**3GPP TSG-RAN2 #116bis-e R2-220xxxx**

**Electronic meeting, January, 2022**

**Agenda item:** **8.4.2.1** (NR\_IAB\_enh-Core)

**Source:** LG Electronics Inc.

**Title:** [AT116bis-e][048][eIAB] RLF indication (LG)

**Document for:** Discussion and Decision

# 1. Introduction

This contribution discusses BH RLF indication, in accordance with the following:

* [AT116bis-e][048][eIAB] RLF indication (LG)

 Scope: Take online agreements into account, treat remaining relevant contents in R2-2201692. Attempt agree offline. Can also capture open points.

 Intended outcome: Report, Agreements

 Deadline: EOM

The discussion consists of two phases, Phase 1 and Phase 2, and the deadline of each phase is given below:

* Phase 1: to agree on easy agreement and attempt to discuss further details of open issues,
Deadline: Friday Jan 21 0900UTC
* Phase 2: to formulate agreeable proposals and capture open issues and FFSes for offline agreement, Deadline: EOM

## **Contact**

To make it easier to find the correct contact delegate in each company for potential follow-up questions, the rapporteur encourages the delegates who provide input to provide their contact information in this table:

|  |  |
| --- | --- |
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# 2. Discussion

## 2.0 Agreements

### Agreement in RAN2#116

|  |
| --- |
| * Type 2 indication by dual-connected node is triggered when the node initiates RRC re-establishment resulting from BH RLF on both CGs or BH RLF on MCG with no fast MCG recovery.
* A node can transmit type-3 indication if re-establishment is successful. FFS whether to specify a detailed condition for success of re-establishment, e.g., successful transmission of RRC reestablishment complete. FFS whether to also include additional triggering condition such as successful transmission of ReconfigurationComplete, which is for the case the node initiates re-establishment and selects a CHO candidate cell and hence performs CHO successfully.
* A node can transmit type-3 indication only if it previously sent type-2 indication, i.e., type-3 indication cannot be triggered without triggering type-2 indication previously.
* Upon reception of type-2 indication, the node should perform local re-routing if possible.
* Upon reception of type-3 indication, the actions (e.g. local re-routing) triggered upon reception of a previous type-2 indication should be reversed, if possible.
* FFS if Type 2 indication by dual-connected node can be triggered when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic (if agreed see R2-2111539 for more details)
* [032] For triggering condition of type-2 indication by a single-connected node, initiation of RRC re-establishment is a sufficient condition to trigger type-2 indication.
* [032]  Proposal 5\_alt: If option 2) is chosen in P1 (i.e. dual-connected node triggers type 2 indication when the node detects BH RLF on any BH link) and option 2 is chosen in P7 (i.e. Received type-2 indication is further propagated),  type-2 indication sent by a single-connected node includes routing ID information indicating which routing IDs are not available. FFS whether inclusion of routing ID can be omitted in some cases. Otherwise, type-2 indication sent by a single-connected node does not carry any further information related to BH RLF.
* [032]  Conditional mobility is not triggered by reception of type-2 indication.
* [032] For the need of further propagating received type-2 indication, FFS which option to take:

Option 1) Received type-2 indication is not propagated further (unless a normal type-2 triggering condition is met).Option 2) Upon reception of type-2 indication, the node should further propagate type-2 indication to the child if it has no alternative path available.* [032] RAN2 does not specify UL transmission constraints (e.g. SR/BSR) to a node receiving the type-2 indication, i.e., whether the node can transmit uplink transmission is left to implementation of the node and also up to scheduling policy of a node transmitting the type-2 indication. FFS whether we need to add a Note in stage-2/3 CR.
* [032] RAN2 does not specify that IAB-support indicator is toggled by reception of type-2 indication, i.e., when how to set IAB-support indicator it is up to implementation. FFS whether we need to add a Note in stage-2/3 CR.
* [032] To agree that the following terms are used:

-  Type-2:  “BH RLF detection indication”, -  Type-3: “BH RLF recovery indication” , and- Type-4: FFS whether “BH RLF recovery failure indication” or existing name “BH RLF indication” |

Agreement in RAN2#116bs

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| --- |
| * Type-2 indication by a dual-connected node is triggered when the node detects BH RLF on a BH link and it cannot perform re-routing for any traffic, i.e. NR RLF for ENDC scenario, (FFS UP Link RLF for CPUP split scenario 1).
* For these cases, the Type-2 indication is handled in the same way as for the case when both links goes down.
 |

## 2.1 Type-2 indication

### 2.1.1 Triggering of type-2 indication by dual-connected node.

During RAN2#116bis, RAN2 made the following agreement

* Type-2 indication by a dual-connected node is triggered when the node detects BH RLF on a BH link and it cannot perform re-routing for any traffic, i.e. NR RLF for ENDC scenario, (FFS UP Link RLF for CPUP split scenario 1).
* For these cases, the Type-2 indication is handled in the same way as for the case when both links goes down.

