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Agenda Item: 7.13.2

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Title: [Pre121bis-e][822][SON/MDT] Summary of agenda item 7.13.2 on MRO for inter-system handover for voice fallback

Document for: Discussion and Decision

# Introduction

In this document, the summary of all the contributions submitted to 7.13.2 agenda item (MRO for inter-system handover for voice fallback) of RAN2#121bis-e meeting as in [1-7] will be presented. Taking the company proposals into account, the 3rd section provides sets of proposals for easy agreement, as well as for further discussions.

# Discussion

## Background

### Voice fallback in Mobility from NR failure in TS38.331

The UE behavior after inter-RAT mobility from NR failure is specified in TS38.331-h40 to include the voice fallback case and emergency services fallback case as below:

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| 5.4.3.5 Mobility from NR failureThe UE shall:1> if the UE does not succeed in establishing the connection to the target radio access technology:2> if the *targetRAT-Type* in the received *MobilityFromNRCommand* is set to *eutra* and the UE supports Radio Link Failure Report for Inter-RAT MRO EUTRA:3> store handover failure information in *VarRLF-Report* according to 5.3.10.5;2> if *voiceFallbackIndication* is included in the *MobilityFromNRCommand* message; or2> if the mobility from NR procedure is for emergency services fallback as specified in TS 23.502 [43]:3> attempt to select an E-UTRA cell:4> if a suitable E-UTRA cell is selected; or4> if no suitable E-UTRA cell is available and an acceptable E-UTRA cell supporting emergency call is selected when the UE has an ongoing emergency call:5> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';4> else:5> revert back to the configuration used in the source PCell;5> initiate the connection re-establishment procedure as specified in clause 5.3.7;NOTE: It is left to UE implementation to determine whether the mobility from NR procedure is for emergency services fallback as specified in TS 23.502 [43].2> else:3> revert back to the configuration used in the source PCell;3> initiate the connection re-establishment procedure as specified in clause 5.3.7;1> else if the UE is unable to comply with any part of the configuration included in the *MobilityFromNRCommand* message; or1> if there is a protocol error in the inter RAT information included in the *MobilityFromNRCommand* message, causing the UE to fail the procedure according to the specifications applicable for the target RAT:2> if the *targetRAT-Type* in the received *MobilityFromNRCommand* is set to *eutra* and the UE supports Radio Link Failure Report for Inter-RAT MRO EUTRA:3> store handover failure information in *VarRLF-Report* according to 5.3.10.5;2> revert back to the configuration used in the source PCell;2> initiate the connection re-establishment procedure as specified in clause 5.3.7. |

### Previous agreements of RAN2 and RAN3

In previous RAN2 meetings, the following agreements were made for Inter-system handover for voice fallback:

Agreements in RAN2#119 meeting:

1 RAN2 to include an indication regarding voice fallback in the RLF report.

 FFS: implicit or explicit flag and other details.

2 RAN2 discuss the following scenarios:

 Suitable EUTRA cell found after MobilityFromNR failure

 No suitable EUTRA cell found after MobilityFromNR failure

Agreements in RAN2#119bis meeting:

1 An explicit indication is included in RLF-report when mobility from NR fails and the corresponding MobilityFromNRCommand includes voiceFallbackIndication

2 The below content is included in RLF-report when reestablishment procedure is initiated due to mobility From NR failure.

 a. reestablishmentCellID

Meanwhile, RAN3 discussed five cases of inter-system handover for voice fallback, and only the first two cases are agreed. The agreements before RAN3#119bis meeting on the cases are:

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| *MRO for inter-system handover for voice fallback:**Consider Case 1-2 for MRO enhancements for inter-system inter-RAT handover for voice fallback:**- Case 1: after failure (HOF/RLF) of inter-system inter-RAT handover from NR to E-UTRAN for voice fallback, a suitable E-UTRA cell is selected, and the UE tries RRC connection setup procedure for the voice service in the E-UTRA cell.**- Case 2: after failure (HOF) of inter-system inter-RAT handover from NR to E-UTRAN for voice fallback, none suitable E-UTRAN cell can be selected, the UE reverts back to the configuration of the source PCell and initiates RRC re-establishment procedure in NR.**Deprioritize Case 5 for MRO enhancements for inter-system inter-RAT handover for voice fallback:**- Case 5: the UE successfully performs inter-system inter-RAT handover from NR to E-UTRAN for voice fallback, but the handover is about to failure.**Deprioritize MRO enhancements for redirection for voice fallback.**Introduce stage 2 descriptions of failure type definition for inter-system inter-RAT HO from NR to E-UTRA for voice fallback.* *The RLF Report needs to indicate that the last failed inter-system inter-RAT HO was triggered due to voice fallback.* |

