**3GPP TSG-****RAN WG2 Meeting #119** **electronic R2-220xxxx**

**Online, 17th Aug – 29th Aug, 2022**

**Agenda Item:** 6.21.1

**Source:** Huawei, HiSilicon

**Title:** Report of [AT119-e][037][NRTEI17] Emergency Service Enhancement (Huawei)

**Document for:** Discussion and decision

# Introduction

This is the report of the following offline discussion.

* [AT119-e][037][NRTEI17] Emergency Service Enhancement (Huawei)

 Scope: Continue discussion on R2-2208617, Determine agreeable parts. For agreeable parts work on a CR.

 Intended outcome: Report with agreements (offline only if possible), Agreed CR (can also be done as short Post discussion)

 Deadline: EOM

# Contact information

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# Discussion

There are two proposals in R2-2208617 targeting at two different fallback procedures:

**For EPS fallback used for emergency service: Proposal 1: A UE is allowed to search for an acceptable E-UTRA cell (not only suitable cell) after HO failure if the HO is triggered by EPS fallback for emergency services.**

**For Emergency service fallback: Proposal 2: For emergency services fallback from NR to LTE, upon HO failure the UE is allowed to search for acceptable or suitable E-UTRA cells.**

In this offline, we discuss the two fallback procedures and clarify the aspects commented by companies in online discussion.

## EPS fallback triggered for emergency service

In Rel-16, the *voiceFallbackIndication* was introduced to reduce the latency of failure recovery for EPS fallback triggered HO, by allowing the UE to search/select a suitable E-UTRA cell first instead of initiating NR RRC re-establishment upon HO failure, as highlighted in green.

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| Excerpt from TS 38.3315.4.3.5 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:3> attempt to select an E-UTRA cell:4> if a suitable E-UTRA cell is selected: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;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; |

It is clearly captured in TS 23.502 that the QoS Flow establishment request for Emergency Services emergency service may trigger EPS fallback procedure as highlighted in green, which also confirmed in previous RAN2 discussion.

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| Excerpt from TS 23.5024.13.4 Emergency Services4.13.4.1 General<Unrelated part is omitted>If the 5GC has indicated Emergency Services Fallback support for the TA and RAT where the UE is currently camping and if the UE supports emergency services fallback, the UE shall initiate the Emergency Services Fallback procedure described in clause 4.13.4.2.At QoS Flow establishment request for Emergency Services, the procedure described in clause 4.13.6.2 Inter RAT Fallback in 5GC for IMS voice or the procedure described in clause 4.13.6.1 EPS fallback for IMS voice may be triggered by the network, when configured. |

Following current SA2/CT1/RAN2 specifications, a UE supporting voice call can initiate emergency call in an acceptable cell when this cell indicating *ims-EmergencySupport* in SIB1 if no suitable found, highlighted in yellow.

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| Excerpt from TS 38.3044.5 Cell CategoriesThe cells are categorised according to which services they offer:**acceptable cell:**An "acceptable cell" is a cell on which the UE may camp to obtain limited service (originate emergency calls and receive ETWS and CMAS notifications). Such a cell shall fulfil the following requirements, which is the minimum set of requirements to initiate an emergency call and to receive ETWS and CMAS notification in an NR network:- The cell is not barred, see clause 5.3.1;- The cell selection criteria are fulfilled, see clause 5.2.3.2.<Unrelated part is omitted>5.2.8 Camped on Any Cell stateThis state is only applicable for RRC\_IDLE state. In this state, the UE shall perform the following tasks:<Unrelated part is omitted>- if the UE supports voice services, the UE is not in SNPN access mode, and the current cell does not support IMS emergency calls as indicated by the field *ims-EmergencySupport* in SIB1 as specified in TS 38.331 [3], the UE shall perform cell selection/reselection to an acceptable cell that supports emergency calls in any supported RAT regardless of priorities provided in system information from current cell, if no suitable cell is found. |

However, the current description in 5.4.3.5 Mobility from NR failure seems preclude UE from initiating emergency call in acceptable cell, as only suitable cell can be selected, which may have serious impact on the support of emergency call. During the online quite a few companies understand this is a bug and can be corrected. Thus we think it should be reasonable to allow UE initiating the emergency call in acceptable cell at least when there is no suitable cell upon HO failure during EPS fallback.

