cell that served the UE at the last handover initialization in NR RLF Report. Previous PCell Id is either NR CGI or E-UTRA CGI. E-UTRA CGI of previous PCell should be added to the NR RLF Report.
	2. CGI of the target E-UTRA or NR cell of the handover (in case of handover failure) in NR RLF Report. Failed PCell Id is either NR CGI or E-UTRA CGI. E-UTRA CGI of failed PCell should be added to the NR RLF Report.
	3. CGI of successful re-connected NR cell or E-UTRA cell: For inter-RAT and inter-system MRO, inclusion of successful re-connected cell CGI will help the network to detect the root cause of the failure. For E-UTRA cell, the TAC of the successful re-connected cell is also needed. RAN3 already agreed the inter-RAT MRO and inter-system MRO in Rel-16 BL CRs.
	4. Time interval between HOF/RLF and successful RRC re-connection: This information helps the network to understand whether the re-connection cell could be used to detect the root cause of failure event.
2. LTE RLF report additions
	1. CGI of the NR or E-UTRA cell that served the UE at the last handover initialization in LTE RLF Report. Previous PCell Id is either NR CGI or E-UTRA CGI. NR CGI should be added to the LTE RLF Report.
	2. CGI of the target NR or E-UTRA cell of the handover (in case of handover failure) in LTE RLF Report. Failed PCell Id is either NR CGI or E-UTRA CGI. NR CGI should be added to the LTE RLF Report.
	3. CGI of successful re-connected NR cell or E-UTRA cell: For inter-RAT and inter-system MRO, inclusion of successful re-connected cell CGI will help the network to detect the root cause of the failure. For E-UTRA cell, the TAC of the successful re-connected cell is also needed. RAN3 already agreed the inter-RAT MRO and inter-system MRO in Rel-16 BL CRs.
	4. Time interval between HOF/RLF and successful RRC re-connection: This information helps the network to understand whether the re-connection cell could be used to detect the root cause of failure event.
3. LTE RLF reporting to NR cell related additions
	1. Source PCell of the failed handover using the NR RRC format in UEInformationResponse message: For handover failure, the UE RLF Report should be forwarded to the source node which triggered the handover. The source PCellId in NR RRC format is needed. failedPCellId-EUTRA should be PCell in which RLF is detected or the source PCell of the failed handover.

#### NR RRC specification related changes

Associated to the issue 1a in section 2.2.3, there is a need to add the possibility to include EUTRA CGI as the previous PCell in NR RLF report.

1. Add the possibility to include EUTRA CGI as the *previousPCellID* in NR RLF report.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes, but | Firstly, for most of discussions in section 2.2.3, we are not sure whether it is too late to progress on them in RAN2. Some proposals seem simple, but they may need more discussions on details if implemented in specs. In addition, almost all issues are related to two RATs/two systems, so a careful review also needs lots of time.Secondly, for this P6, we support to include E-UTRA CGI as the previousPCellID in NR RLF report.We think the current LTE spec only supports LTE RLF report for LTE-EPC case. If it is to support LTE RLF report for LTE-5GC case, more discussions/spec efforts may be needed.So We think here “EUTRA CGI” should be only for LTE-EPC case, and thus the scenario for section 2.2.3 is **inter-system inter-RAT RLF report**. |
| Samsung | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell | Yes | This seems to meet RAN3 expectations |

**Summary:**

Number of companies supporting the proposal: 8/8

Number of companies not supporting the proposal: 0/8

1. Add the possibility to include EUTRA CGI as the *previousPCellID* in NR RLF report

Associated to the issue 1b in section 2.2.3, there is a need to add the possibility to include EUTRA CGI as the failed PCell in NR RLF report.