**Sanity check for agreement**

Before we start discussion of remaining open issues, the rapporteur suggests to review the first agreement in yellow to build a robust basis for further discussion. To be clear, the intention is not to challenge the yellow agreement but to clarify implications.

The intention of the first agreement above is that type-2 indication by a dual-connected node should not be triggered when there is BH failure on BH link but there is alternative BH link available to use for re-routing. The underlying assumption of this agreement was that the node is expected to re-route *all* affected traffic to the alternative link, and hence there is no need to pursue optimization for partial re-routing.

However, it may not be crystal clear if the node *is required* to re-route ‘all’ affected traffic or if the node is still allowed to skip re-routing for some affected traffic or to not perform local re-routing at all. Note that in Rel-16, local re-routing upon R16 BH RLF is not mandatory, and whether to perform local re-routing upon R16 BH RLF is gracefully left to implementation as specified below.

*TS 38.340:*

*NOTE: Data buffering on the transmitting part of the BAP entity, e.g., until RLC-AM entity has received an acknowledgement, is up to implementation. In case of BH RLF, the transmitting part of the BAP entity may reroute the BAP Data PDUs, which has not been acknowledged by lower layer before the BH RLF, to an alternative path in accordance with clause 5.2.1.3.*

In Rel-17, if re-routing of ‘all’ affected traffic upon failure of a single BH failure is mandatory for the node capable of local re-routing, there is no issue on the agreement since things work as intended. In contrast, if the node is allowed to re-route a *faction* of affected traffic or allowed not to perform local re-routing at all like Rel-16, the agreement may be misleading; the node will not trigger type-2 indication in case the node performs partial re-routing, because condition “it cannot perform re-routing for *any* traffic” is not literally met.

If execution of local re-routing of all affected traffic upon BH RLF is not mandatory in Rel-17, it seems that the aforementioned misinterpretation may be unavoidable. Note that upon reception of type-2 indication, a node *should* perform re-routing, if possible, i.e., local re-routing is mandatory and it further implies that *all* affected traffic should be re-routed. Companies are kindly requested to review the rapporteur understanding and provide comments.

**Q1. Do you agreed that, if execution of local re-routing of all affected traffic upon BH RLF is not mandatory for a node capable of local re-routing via alternative link, the node may perform *partial* re-routing upon BH RLF, resulting in no triggering of type-2 indication as per the current agreement?**

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| --- | --- | --- |
| Company | Y/N  | Comment |
| Kyocera | **Y** | We agree with the rapporteur’s understanding of the agreement. But we wonder if this is another case to be considered, i.e., the issue related to “mandatory/optional re-routing of all traffic” which is different scenario than EN-DC (and CP/UP separation). We also wonder if Type 2 Indication should be sent when at least one route is not re-routed.  |
| Ericsson | **N** | It is not clear why only some traffic should be rerouted via the alternative link. If one link is broken but the other is available, then the IAB node should aim at recovering all the traffic via the alternative link. It is not clear why it should not do it. Note also that the RLF situation should last for very short time, and the CU will make sure to restore the RLF-ed link as soon as possible. So any potential performance degradation over the alternative link due to the local re-routing should last for very short time. |
| ZTE | **Y**  | It was agreed in last RAN2 meeting that upon reception of type-2 indication, a node *should* perform re-routing, if possible. And from RAN3 perspective, whether to establish tunnels between donor DUs or when to establish tunnels are up to implementation. That implies that the local rerouting when the node detects BH RLF on a BH link is not mandatory.  |
| Nokia | **Y, but** | We believe the Rel-17 enhancement intention is not to mandate re-routing of ‘all’ affected traffic upon failure of a single BH failure. There can be cases where only part of the traffic can be re-routed. Hence, some ambiguity seems to remain in the agreement. |
| Samsung  | **Y but clarification needed** | We think the highlighted agreement is specific to the ENDC and CP/UP separation scenario 1. But anyway, applying this agreement to the normal NRDC case as it is, node only executing partial re-routing is not satisfying “cannot perform re-routing for any traffic”, so type2 indication is not triggered. But we believe that network implementation will cover the re-routing for the all affected traffic not only for partial re-routing. Why the network configure the partial one ?  |
| vivo | **N** | We also understand that there is mandate for re-routing, so we do not see why only some traffic should be rerouted via the alternative link and some cannot be re-routed. |
| Fujitsu | **Y** | We think the RAN2 agreement is clear. In our understanding, the agreement says that only in the stated DC scenarios (with one CG RLF), namely NR RLF in ENDC and BH RLF for CPUP split (FFS) scenario, the type2 BH RLF indication is triggered. In these scenarios, the local re-routing is impossible for any traffic. If partial local re-routing is possible, then the type2 BH RLF will NOT be triggered. |