Q1: Do companies agree that UE should be allowed to select an acceptable cell (at least when there is no suitable cell) for emergency call upon HO failure during EPS fallback?

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| **Company** | **Yes/No** | **Comments** |
| Vodafone | depends | In our view, it is allowed to search for an acceptable cell, but only if there is no suitable cell found. In general, as we speak about the Handover failure from NR to LTE, there should be sufficient cells/frequencies in LTE to find a suitable cell. It has also to be noted that in LTE (36.331) the field: ims-EmergencySupport has to be broadcasted, so that the selection of an LTE cell makes only cell if this IE is broadcasted. Please also note, the red marked text from the above 5.2.8. |
| Qualcomm Incorporated | Yes |  |
| CMCC | Yes |  |
| Ericsson | Yes |  |
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The original proposal is to allow UE simultaneously perform suitable cell selection and acceptable selection. If an acceptable cell can be found first, UE can camp on the cell to initiate emergency call. The motivation is for emergency call fast and successful call setup is more critical than normal call. And as specified in TS 38.304, the UE shall perform cell reselection to suitable cell regularly, as highlighted in blue. This can ensure UE will be back to normal service provided by HPLMN after emergency call is finished.

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| Excerpt from TS 38.3045.2.8 Camped on Any Cell stateThis state is only applicable for RRC\_IDLE state. In this state, the UE shall perform the following tasks:<Unrelated part is omitted>- regularly attempt to find a suitable cell trying all frequencies of all RATs that are supported by the UE. If a suitable cell is found, UE shall move to *camped normally* state.- if the UE supports voice services, the UE is not in SNPN access mode, and the current cell does not support IMS emergency calls as indicated by the field *ims-EmergencySupport* in SIB1 as specified in TS 38.331 [3], the UE shall perform cell selection/reselection to an acceptable cell that supports emergency calls in any supported RAT regardless of priorities provided in system information from current cell, if no suitable cell is found. |

But during the online discussion, companies raised concerns on the order and would like to keep the UE behaviouras current idle cell selection, i.e. suitable cell first and then acceptable cell. Therefore we would like to further check companies’ view.

The TP in Annex gives the examples of option1 and option2 below.

Q2: Which option do you prefer?

* Option1: UE is allowed to perform suitable cell search and acceptable cell search simultaneously, and select either one which is found first.
* Option2: UE shall perform suitable cell search first, and can perform acceptable cell search only when no suitable cell is found.

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| **Company** | **Option1/Option2** | **Comments** |
| Vodafone | Option 2 | As commented before, we believe, that normally suitable cells should be searched first and only if there are none of them, the UE should search for acceptable cells and select it. |
| Qualcomm Incorporated | Option 2 | We suggest making the search for acceptable cell optional in the procedural text, i.e. “the UE may…”. |
| CMCC | Option 2 |  |
| Ericsson | Option 2 | But we don’t see how the TP for option 2 achieves that the UE first must select a suitable cell before attempting to select an acceptable cell. Relevant statements:3> attempt to select an E-UTRA cell:4> if a suitable E-UTRA cell is selected:5> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';4> else if an emergency service is ongoing and an acceptable E-UTRA cell which supports emergency calls is selected:5> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';The level-3 bullet says that the UE shall attempt to select an E-UTRA cell. But important: this statement itself does not force the UE to prioritize suitable cells over acceptable cells. So this does not implement option 2.Note: The fact that if statement is structured so the UE **first** checks if the (at this point already selected) cell is a suitable cell **followed by** a check if the (already selected) cell is an acceptable cell, that itself doesn’t make the UE prioritize suitable cells. What we need to do is to change the level-3 bullet to prioritize suitable cells.The following approach is perhaps a better starting point?3> attempt to select an E-UTRA cell by selecting a suitable E-UTRA cell or, if no suitable cell is found, selecting an acceptable E-UTRA cell that supports emergency calls:4> if an E-UTRA cell is selected:5> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';[Moderator] Thanks for the suggestion. In general it looks fine to us, and we can discuss the detailed changes in CR drafting phase after achieving some basic agreements.  |
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## 3.2 Emergency service fallback

To support emergency service, emergency service fallback is specified in addition to EPS fallback. During emergency fallback, it is UE to send NAS request to AMF to request a fallback to E-UTRA for emergency call, and AMF will inform gNB to perform HO to E-UTRA, highlighted in orange. The AS procedure is the same as normal HO (e.g. triggered by EPS fallback).

