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

**Electronic meeting, April 20 – April 30**

**Agenda item:** 6.1.6

**Source:** Qualcomm Incorporated (Rapporteur)

**Title:** [AT109bis-e][022][IAB] RLF Handling (Qualcomm)

**Document for:** Discussion

# Introduction

This document handles offline email discussion:

* [AT109bis-e][022][IAB] RLF Handling (Qualcomm)

Scope: Treat RLF handling to close open issues and make correction if applicable, [R2-2003813](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2003813.zip), and [R2-2003726](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2003726.zip)

Expected outcome: Decisions taken in this email discussion shall be taken into account in the other email discussions on CRs: RRC, possibly BAP, Possibly Idle Mode TS.

Deadline: April 24 0700 UTC

Since the report from [Post109e#36][IAB] RLF Handling Open Issues was not handled during the webinar session, this conclusion section will include the proposals from that session. These proposals (in short) were:

**Proposal 1-1: IAB-DU behavior after RLF declaration is left up to implementation. IAB-DU should be able to send RLF notification when RLF recovery fails.**

**Proposal 1-2: Fast MCG link recovery is supported for NRDC and ENDC.**

This offline discussion aims to address further issues that have not been properly resolved during the post-109e email discussion or that have been identified in contributions to R2#109e-bis. It will *not* address topics which were properly addressed in post-109e email discussion and did not result in any proposals. It will not discuss support for Rel-15/16 features.

**We should aim for functional freeze in this meeting since it is the second-to-last of the WI. The timeframe of this offline is very short. Therefore, we can only move forward with proposals that get broad support.**

# Discussion

2.1 SCGFailureInformation report includes a new failure type

This issue was raised by two companies during the discussion in the post-109e email discussion.

**Proposal 2-1: SCGFailureInformation report includes “reception of RLF recovery failure” as new type.**

**Q: Do you agree with proposal 2.1?**

|  |  |  |
| --- | --- | --- |
| Company | Agree with proposal | Comment |
| Ericsson |  | The issue of new failure type for SCGFailureInformation and MCGFailureInformation was discussed in [Post109e][035] and there was a consensus to have a new failure type. The draft CR (offline-021) has already included the ASN.1 signaling for these new failure type.  So, we suggest not to discuss this issue again.  The issue is which failure type to select in FailureReportSCG. Since no legacy existing failure type seems to really fit the scenario of parent BH link failure recovery, it is reasonable to introduce a new failure type. The same should be included also in MCGFailureInformation.  That being said, this has already been discussed in the IAB RRC email discussion, and the RRC details are being discussed in offline-21. Thus, no need to discuss again here. |
| Nokia | Yes | The same is applicable to MCG failure. As mentioned by Ericsson, probably there is no use to discuss this again. |
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2.2 Reestablishment at former parent node

The IAB-node should *not* attempt reestablishment at its former parent node for some time after receiving BH RLF notification. This was proposed by R2-2003302 and R2-2003314.

We need to agree if anything should be captured:

**Proposal 2-2: Specification captures that the parent node, which sent BH RLF notification, should not be considered for reestablishment for some time.**

**Q: Do you agree with proposal 2.2?**

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| --- | --- | --- |
| Company | Agree with proposal | Comment |
| Ericsson |  | We agree with the intention of this proposal. However, we believe that given the limited time, it is not necessary to specify that in Rel.16, it can be handled via implementation. |
| Nokia | No | This can be achieved by implementation as reestablishment is based on cell selection. The node which sends the RLF indication may also disable IAB support indication to prevent IAB-MTs from attempting to connect. |
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It needs to be decided if the time frame is up to implementation or configurable.

**Option a: Time frame is up to implementation**

**Option b: Time frame is configurable.**

**Q: Which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option (a, b) | Comment |
| Ericsson | a | This should leave to implementation. |
| Nokia | a | It should be up to network implementation how to handle this. No specification is needed. |
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2.3 Support of other types of RLF indication

Types 1/2/3 RLF indications were established in an email discussion during last year. They were further proposed in post-109e email discussion as well as in R2-2002855, R2-2002991, R2-2003302, and R2-2003314. These types of RLF indication can help avoiding that the IAB-node tries to re-establish at its own descendant nodes.