1. Add the possibility to include EUTRA CGI as the *failedPCellID* in NR RLF report.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | As we commented for P6, we think the scenario for section 2.2.3 is **inter-system inter-RAT RLF report**, and thus the target should be NR cell (i.e. not LTE cell). In this case, this P7 is not needed. |
| ZTE | Yes |  |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell | Yes | This seems to meet RAN3 expectations (point 1) in R3-202818, but we agree it should be checked how feasible and complex it is for RAN2 |

**Summary:**

Number of companies supporting the proposal: 6/7

Number of companies not supporting the proposal: 1/7

1. Add the possibility to include EUTRA CGI as the *failedPCellID* in NR RLF report.

Associated to the issue 1c in section 2.2.3, there is a need to add the possibility to include NR or EUTRA CGI as the successful reconnection attempt cell in NR RLF report.

1. Include *selectedCellID* in NR RLF report and add the possibility to include EUTRA CGI or NR CGI and the associated TAC as part of the *selectedCellID*.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | We think main impacts are for LTE specs (e.g. in LTE spec, the UE may need to add the selectedCellID into NR RLF report variable), and it is very challenging to finalize all details at RAN2-110-e meeting. |
| Samsung | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell | Not sure | It may not be the same cell id as the ‘reconnected’ cell – which is needed for MRO |

**Summary:**

Number of companies supporting the proposal: 6/8

Number of companies not supporting the proposal: 1/8

Number of companies not sure: 1/8

1. Include *selectedCellID* in NR RLF report and add the possibility to include EUTRA CGI or NR CGI and the associated TAC as part of the *selectedCellID.*

Associated to the issue 1d in section 2.2.3, there is a need to add the possibility to include time interval between HOF/RLF and successful RRC re-connection in NR RLF report.

1. Include *timeUntilReconnection* in NR RLF report which signifies the time interval between HOF/RLF and successful RRC re-connection.

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| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | We think main impacts are for LTE specs (e.g. in LTE spec, the UE may need do the calculation of timeUntilReconnection and add it into NR RLF report variable), and it is very challenging to finalize all details at RAN2-110-e meeting. |
| Samsung | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell |  | Seems required by RAN3 for MRO (point 6) in R3-202818 |

**Summary:**

Number of companies supporting the proposal: 7/8 (Based on the comment from Nokia, we have classified them to be supportive of the proposal)

Number of companies not supporting the proposal: 1/8

1. Include *timeUntilReconnection* in NR RLF report which signifies the time interval between HOF/RLF and successful RRC re-connection.

Associated to the issue 3a in section 2.2.3, there is a need to add the possibility to include previous source cell related information using NR RRC format when reporting an LTE RLF report to a NR cell. Currently, the field failedPCell-EUTRA is used to encode the PCell in which RLF is detected or the target PCell of the failed handover. Based on the request from RAN3, we can change the field description of failedPCell-EUTRA to indicate that this field is used to encode the PCell in which RLF is detected or the source PCell of the failed handover.

1. Change the field description of failedPCell-EUTRA to indicate that this field is used to encode the PCell in which RLF is detected or the source PCell of the failed handover.

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| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes | Ok with this proposal, and there is a typo, i.e. failedPCell-EUTRA should be failedPCellId-EUTRA (the following text is from the latest 38.331 MDT CR).*failedPCellId-EUTRA**This field is used to indicate the PCell in which RLF is detected or the target PCell of the failed handover in an E-UTRA RLF report.* |
| Samsung | Yes |  |
| ZTE | Yes | According to RAN3 requirement, for on-going HO failure scenarios, the RLF report shall be directly forwarded to source not target cell. Considering the failedPCell-EUTRA in NR RLF report is introduced for forwarding the LTE RLF report, to avoid misunderstanding of this parameter with the failedPCell defined in LTE specs, we suggest to modify the name to ForwardPCell-EUTRA. Moreover, UE behavior on how to fill in this field is required to be specified,i.e., UE will fill in the failed Pcell Id if the rlf-type is rlf else if the rlf-type is hof, fill in the source PCell ID. |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell | Yes | Reasonable to have clear distinction |

**Summary:**

Number of companies supporting the proposal: 8/8

Number of companies not supporting the proposal: 0/8

1. Change the field description of failedPCell-EUTRA to indicate that this field is used to encode the PCell in which RLF is detected or the source PCell of the failed handover.