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| Excerpt from TS 23.5024.13.4.2 Emergency Services FallbackThe call flow in Figure 4.13.4.2-1 describes the procedure for emergency services fallback.**Figure 4.13.4.2-1: Emergency Services Fallback**1. UE camps on E-UTRA or NR cell in the 5GS (in either CM\_IDLE or CM\_CONNECTED state).2. UE has a pending IMS emergency session request (e.g. voice) from the upper layers.<Unrelated part is omitted>4. 5GC triggers a request for Emergency Services Fallback by executing an NG-AP procedure in which it indicates to NG-RAN that this is a fallback for emergency services. <Unrelated part is omitted>5. Based on the target CN if indicated in message 4 or otherwise based on the RAN configuration, one of the following procedures is executed by NG-RAN:5b. NG-RAN initiates handover (see clause 4.11.1.2.1) or redirection to E-UTRAN connected to EPS. NG-RAN uses the security context provided by the AMF to secure the redirection procedure. |

As commented by other companies in online session, the emergency fallback is initiated by UE, the UE is able to be aware that the HO is for emergency fallback, thus it could be up to UE implementation.

However, according to the current specification, once step 5b cited from 23.502 above is initiated, the UE would execute the HO procedures specified in 38.331. In case of handover failure as specified in 5.4.3.5, the UE can select to an E-UTRA cell only when the *voiceFallbackIndication* is provided in HO command as highlighted in green, otherwise it has to revert to NR configuration and perform RRC reestablishment marked in grey. There is no room left to UE implementation to select an E-UTRA cell in case of an emergency call. .

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| Excerpt from TS 38.3315.4.3.5 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:3> attempt to select an E-UTRA cell:4> if a suitable E-UTRA cell is selected: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;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; |

Q3: Do companies agree to the UE should be allowed to select a suitable E-UTRA cell upon HO failure during Emergency service fallback?

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| **Company** | **Yes/No** | **Comments** |
| Vodafone |  | Is there a difference in terms of selection process between Emergency Services Fallback and EPS fallback triggered for emergency service. Please clarify, otherwise see my comments above.[Moderator]In Rel-15, after HO failure for both EPS fallback and emergency service fallback, UE behaviour is the same, i.e. RRC reestablishment in NR. But in Rel-16 after introducing voiceFallbackIndication for EPS fallback, when network indicate EPS fallback in HO command[marked in green in cited RRC text above], upon HO failure the UE is required to select E-UTRA cell first. However for emergency fallback, this enhancement cannot be used, thus UE should initiate RRC reestablishment [marked in grey in cited RRC text above].  |
| Qualcomm Incorporated | Yes | It looks like RAN2#113 (email discussion 029) concluded as follows, and did not change the specification text.* [029] The *voiceFallbackIndication* is not included in the handover message for handover based Emergency service fallback. It is left for UE implementation to prioritize E-UTRA cells in case of HO failure during the Emergency services fallback.

We think it can also be left to UE implementation how the UE prioritizes E-UTRA cells (selecting a suitable cell or an acceptable cell).[Moderator] Thanks for reminding this. Our understanding on this agreement was here to say UE implementation is more about confirming UE can be aware of emergency service fallback by itself without network including voiceFallbackIndication, while the part of UE can select E-UTRA cell is not reflected in the specification. In this case, we think this part can be confirmed and captured in the specification explicitly.  |
| CMCC | Yes |  |
| Ericsson | Yes |  |
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Similar like the discussion for EPS fallback, it is seen helpful to allow UE select an acceptable cell at least when there is no suitable cell.

Q4: Do companies agree that UE should be allowed to select an acceptable cell (at least when there is no suitable cell) for emergency call upon HO failure during EPS fallback?

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| **Company** | **Yes/No** | **Comments** |
| Vodafone |  | Please see my answers on Q1 and Q2 |
| Qualcomm Incorporated | Yes | It looks like RAN2#113 (email discussion 029) concluded as follows, and did not change the specification text.* [029] The *voiceFallbackIndication* is not included in the handover message for handover based Emergency service fallback. It is left for UE implementation to prioritize E-UTRA cells in case of HO failure during the Emergency services fallback.