Getting agreement on such a complex issue at this late stage of the WI is a rather adventurous undertaking. There are lots of different options to be considered. We will try to explore the space.

Type-1/2 indication allows fast propagation of RLF problems throughout the subtree. Here is how this would work:

If a single-connected IAB-node has determined BH RLF or received a BH RLF indication (which is different from the RLF notification sent after recovery failure) from its parent node, it sends an RLF indication to its child node, removes the “IAB-supported” indicator in SIB1 and blocks IAB-MT access.

This already contains a lot of material, but there is little benefit in breaking it further down.

**Proposal 3-0a: If a single-connected IAB-node has detected a BH RLF, it may send an RLF detection indication (type-2) to its children nodes.**

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| --- | --- | --- |
| Company | Agree with proposal | Comment |
| Ericsson | Yes | This proposal is needed to allow the child node to prepare for possible performance degradation at the parent node or search for alternative parents, up to the implementation. |
| Nokia | Yes | We described our overall “vision” of how additional types of RLF indications should work in the reply to Proposal 3-1. This proposal seems to be aligned with that. |
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**Proposal 3-0b: If a single-connected IAB-node has recovered from BH RLF, it may send an RLF recovery indication (type-3) to its children node.**

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| --- | --- | --- |
| Company | Agree with proposal | Comment |
| Ericsson | Yes | This proposal is needed to inform the child node that the parent has recovered the connection so that it can resume normal operations. |
| Nokia | Yes | We described our overall “vision” of how additional types of RLF indications should work in the reply to Proposal 3-1. This proposal seems to be aligned with that. |
|  |  |  |

**Proposal 3-1: If a single-connected IAB-node has determined BH RLF or received a BH RLF indication (which is different from the RLF notification sent after recovery failure) from its parent node, it sends an RLF indication to its child node, removes the “IAB-supported” indicator in SIB1 and blocks IAB-MT access.**

**Q: Do you agree with proposal 3.1? Any variation?**

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| --- | --- | --- |
| Company | Agree with proposal | Comment |
| Ericsson | No | It is not needed to propagate the RLF indication along the path since the parent node can try to recover the connection. That can also be complicated in terms of message overhead, depending on the topology structure. So better leave this aspect (what the child node does when receiving the indicators) to implementation,  For example, no need to specify behavior at child/parent node upon receiving/sending such RLF notification, such as modifying SIB or blocking other MT access. |
| Nokia | No | We did not bring the paper on this issue to this meeting, but our views are expressed in the paper we had in RAN2#109-e meeting in R2-2001056. We think that actions performed upon receiving BH RLF indication by the IAB-DU should be left to network implementation. We think that we just need to specify what events trigger different notifications. We propose the following:   * “RLF recovery failure” triggered by RRC Reestablishment failure, already specified * “RLF detection” triggered by RLF being declared * “RLF recovery” triggered by successful RRC Reestablishment   We think we only need to specify that upon such events the indications are provided to BAP. What to do at BAP layer, i.e. whether to send them to child nodes or not, can be up to implementation. We also do not think we need to specify the behavior on the receiving end for those two additional indications. |
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If the “MT-access blocking” state was triggered by local RLF, it can be reversed upon recovery. Otherwise, it can be reversed after expiration of a (configurable) timer or upon reception of a type-3 indication.

**Option 1: The IAB-node reinstates “IAB-supported” indicator in SIB1 and readmits IAB-MT access attempts upon RLF recovery or after some time.**

**Option 2: The IAB-node reinstates “IAB-supported” indicator in SIB1 and readmits IAB-MT access attempts upon RLF recovery or after reception of a type-3 indication.**

**Option 3: Child/parent IAB node actions upon receiving/sending the RLF notification/recovery are left to implementation.**

**Q: Which option do you prefer?**

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| --- | --- | --- |
| Company | Option preferred | Comment |
| Ericsson | 3 | Assuming that the RLF indication signaling is in place, it could be left to the implementation of the child/parent node how to behave. |
| Nokia | 3 |  |
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In case of Option 1, the time frame might be based on implementation or based on a configurable timer:

**Option 1.1: Time frame up to implementation**

**Option 1.2: Time frame configurable**

**Q: In case of option 1, which sub-option do you prefer?**

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| --- | --- | --- |
| Company | Option preferred | Comment |
| Nokia | 1.1 |  |
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In case of option 2: If multiple BH links in a chain have link quality issues their RLF indicators and radio-link recovery (RLR) indicators may overlap in time and create a state of uncertainty among the descendant nodes. To avoid such a situation, the BH RLF indicator and BH RLR indicator should contain, e.g., the node’s BAP address to avoid such conflicting information.