## Scenarios related issues

### Support scenarios and the spec impact

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| **TDoc** | **Company name** | **Proposals** |
| R2-2302613 | CATT | Proposal 3: RAN2 to support the scenario of RLF occurs shortly after successful inter-system HO for voice fallback which has already been agreed in RAN3 case 1. |
| R2-2303244 | Lenovo | Proposal 1: For the case that a suitable E-UTRAN cell is selected after HOF of inter-system inter-RAT handover from NR to E-UTRAN for voice fallback, when the UE is back to a NG-RAN node, the UE may send the NR RLF report which is enhanced to include an indication concerning that the last failed inter-system inter-RAT HO was triggered due to voice fallback to the connected NG-RAN node.Proposal 2: For the case that a suitable E-UTRAN cell is selected after a RLF occurs shortly after a successful inter-system inter-RAT handover from NR to E-UTRAN for voice fallback, the UE may send the LTE RLF report which is enhanced to include an indication concerning that the last failed inter-system inter-RAT HO was triggered due to voice fallback to the re-connected E-UTRAN node.Proposal 3: For the case that the UE reverts back to the configuration of the source PCell and initiates RRC re-establishment procedure in a NR cell after HOF of inter-system inter-RAT handover from NR to E-UTRAN for voice fallback, the UE may send the NR RLF report which is enhanced to include an indication concerning that the last failed inter-system inter-RAT HO was triggered due to voice fallback to the re-connected NG-RAN node. |
| R2-2303453 | Ericsson | Proposal 2 UE logs the explicit indication for voice fallback handover in the LTE RLF report for the scenario of RLF after successful voice fallback HOs. |
| R2-2303956 | Huawei, HiSilicon | Proposal 1: If case 1b is confirmed by RAN2, the indication of voice fallback should be introduced to the LTE RLF report. |

**Rapporteur Summary:**

The RAN3 agreed Case 1 for HOF/RLF includes the following two sub-cases, which may have different requirements of RLF report format and forwarding:

* RAN3 Case 1a: handover failure from source cell1 to E-UTRA cell1 occurs, a suitable E-UTRA cell2 is selected;
* RAN3 Case 1b: handover from NG-RAN cell1 to E-UTRA cell 1 succeeds but shortly RLF in E-UTRA cell1 occurs, a suitable E-UTRA cell2 is selected.

RAN3 agreed Case1a and Case2 shown in the 2.1.2 background can be mapped to the RAN2 agreed two scenarios. But current RAN2 discussion does not consider the RAN3 case1b as part of the study on inter-system handover for voice fallback.

The RAN3 agreed case1b is proposed to be supported in RAN2 by 3 companies including CATT, Lenovo and Ericsson. And if case 1b can be confirmed by RAN2, an explicit indication is proposed to be introduced by Lenovo, Ericsson and Huawei.

**Proposal 1: RAN2 to support the scenario of “after RLF occurs shortly after successful HO from NR to E-UTRAN for voice fallback, a suitable E-UTRA cell is selected, and the UE tries RRC connection setup procedure for the voice service in the E-UTRA cell”.**

If the above Proposal 1 can be agreed, an indication needs to be introduced in LTE RLF report, to make the network deduce if the handover was performed due to voice fallback reason or not.