#### LTE RRC specification related changes

Associated to the issue 2a in section 2.2.3, there is a need to add the possibility to include NR CGI as the previous PCell in LTE RLF report.

1. Add the possibility to include NR CGI as the *previousPCellID* in LTE RLF report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | We think that if we only consider **inter-system inter-RAT RLF report** for 2a/b/c/d, and the current LTE text is enough. For **intra-system inter-RAT RLF report, and inter-system intra-RAT** **RLF report** case, 2a/b/c/d may bring considerable impacts to LTE specs because of LTE-5GC, e.g. LTE RLF report may need to be extended by adding LTE-5GC cell info, NR cell info, timer, UE behaviours. So it is very challenging to finalize all details at RAN2-110-e meeting. |
| Samsung | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell |  | Seems to be required for MRO (point 3) in R3-202818, and is part of RAN BL CRs, but it should be also checked in RAN2 how feasible it is |

**Summary:**

Number of companies supporting the proposal: 6/8

Number of companies not supporting the proposal: 1/8

Number of companies with concerns: 1/8

1. Add the possibility to include NR CGI as the *previousPCellID* in LTE RLF report.

Associated to the issue 2b in section 2.2.3, there is a need to add the possibility to include NR CGI as the failed PCell in LTE RLF report.

1. Add the possibility to include NR CGI as the *failedPCellID* in LTE RLF report.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | Similar comments to P11. |
| Samsung | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell |  | Seems to be required for MRO (point 5) in R3-202818 |

**Summary:**

Number of companies supporting the proposal: 7/8

Number of companies not supporting the proposal: 1/8

1. Add the possibility to include NR CGI as the *failedPCellID* in LTE RLF report.

Associated to the issue 2c in section 2.2.3, there is a need to add the possibility to include NR or EUTRA CGI as the successful reconnection attempt cell in LTE RLF report.

1. Add the possibility to include EUTRA CGI (*selectedEUTRA-CellId*) or NR CGI (*selectedNR-CellId*) and the associated TAC of the cell in which the UE successfully performs reconnection after declaring RLF or HOF.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | Similar comments to P11. |
| Samsung | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell |  | Are “selected” cell ids to be the same as “target” in case of HO? More detailed checking should be done |

**Summary:**

Number of companies supporting the proposal: 6/8

Number of companies not supporting the proposal: 1/8

Number of companies needing further check: 1/8

1. Add the possibility to include EUTRA CGI (*selectedEUTRA-CellId*) or NR CGI (*selectedNR-CellId*) and the associated TAC of the cell in which the UE successfully performs reconnection after declaring RLF or HOF.

Associated to the issue 1d in section 2.2.3, there is a need to add the possibility to include time interval between HOF/RLF and successful RRC re-connection in NR RLF report.

1. Include *timeUntilReconnection* in KTE RLF report which signifies the time interval between HOF/RLF and successful RRC re-connection.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Yes/No/May be** | **Additional comments on consequences** |
| Ericsson | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | Similar comments to P11. |
| Samsung | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Nokia, Nokia Shanghai Bell |  | The RAN3 LS does not make any distinction for the timer (for LTE report or NR report), would be good to check if required for both |

**Summary:**

Number of companies supporting the proposal: 6/8

Number of companies not supporting the proposal: 1/8

Number of companies needing further check: 1/8

1. Include *timeUntilReconnection* in KTE RLF report which signifies the time interval between HOF/RLF and successful RRC re-connection.

## Mobility history information related

This section addresses the following FFSs.

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

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

It has already been agreed to include LTE cell related mobility history information in the MHI report to be sent to the NR cell.

Agreements from RAN2#108 meeting:

1-3: Enhance Visited Cell Information List in NR to record the information of both LTE cells and NR cells.