**Q: In case of option 2, should the BAP address (or another identifier) be included in the RLR indication?**

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| --- | --- | --- |
| Company | BAP address in included in RLF/RLR indication (yes/no) | Comment |
| Ericsson | No | We do not see this scenario as really an issue, given that the RLF indication and RLF recovery success/unsuccess are sent to the child. |
| Nokia | No | This can also be left to network implementation. If we try to over-optimize, then indeed this task seems to be too complicated. We think a simple scheme of additional RLF indications with no extra information is something that we should aim for. |
|  |  |  |

Dual-connected IAB-nodes with RLF on one of the BH links might be able to use the other link for backhauling. If the dual-connected IAB-node receives a RLF indicator from the parent node, however, it does not know if the failed link resides on a subset of paths or on all paths. In prior case, it should make itself available to allow access by orphaned IAB-nodes, in the latter it shouldn’t.

Options considered might be:

**Option A:** Dual-connected nodes do not send RLF and RLR indications.

**Option B:** Dual-connected nodes do send RLF and RLR indications.

**Option C:** Nothing needed in this release.

**Option D:**

**Q: How should dual-connected nodes behave?**

|  |  |  |
| --- | --- | --- |
| Company | Option (A, B, C…) | Comment |
| Ericsson | C |  |
| Nokia |  | This can be left up to network implementation |
|  |  |  |

**Q: Anything forgotten?**

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| --- | --- |
| Company | Comment |
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2.4 Include BAP address into MCG or SCG failure report

This was proposed by R2-2002855. It provides the CU with more detailed information on where the RLF occurred.

**Proposal 4-1: The IAB-MT includes its BAP address in the MCG and SCG failure report.**

**Q: Do you agree with proposal 4-1?**

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| --- | --- | --- |
| Company | Agree with proposal | Comment |
| Ericsson | No | The CU already knows to which node(s) the IAB-MT is connected to. When the CU gets the MCG/SCG failure report, it implicitly will know which node experienced the BH RLF. |
| Nokia | No | Isn’t that already clear that the failure information is about IAB-MTs MCG or SCG? |
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2.5 Max timer for MCG recovery

This proposal by R2-2003099 is conditional on Proposal 2, i.e. support for MCG recovery. The max time value for T316 for MCG recovery presently is 2000ms. For IAB-nodes, a longer timer might be advantageous since the BH can still operate on the SCG link.

**Proposal 5-1: The max-time of T316 for MCG recovery can be configured to larger values than 2sec for IAB-MT.**

**Q: Do you agree with proposal 5-1?**

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| --- | --- | --- |
| Company | Agree with proposal | Comment: Please include the max time value for MT |
| Ericsson | No strong view | We believe 2 sec is enough for the time being. |
| Nokia | No | 2 seconds is already a long time and should be sufficient to make MCG operational and in case this is not possible, then there is probably something wrong with MN connection in general, so the IAB-MT should not continue operation in such case forever. |
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* 1. RLF indication in SIB1 for UEs

R2-2003314 proposes to have SIB1 send an RLF indicator to allow UEs to perform reestablishment. This, of course, would only be applicable to Rel-16+ UEs.

**Q: Do you agree with proposal 6-1?**

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| --- | --- | --- |
| Company | Agree with proposal | Comment |
| Ericsson | No | The starting point of IAB rel-16 was to not impact the UEs and we should keep this principle. Otherwise, we should reconsider many of the agreements we have taken as some of them were based on the initial principle that UEs cannot be affected.  We do not see a big benefit from it at the moment. UEs can simply use legacy rules to determine RLF. Additionally, before those legacy RLF conditions are met, maybe the IAB node has already reestablished to an alternative path, and it is better if UEs remain attached to such IAB node, rather than performing reestablishment themselves. |
| Nokia | No | We agreed we will not introduce impact to Access UEs. |
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# Conclusion

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