**Proposal 2: If Proposal 1 is agreed, introduce an indication for the scenario of RLF after successful voice fallback HO in the LTE RLF report.**

RAN3 Case1a and Case2 have been supported by RAN2, and RAN2 agreed to include an indication regarding voice fallback in the RLF report for both cases. Rapporteur thinks it only impacts NR RLF report since the source node before Mobility from NR failure is of NR system:

**Proposal 3: UE logs the agreed indication regarding voice fallback in the NR RLF report.**

### Differentiation of scenarios by UE

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| **TDoc** | **Company name** | **Proposals** |
| R2-2302613 | CATT | Proposal 1: Introduce an indicator of “acceptable E-UTRA cell is found for ongoing emergency call” in the RLF report besides the voice fallback indication. |
| R2-2303143 | ZTE Corporation, Sanechips | Proposal 2: The differentiation between non suitable EUTRA cell and suitable EUTRA cell found can be done by agreed fields ( reestablishmentCellId and explicit indication) and existing field (i.e.,noSuitableCellFound) in RLF report, no new fields is needed. |
| R2-2303453 | Ericsson | Proposal 1 RAN2 agree to differentiate an acceptable cell from a suitable cell in the RLF report in case of voiceFallback HOF. FFS how/details. |
| R2-2303683 | Samsung | Proposal 2: No additional indication is needed to handle the scenarios identified for voice fallback optimisation. |
| R2-2303694 | Qualcomm | Proposal 1: For failure scenario, inter-system voice fallback failure and suitable EUTRA Cell found, the following IEs in RLF reports are sufficient,PreviousPCellID, NR PCell ID from which UE received MobilityFromNRCommandFailedPCellID, EUTRA PCell ID on which HoF happenedvoiceFallbackIndication, an indication that MRO scope is voice fallback ReConnectCellID, indicating the EUTRA cell ID selected after MobilityFromNRCommand failureProposal 2: For failure scenario, inter-system voice fallback failure and no suitable EUTRA Cell found, the following IEs in RLF reports are sufficient,PreviousPCellID, NR PCell ID from which UE received MobilityFromNRCommandFailedPCellID, EUTRA PCell ID on which HoF happenedvoiceFallbackIndication, an indication that MRO scope is voice fallback ReestablishmentCellID, indicating the NR PCell ID selected after UE failed to find a suitable EUTRA Cell (implicitly this implies that no suitable EUTRA cell was found)Proposal 3: For failure scenario, inter-system voice fallback failure, and no suitable EUTRA and NR Cell found, the following IEs in RLF reports are sufficient,PreviousPCellID, NR PCell ID from which UE received MobilityFromNRCommandFailedPCellID, EUTRA PCell ID on which HoF happenedvoiceFallbackIndication, an indication that MRO scope is voice fallback NoSuitableCellFound, indicating no suitable NR cell found for the reestablishment ReConnectCellID, indicating the Cell ID in which UE comebacks to connected after failing to perform reestablishment. Proposal 4: No further enhancements are required for MRO for voice fallback scenarios in Proposal 1 – Proposal 3.  |
| R2-2303956 | Huawei, HiSilicon | Proposal 2: Introduce the indication of whether the reconnected E-UTRA cell is acceptable E-UTRA cell or not. |

**Rapporteur Summary:**

3 companies including CATT, Ericsson and Huawei concern about the “mobility from NR procedure is for emergency services fallback” case. The UE is allowed to select an acceptable E-UTRA cell after voiceFallback HOF to continue the going emergency call if no suitable E-UTRA cell is found. And not differentiating acceptable cell from suitable cell that UE connected to after the failure, in the RLF report, can mislead the network to conclude that an acceptable cell can be a candidate for the next handovers with different services type. To solve this problem, CATT and Huawei suggest introducing a new indicator, and Ericsson proposes RAN2 agree to differentiate an acceptable cell from a suitable cell in the RLF report in case of voiceFallback HOF first.

3 companies including ZTE, Samsung and Qualcomm think the differentiation between non suitable EUTRA cell and suitable EUTRA cell found can be done by the agreed parameters of e.g. reestablishmentCellId, noSuitableCellFound, voiceFallbackIndication, PreviousPCellID, FailedPCellID, ReConnectCellID.