**Q2. For companies agreeing to Q1, do we need to mandate local re-routing of *all* affected traffic upon BH RLF for a node capable of local re-routing via alternative link? Or would it be sufficient to know the consequence of partial local re-routing (i.e., no triggering of type-2 indication) and still allow partial re-routing as network implementation freedom?**

* **Option1: To mandate local re-routing of *all* affected traffic upon BH RLF for a node capable of local re-routing via alternative link.**
* **Option2: To not mandate local re-routing of *all* affected traffic upon BH RLF for a node capable of local re-routing via alternative link.**

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| --- | --- | --- |
| Company | Option | Comment |
| Kyocera | **Option 2** | We don’t think it’s mandatory for IAB-node, but we wonder if Type 2 Indication should be sent even in this case (i.e., the IAB-node re-routes “some” traffic but it does not re-route “some other” traffic), as commented in Q1 above.  |
| Ericsson | **-** | We do not think the issue is about mandating or not mandating. It is more on why an IAB node implementation should not aim at “saving” all the traffic via the alternative link. As said above, the RLF situation should last for very short time, and the CU will make sure to restore the RLF-ed link as soon as possible. Hence any performance degradation on the alternative link should last for short time. |
| ZTE | **Option 2** | We don’t see the motivation to mandate local rerouting of all affected traffic since it’s possible that only part of affected traffic could be rerouted. IAB MT could determine whether local rerouting could be performed based on the routing and rewriting configuration.  |
| Nokia | **Option 2** | We cannot mandate re-routing of all affected traffic as they can have multiple destinations and re-routing configurations may not exist for all. In the case of partial re-routing, Type-2 indication could be sent indicating the non-available routes/destinations. |
| Samsung  | **2** | We don’t know if there is big difference between allowing partial re-routing and allowing re-routing for all affected traffic in terms of network resource usage and signaling complexity. We think network can configure the rerouting configuration for the all the affected traffic even which is not mandated feature. For the spec point of view, we think not mandating seems consistent with the legacy, but actual implementation will be configured for the all the affected traffic.  |
| vivo |  | We do not see is the issue we are trying to resolve by mandating local rerouting. |
| Fujitsu |  | It depends on configuration. If a node is capable of local re-routing and there is an alternative path configured for this routing ID, then it will do local re-routing.  |

#### Proposal 1: FFS if execution of local re-routing of *all* affected traffic upon BH RLF is not mandatory for a node capable of local re-routing via alternative link. If so, does *partial* re-routing upon BH RLF result in no triggering of type-2 indication as per the current agreement? Do we need to mandate local re-routing of *all* affected traffic upon BH RLF for a node capable of local re-routing via alternative link or not?

**EN-DC/CP-UP separation**

Currently Type-2 triggering condition for CP-UP separation scenarios is FFS. Based on the online discussion, the following question can be asked directly:

**Q3. For dual-connected node with CP-UP split, should type-2 indication be triggered when one CG providing UP fails?**

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| Company | Y/N  | Comment |
| Kyocera | **Y, but…** | We think the agreement can cover the case anyway, i.e., “*when the node detects BH RLF on a BH link and it cannot perform re-routing for any traffic*”.  |
| Huawei, HiSilicon |  | To make the CP-UP/EN-DC case and the NR-DC case general condition, we prefer to use “when CG(s) provide F1-over-BAP fails”In NR-DC, it is triggered when both CG providing F1-over-BAP failures, including both CP and UP.In CP-UP/EN-DC case, it is triggered when the CG both CG providing F1-over-BAP failures, including only UP. |
| Ericsson |  | Agree with Huawei |
| ZTE | **Yes**  |  |
| Nokia | **Y** | The agreement cover the case anyway |
| Samsung  | **please see the comment** | In first, we wonder if ENDC (or NRDC) CP-UP separation architecture has any part of SA mode IAB topology in the middle, like dotted box in below figure:, If this is valid scenario, then it is meaningful to have type 2 indication for re-routing, and the answer for Q3 could be Y. Otherwise we don’t think type 2 indication is necessary since there is no alternative path for re-routing in any IAB node. Please note that 38.300 has ENDC architecture description where IAB node has only single NR BH and LTE link, even there is no explicit restriction though. And I remember CP-UP split scenario from RAN3 also was to use only single BH for each IAB node.  |
| vivo |  | Agree with Huawei |
| Fujitsu | **See comment** | The local re-routing is still possible in CP-UP split scenario, if the other leg has BH link. So it depends on the scenario and BH configuration. |

#### Proposal 2: FFS For a dual-connected node configured with CP-UP split, type-2 indication is triggered when one CG providing UP fails.

Consider the case that type-2 indication was triggered by failure of a BH link providing UP (e.g., SCG failure in EN-DC and CU split architecture) but the other link has just failed prior to the recovery of the previously failed BH link. In that case, since the concerned node experiences failure on both BH links, it initiates re-establishment, which may trigger another type-2 indication. These successive type-2 indications are not useful to child nodes since there is no extra information conveyed by later indication. Furthermore, the second indication may further propagate to descendent nodes depending on topology. So, rapporteur would like to ask the following question:

**Q4. In case failure of one BH link triggered type-2 indication (but not re-establishment) and recovery has not been completed, should the failure of the other BH link trigger another type-2 indication or not?**

* Option1: The failure of the other BH link triggers another type-2 indication.
* Option2: The failure of the other BH link should not trigger another type-2 indication

|  |  |  |
| --- | --- | --- |
| Company | Option  | Comment |
| Kyocera | **-** | We prefer Option 2 if there is no additional information in the second Type 2 Indication, but we assume it still depends on other discussion.  |
| Ericsson | **-** | What is the scenario here? Is it CP/UP split? If only one link is configured with the BH, then the type-2 should be transmitted only when that link fails.  |
| ZTE |  | It depends on the trigger condition of type 2 indication for dual connected MT in NR-DC non CP-UP separation scenario. If type 2 indication is allowed to be triggered upon detection of BH RLF on one BH link and it cannot perform re-routing in NR-DC non CP-UP separation scenario, the failure of the other BH link triggers another type-2 indication, i.e. option 1. Otherwise, option 2 is more reasonable.  |
| Nokia | **Option 2** | The 2nd Type-2 indication do not have to be sent as the 1st one has already indicated the BH (non-)availability. |
| Samsung  | **2** | But, before the conclusion on this question, we think there should be the clarification on CP-UP split architecture as in Q3 comment.  |
| vivo |  | We do not think the failure of the other BH link should trigger another type-2 indication, we also think the scenario may need some clarification as pointed out by Ericsson. |
| Fujitsu | **Option 2** | We should avoid a storm of type-2 indications. |

**Q5. If Option2 is chosen, how to block triggering of another type-2 indication?**

* Option1: Revise a triggering condition such that same node does not trigger type-2 indications successively.
* Option2: Others

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| --- | --- | --- |
|  Company | Option  | Comment |
| Kyocera | **Option 2** | We wonder if the previous agreement, i.e., trigger upon RRC Reestablishment, is no longer needed, since the new agreement, i.e., “*when the node detects BH RLF on a BH link and it cannot perform re-routing for any traffic*” can cover the case. |
| ZTE | **Option 2**  |  |
| Nokia | **Option 1** | There is no need to specify “ blocking” condition. Procedures on handling the (first) triggering condition should be self-explanatory that the status is valid. The behaviour could be clarified. If the triggering condition explicitly states the RLF on a BH link (which the CP link isn’t), that could also solve the ambiguity. |
| Samsung  | **2** | But, before the conclusion on this question, we think there should be the clarification on CP-UP split architecture as in Q3 comment. |
| Fujitsu | **Option 1/2** | Option 1: only one type 2 BH RLF indication is triggered before a Type 3 BH RLF indication is generatedOption 2: a prohibit timer-based mechanism |

### 2.1.2 Further propagation of type-2 indication

In RAN2#116, RAN2 made the following agreements:

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| * [032] For the need of further propagating received type-2 indication, FFS which option to take:

Option 1) Received type-2 indication is not propagated further (unless a normal type-2 triggering condition is met).Option 2) Upon reception of type-2 indication, the node should further propagate type-2 indication to the child if it has no alternative path available. |

Hence, RAN2 needs to decide on one of following options:

* Option 1: Received type-2 indication is not propagated further.
* Option 2: Upon reception of type-2 indication, the node should further propagate type-2 indication to the child if it has no alternative path available.