The ASN.1 code for the MHI report in TS38.331 also includes this information.

***VisitedCellInfoList* information element**

-- ASN1START

-- TAG-VISITEDCELLINFOLIST-START

VisitedCellInfoList-r16 ::= SEQUENCE (SIZE (1..maxCellHistory-r16)) OF VisitedCellInfo-r16

VisitedCellInfo-r16 ::= SEQUENCE {

 visitedCellId-r16 CHOICE {

 nr-CellId-r16 CHOICE {

 cgi-Info CGI-InfoNR,

 pci-arfcn-r16 SEQUENCE {

 physCellId-r16 PhysCellId,

 carrierFreq-r16 ARFCN-ValueNR

 }

 },

 eutra-CellId-r16 CHOICE {

 cellGlobalId-r16 CGI-InfoEUTRA,

 pci-arfcn-r16 SEQUENCE {

 physCellId-r16 PhysCellId,

 carrierFreq-r16 ARFCN-ValueEUTRA

 }

 }

 } OPTIONAL,

 timeSpent-r16 INTEGER (0..4095),

 ...

}

-- TAG-VISITEDCELLINFOLIST-STOP

-- ASN1STOP

There is also an agreement to use LTE as the baseline for MHI. As per the LTE baseline, the out-of-service related recording is also already supported.

1-1: Reuse LTE solution as the baseline for NR mobility history information.

The procedural text from TS 36.331 already captures this.

5.6.11.2 Initiation

If the UE supports storage of mobility history information, the UE shall:

1> Upon change of cell, consisting of PCell in RRC\_CONNECTED or serving cell in RRC\_IDLE, to another E-UTRA or inter-RAT cell or when entering out of service:

2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following*:*

3> if the global cell identity of the previous PCell/ serving cell is available:

4> include the global cell identity of that cell in the field *visitedCellId* of the entry;

3> else:

4> include the physical cell identity and carrier frequency of that cell in the field *visitedCellId* of the entry;

3> set the field *timeSpent* of the entry as the time spent in the previous PCell/ serving cell;

1> upon entering E-UTRA (in RRC\_CONNECTED or RRC\_IDLE) while previously out of service and/ or using another RAT:

2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following:

3> set the field *timeSpent* of the entry as the time spent outside E-UTRA;

However, the corresponding procedural text related to the inclusion of EUTRA cells’ MHI is not captured. As per the current procedural text, the UE records the time spent in LTE cells as time spent in out-of-service. This needs to be corrected.

As this is related to the exact procedural text to be added to the TS 38.331, the rapporteur proposes the text proposal below which can be discussed via companies’ comments.

**Text proposal for TS 38.331 to resolve the above issue (changes are highlighted in red text)**

5.7.9.2 Initiation

If the UE supports storage of mobility history information, the UE shall:

1> Upon change of cell, consisting of PCell in RRC\_CONNECTED or serving cell in RRC\_IDLE or RRC\_INACTIVE (for NR cell) or in RRC\_IDLE (for E-UTRA cell), to another NR or E-UTRA cell, or when entering out of service:

2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following*:*

3> if the global cell identity of the previous PCell/serving cell is available:

4> include the global cell identity of that cell in the field *visitedCellId* of the entry;

3> else:

4> include the physical cell identity and carrier frequency of that cell in the field *visitedCellId* of the entry;

3> set the field *timeSpent* of the entry as the time spent in the previous PCell/serving cell;

1> upon entering NR (in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED) while previously out of service:

2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following:

3> set the field *timeSpent* of the entry as the time spent in out of service ~~outside NR~~.