Rapporteur thinks based on text procedure of section 5.4.3.5 of the latest version of TS38.331, the “Acceptable E-UTRA cell is found after Mobility from NR failure with ongoing emergency call” case does indeed exist, and it can be considered as a sub-scenario of “No suitable EUTRA cell found after MobilityFromNR failure” since the cell UE found is not a **suitable** cell. For this case, the parameters of e.g. reestablishmentCellId, noSuitableCellFound, voiceFallbackIndication, PreviousPCellID, FailedPCellID, ReConnectCellID for “Acceptable E-UTRA cell supporting emergency call found after MobilityFromNR failure” can have the same value as the scenario of “Suitable EUTRA cell found after MobilityFromNR failure” based on the procedure in TS38.331:

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| **Scenarios** | ***“reestablishmentCellId”***  | ***“noSuitableCellFound”***  | ***“voiceFallbackIndication”***  | ***“PreviousPCellID”***  | ***“FailedPCellID”*** | ***“ReConnectCellID”***  |
| Suitable EUTRA cell found after MobilityFromNR failure | Not set, since UE found an suitable E-UTRA cell but not an NR cell | Not set, since t311 is not start/expire | Set | NR PCell ID where the last MobilityFromNRCommand message was received | Target E-UTRA PCell ID of the failed handover | The Suitable E-UTRA cell ID which is found and successfully connected to by the UE |
| Acceptable E-UTRA cell is found after MobilityFromNR failure for ongoing emergency call | Not set, since UE found an acceptable E-UTRA cell but not an NR cell | Not set, since UE does not enter reestablishment procedure, so t311 is not start | Set | NR PCell ID where the last MobilityFromNRCommand message was received | Target E-UTRA PCell ID of the failed handover | The acceptable E-UTRA cell ID which is found and successfully connected to by the UE |

Therefore to distinguish the two MobilityFromNR failure cases agreed in RAN2, it is necessary to differentiate an acceptable E-UTRA cell (for the ongoing emergency call) from a suitable cell. And the detail of how to indicate the acceptable E-UTRA cell can be FFS.

And Rapporteur thinks except this acceptable E-UTRA cell case, the existing parameters are enough to indicate no suitable E-UTRA cell and no acceptable E-UTRA cell. And the detail can be FFS.

**Proposal 4: RAN2 agree to differentiate an acceptable E-UTRA cell from a suitable E-UTRA cell in the RLF report in case of voiceFallback HOF. FFS explicit or implicit indications.**

## Other aspects

***How to explicitly indicate the mobility from NR fails with voicefallback***

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| **TDoc** | **Company name** | **Proposals** |
| R2-2303143 | ZTE Corporation, Sanechips | Proposal 1: RAN2 discuss and select one of below options to indicate in RLF-report that mobility from NR failure is triggered due to EPS fallback* Opt1: Includes a new one-bit flag in RLF report
* Opt2: Extend lastHO-Type-r17 with new type field, and clarifying in field description that when the HOF is initiated by reception of MobilityFromNRCommand, only failure case is considered
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| R2-2303683 | Samsung | Proposal 1: A new type is included for lastHO-Type-r17 IE to indicate voice fallback. |

***New capability***

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| **TDoc** | **Company name** | **Proposals** |
| R2-2303143 | ZTE Corporation, Sanechips | Proposal 3: New capability is introduced to indicate whether UE supports logging RLF-report when mobility from NR fails and the corresponding MobilityFromNRCommand includes voiceFallback indication. |

***Report of suitable EUTRA cell ID***

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| **TDoc** | **Company name** | **Proposals** |
| R2-2302613 | CATT | Proposal 2: RAN2 discuss whether to report the suitable EUTRA cell ID selected by the UE in parallel with the legacy field of the NR reestablishmentCellId after MobilityFromNR failure for voice fallback. |

***Voice fallback HO failure due to blind handover***

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| **TDoc** | **Company name** | **Proposals** |
| R2-2303453 | Ericsson | Proposal 3 RAN2 consider the scenario that upon transition to connected state from IDLE and immediate HO to LTE network due to voice fallback, the UE may not have L3 measurements available to report in the RLF report.Proposal 4 UE includes un-fetched early measurements in the RLF report after experiencing voice fallback HOF.Proposal 5 UE includes time spent in the source cell in the RLF report upon voiceFallback HOF. |

**Rapporteur Summary:**

Furthermore,

* ZTE and Samsung suggest discussing the format of the agreed explicit indicator in RLF-report;
* ZTE suggests introducing a new capability to indicate to the NW whether UE supports logging RLF-report in the corresponding voiceFallback cases;
* CATT suggests discussing whether to report the suitable EUTRA cell ID selected by the UE;
* Ericsson suggests including measurement and time information for possible blind voiceFallback handover.