We think it can also be left to UE implementation how the UE prioritizes E-UTRA cells (selecting a suitable cell or an acceptable cell). |
| CMCC | Yes |  |
| Ericsson | Yes |  |
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If it can be agreed that both EPS fallback and emergency service fall back allow acceptable cell selection, then the same handling on the order of suitable cell search and acceptable cell search should be adopted.

Q5: Do companies agree the same option adopted for EPS fallback (in Q2) should apply to emergency service fallback?

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| **Company** | **Yes/No** | **Comments** |
| Vodafone | Yes | I do not currently see a difference in selection procedure. What is the justification to have different behaviours |
| Qualcomm Incorporated | Yes, by implementation. | It looks like RAN2#113 (email discussion 029) concluded as follows, and did not change the specification text.* [029] The *voiceFallbackIndication* is not included in the handover message for handover based Emergency service fallback. It is left for UE implementation to prioritize E-UTRA cells in case of HO failure during the Emergency services fallback.

We think it can also be left to UE implementation how the UE prioritizes E-UTRA cells (selecting a suitable cell or an acceptable cell).[Moderator] If companies think the order (suitable cell first, and then acceptable cell if no suitable cell found) is important, it would be clearer to capture it in spec? And we can also explicitly say how to determine it is emergency service call is left to UE implementation if needed. |
| CMCC | Yes |  |
| Ericsson | Yes |  |
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Q6: Do companies agree that the specification needs to be updated to allow the UE to select to a suitable or an acceptable cell for emergency service fallback?

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| **Company** | **Yes/No** | **Comments** |
| Vodafone |  | We are not against it as long the search is done in order of “suitable cells first”, “acceptable cells if no suitable cells are found” |
| Qualcomm Incorporated | No | It looks like RAN2#113 (email discussion 029) concluded as follows, and did not change the specification text.* [029] The *voiceFallbackIndication* is not included in the handover message for handover based Emergency service fallback. It is left for UE implementation to prioritize E-UTRA cells in case of HO failure during the Emergency services fallback.

We think it can also be left to UE implementation how the UE prioritizes E-UTRA cells (selecting a suitable cell or an acceptable cell).[Moderator] If companies think the order (suitable cell first, and then acceptable cell if no suitable cell found) is important, it would be clearer to capture it in spec? And we can also explicitly say how to determine it is emergency service call is left to UE implementation. |
| CMCC | Yes |  |
| Ericsson | Yes | We think we can implement this proposal in concise way without repetitions like this:2> if *voiceFallbackIndication* is included in the *MobilityFromNRCommand* message; or 2> 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 by selecting a suitable E-UTRA cell or, if no suitable cell is found, selecting an acceptable E-UTRA cell that supports emergency calls:4> if an ~~suitable~~ E-UTRA cell is selected: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;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.[Moderator] Thanks for the suggestion. In general it looks fine to us, and we can discuss the detailed changes in CR drafting phase after achieving some basic agreements. |
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# Conclusion

# Annex: Text proposal for TS 38.331 v17.1.0

Option1

5.4.3.5 Mobility from NR failure

The 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:

3> attempt to select an E-UTRA cell:

4> if a suitable E-UTRA cell is selected; or

4> if an emergency service is ongoing and an acceptable E-UTRA cell which supports emergency calls is selected:

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;

2> else:

3> if the mobility from NR procedure is for emergency services fallback as specified in TS 23.502 [43]:

4> attempt to select an E-UTRA cell:

5> if a suitable or acceptable E-UTRA cell which supports emergency services is selected:

6> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';

5> else:

6> revert back to the configuration used in the source PCell;

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

3> else:

4> revert back to the configuration used in the source PCell;

4> 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; or

1> 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.

Option2

5.4.3.5 Mobility from NR failure

The 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:

3> attempt to select an E-UTRA cell:

4> if a suitable E-UTRA cell is selected:

5> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';

4> else if an emergency service is ongoing and an acceptable E-UTRA cell which supports emergency calls is selected:

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;

2> else:

3> if the mobility from NR procedure is for emergency services fallback as specified in TS 23.502 [43]:

4> attempt to select an E-UTRA cell:

5> if a suitable E-UTRA cell is selected:

6> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';

5> else if an acceptable E-UTRA cell which supports emergency calls is selected:

6> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure';

5> else:

6> revert back to the configuration used in the source PCell;

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

3> else:

4> revert back to the configuration used in the source PCell;

4> 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; or

1> 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.