Companies are requested to provide input on the above text proposal.

|  |  |  |
| --- | --- | --- |
| **Company name** | **Agree/Disagree with the TP**  | **Additional comments on consequences** |
| Ericsson | Agree |  |
| CATT | Agree |  |
| Qualcomm | Not Sure. Seems incorrect to me. | Consider following examples:1. $NR\_{1}⟹NR\_{2}⟹OoS⟹NR\_{3}⟹LTE\_{1}$2. $NR\_{1}⟹NR\_{2}⟹OoS⟹LTE\_{1}⟹NR\_{3}$In the first, the OoS time is captured. However, in the second OoS time is not captured. 1> upon entering NR (in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED) while previously out of service: To1> upon entering NR cell or an E-UTRA cell (in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED) while previously out of service:Apart from these, there are other issue as how OoS defined:For example, time spent in flight mode can not be computed as OoS time.The OoS time should be defined as the time spent by the UE in the *any cell state.* Maybe, UE should compute the time spent in *any cell state* as OoS time.Currently, the definition of OoS and corresponding time seems vague to me.  |
| Huawei, HiSilicon | Agree | The change proposed (the red text) by Qualcomm is also ok. |
| Samsung | Agreeable with the suggested TP and QC’s further suggestion |  |
| ZTE | Partially agree, and | Since RAN2 agreed in RAN2#108 meeting that “1-2a: The enhancement for mobility history information should focus on NR, any enhancement for mobility history information for eLTE should be down-prioritised. It means no change needed for LTE”, therefore MHI when using EUTRA doesn’t log timeSpent and visited cell in RRC inactive state. Therefore in order to align the MHI between 36.331 and 38.331, we need to update TS 36.331 as well, or it is suggested to adopt following text change:If the UE supports storage of mobility history information, the UE shall:1> Upon change of cell, consisting of PCell in RRC\_CONNECTED or serving cell in RRC\_IDLE or RRC\_INACTIVE (for NR cell) or in RRC\_IDLE (for E-UTRA cell), to another NR or E-UTRA cell, or when entering out of service:2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following*:*3> if the global cell identity of the previous PCell/serving cell is available:4> include the global cell identity of that cell in the field *visitedCellId* of the entry;3> else:4> include the physical cell identity and carrier frequency of that cell in the field *visitedCellId* of the entry;3> set the field *timeSpent* of the entry as the time spent in the previous PCell/serving cell;1> upon entering NR cell (in RRC\_IDLE, RRC\_INACTIVE or RRC\_CONNECTED) or E-UTRA cell (in RRC\_IDLE, RRC\_CONNECTED) while previously out of service:2> include an entry in variable *VarMobilityHistoryReport* possibly after removing the oldest entry, if necessary, according to following:3> set the field *timeSpent* of the entry as the time spent in out of service ~~outside NR~~. |
| vivo | Partly agree | We share the same view with QC, the current description fails to capture the OoS time upon entering LTE while previously out of service. |
| Nokia, Nokia Shanghai Bell | Not sure | WE agree that out of service as a term is very vague here. We should refer to ‘any cell Selection’ in NR and or ‘any cell Selection in LTE’ then it becomes much more clear it=n terms of UE behaviour what it has detected |

**Summary:**

All companies seems to be fine with the TP with additional changes. However, there seems to be some concern over the term ‘out-of-service’. Therefore, to make progress, we can split the changes into two parts.

First part:

1> Upon change of cell, consisting of PCell in RRC\_CONNECTED or serving cell in RRC\_IDLE or RRC\_INACTIVE (for NR cell) or in RRC\_IDLE (for E-UTRA cell), to another NR or E-UTRA cell, or when entering out of service:

Second part:

3> set the field *timeSpent* of the entry as the time spent in out of service ~~outside NR~~.

Based on the comments in the document, the first part seems agreeable to all. Thereofre, that part can be treated as cat-A.

For the second part, as this is the term used in LTE, the same can be used in NR as well with the same behavior from the UE. However, it is also a good time to clarify what this out-of-service mean. So, the rapporteur proposes to further discuss on the current text proposal during the coming week before the start of the meeting.