The first two issues are about stage3 ASN.1 or UE capability which can be discussed online. The other two issues are about new parameter or new scenario which can be discussed if time allows.

**Proposal 5: RAN2 discuss and select one of below options to indicate in RLF-report that mobility from NR failure is triggered due to EPS fallback:**

* **Opt1: Includes a new one-bit flag in RLF report**
* **Opt2: Extend lastHO-Type-r17 with new type field, and clarifying in field description that when the HOF is initiated by reception of MobilityFromNRCommand, only failure case is considered**

**Proposal 6: New capability is introduced to indicate whether UE supports logging RLF-report when mobility from NR fails and the corresponding MobilityFromNRCommand includes voiceFallback indication.**

**Proposal 7: RAN2 discuss whether to report the suitable EUTRA cell ID selected by the UE in parallel with the legacy field of the NR reestablishmentCellId after MobilityFromNR failure for voice fallback.**

**Proposal 8: RAN2 consider the scenario that upon transition to connected state from IDLE and immediate HO to LTE network due to voice fallback, the UE may not have L3 measurements available to report in the RLF report. UE includes un-fetched early measurements and the time spent in the source cell in the RLF report.**

# Conclusion

Based on summary of [1-7], following proposals are made for further discussion, and some proposals are only discussed under certain conditions.

**For easy agreement**

**Proposal 1: RAN2 to support the scenario of “after RLF occurs shortly after successful HO from NR to E-UTRAN for voice fallback, a suitable E-UTRA cell is selected, and the UE tries RRC connection setup procedure for the voice service in the E-UTRA cell”.**

**Proposal 2: If Proposal 1 is agreed, introduce an indication for the scenario of RLF after successful voice fallback HO in the LTE RLF report.**

**Proposal 3: UE logs the agreed indication regarding voice fallback in the NR RLF report.**

**For online discussion**

**Proposal 4: RAN2 agree to differentiate an acceptable E-UTRA cell from a suitable E-UTRA cell in the RLF report in case of voiceFallback HOF. FFS explicit or implicit indications**

**Proposal 5: RAN2 discuss and select one of below options to indicate in RLF-report that mobility from NR failure is triggered due to EPS fallback:**

* **Opt1: Includes a new one-bit flag in RLF report**
* **Opt2: Extend lastHO-Type-r17 with new type field, and clarifying in field description that when the HOF is initiated by reception of MobilityFromNRCommand, only failure case is considered**

**Proposal 6: New capability is introduced to indicate whether UE supports logging RLF-report when mobility from NR fails and the corresponding MobilityFromNRCommand includes voiceFallback indication.**

**Discussed if time allows**

**Proposal 7: RAN2 discuss whether to report the suitable EUTRA cell ID selected by the UE in parallel with the legacy field of the NR reestablishmentCellId after MobilityFromNR failure for voice fallback.**

**Proposal 8: RAN2 consider the scenario that upon transition to connected state from IDLE and immediate HO to LTE network due to voice fallback, the UE may not have L3 measurements available to report in the RLF report. UE includes un-fetched early measurements and the time spent in the source cell in the RLF report.**

# Reference

1. R2-2302613, Consideration on Inter-system Handover for Voice Fallback, CATT
2. R2-2303143, Consideration on MRO for inter-system handover for voice fallback, ZTE Corporation, Sanechips
3. R2-2303244, MRO for inter-system handover for voice fallback, Lenovo
4. R2-2303453, MRO for inter-system handover for voice fallback, Ericsson
5. R2-2303683, MRO for inter-system handover for voice fallback, Samsung R&D Institute India
6. R2-2303694, Data collection for MRO for inter-system handover for voice fallback, Qualcomm Incorporated
7. R2-2303956, Discussion on MRO for inter-system handover for voice fallback, Huawei, HiSilicon