1. RAN2 to agree the following TP related to MHI.

1> Upon change of cell, consisting of PCell in RRC\_CONNECTED or serving cell in RRC\_IDLE or RRC\_INACTIVE (for NR cell) or in RRC\_IDLE (for E-UTRA cell), to another NR or E-UTRA cell, or when entering out of service:

1. RAN2 to discuss the definition of ‘out-of-service’ in the context of MHI.

# Conclusion

Based on the discussion in previous section, the following are captured as Cat-A proposals:

[Cat-a-Proposal 1 For SSB based RA attempt based on contention free random-access resources contentionDetected-r16 is not included in PerRAInfoList-r16.](#_Toc40878780)

[Cat-a-Proposal 2 The UE does not include the dlRSRPAboveThreshold-r16 flag for SSB based CFRA if the CFRA is not associated to PDCCH ordered RA and the UE includes the dlRSRPAboveThreshold-r16 flag for SSB based CFRA if the CFRA is associated to PDCCH ordered RA.](#_Toc40878781)

[Cat-a-Proposal 3 The UE shall append the new EPLMNs to the PLMN entries in the plmn-IndentityList until the maximum number is reached and after this limit is reached the UE shall stop the recording of the RAReports until the existing contents of VarRAReport is fetched by the network or the 48 hour time window expires.](#_Toc40878782)

[Cat-a-Proposal 4 Add the possibility to include EUTRA CGI as the *previousPCellID* in NR RLF report](#_Toc40878783)

[Cat-a-Proposal 5 Change the field description of failedPCell-EUTRA to indicate that this field is used to encode the PCell in which RLF is detected or the source PCell of the failed handover.](#_Toc40878784)

[Cat-a-Proposal 6 RAN2 to agree the following TP related to MHI.](#_Toc40878785)

[1> Upon change of cell, consisting of PCell in RRC\_CONNECTED or serving cell in RRC\_IDLE or RRC\_INACTIVE (for NR cell) or in RRC\_IDLE (for E-UTRA cell), to another NR or E-UTRA cell, or when entering out of service:](#_Toc40878786)

Based on the discussion in previous section, the following are captured as Cat-B proposals:

[Cat-b-Proposal 1 The UE includes *lbtFailure* as a rlf-Cause. No further LBT failure specific measurements are added to the RLF report in rel-16.](#_Toc40878787)

[Cat-b-Proposal 2 Add the option of *scg-lbtFailure* as an option for *failureType* in *SCGFailureInformationNR* message of TS 36.331](#_Toc40878788)

[Cat-b-Proposal 3 Add the possibility to include EUTRA CGI as the *failedPCellID* in NR RLF report.](#_Toc40878789)

[Cat-b-Proposal 4 Include *selectedCellID* in NR RLF report and add the possibility to include EUTRA CGI or NR CGI and the associated TAC as part of the *selectedCellID.*](#_Toc40878790)

[Cat-b-Proposal 5 Include *timeUntilReconnection* in NR RLF report which signifies the time interval between HOF/RLF and successful RRC re-connection.](#_Toc40878791)

[Cat-b-Proposal 6 Add the possibility to include NR CGI as the *previousPCellID* in LTE RLF report.](#_Toc40878792)

[Cat-b-Proposal 7 Add the possibility to include NR CGI as the *failedPCellID* in LTE RLF report.](#_Toc40878793)

[Cat-b-Proposal 8 Add the possibility to include EUTRA CGI (*selectedEUTRA-CellId*) or NR CGI (*selectedNR-CellId*) and the associated TAC of the cell in which the UE successfully performs reconnection after declaring RLF or HOF.](#_Toc40878794)

[Cat-b-Proposal 9 Include *timeUntilReconnection* in KTE RLF report which signifies the time interval between HOF/RLF and successful RRC re-connection.](#_Toc40878795)

[Cat-b-Proposal 10 RAN2 to discuss the definition of ‘out-of-service’ in the context of MHI.](#_Toc40878796)

# References

1. R2-2004334 – LS on information needed for MRO in UE RLF Report, RAN2#110-e meeting.