On complexity of each option, option1 is simpler, but the difference of complexity between options seems small.

On achievable gain of each option, in option1, the chance of local re-routing triggered by type-2 indications is limited to one-hop descendent nodes. Option2 allows for more chance of re-routing at lower descendent nodes to circumvent upper node(s) experiencing BH failure(s). The difference of achievable gain between two options may not be small, but the actual gain would be largely dependent on architecture/topology of concerned IAB networks. If most of nodes in IAB network are dual-connected and local re-routing are universally available at every node, the difference of achievable gain will diminish. If IAB network is a complex mixture of single-connected nodes and dual-connected nodes or it is (partially) based on EN-DC or CP-UP separation architecture, the difference becomes noticeable; option2 can provide better performance due to its full exploitation of the potential of local re-routing capabilities at lower descendent nodes.

Note that there are sharply split views (7 vs 6) as expressed in contributions in [1]-[16]. To make a decision, it seems necessary to collect acceptance level of each option as well as polling of preferred option.

**Q6. Please express your preferred option and acceptance of the other option.**

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| --- | --- | --- | --- | --- |
| Company | Preferred option | Is Option1 acceptable? Y/N  | Is Option2 acceptable? Y/N | Comment/JustificationPlease specify reasoning for NO acceptance; Otherwise your acceptable answer may be considered as Yes.  |
| Kyocera | **Option 2** | **(Y)** | Y | We agree with the rapporteur’s analysis that Option 2 would provide better performance with small additional complexity. Though, we don’t refuse Option 1, if the progress is achieved by such a compromise.  |
| Huawei, HiSilicon | **Option 1** |  | N |  |
| Ericsson | **Option 1** |  | N | The time interval between type-2 and type-3/4 is very little, hence the propagation just brings overhead and no clear gain. By the time a descendant node gets the type-2, a parent node may have already recovered its link or re-established.  |
| ZTE | **Option 2** | **N** |  | The situation at descendant node is similar as the IAB node which detects BH RLF. Specifically, the descendant node may cannot perform local rerouting for affected traffic, e.g. inter-donor rerouting is not available, UP link fails in EN-DC or CU-UP separation case. In these cases, descendant node needs to propagate type 2 indication to its child nodes.  |
| Nokia | **Option 2** | **N (for some scenarios)** | Y | DC may not be available in wider scale in the IAB networks, hence Opt.2 would provide benefits. Furthermore, propagation enables descendant nodes stop/slow down UL traffic which may be lost if RLF/re-routing eventually happens. |
| Samsung  | **Option 1** |  | **See comments** | Same comment as in Q3, i.e., first we would like to know the mixture of SA mode and ENDC can be valid scenario. If this is valid then we can accept option 2. Otherwise we don’t have any clue to use propagation. We are just curious that rapporteur’s justification that the gain of option 2 can be amplified on ENDC/CPUP separation case in this aspect.  |
| Vivo | **Option 1** |  | N |  |
| Fujitsu | **Option 1** |  | Y |  |

#### Proposal 3: FFS further propagation of type-2 indication is supported.

**Q7. In case further propagation of type-2 indication is supported, do you agree that, when propagation condition is met, the received tye-2 indication is simply forwarded to child nodes without regeneration at the forwarding node?**

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| --- | --- | --- |
| Company | Y/N  | Comment |
| Kyocera | **Maybe Y** | We assume it depends on the other discussions.  |
| ZTE | **N**  | That depends on the content of the type 2 indication. In our view, if unavailable routing ID is included in the type 2 indication, and the descendant nodes perform rerouting only for part of the affected traffic, then it needs to removes some routing IDs in the received type 2 indication and re-generate a new type 2 indication. |
| Nokia | **Y** | If it carries additional information about the available routes, it is relevant also for the descendant nodes. |
| Fujitsu | **Y** | With the new RAN2 agreement on the type-2 trigger in DC case, we think there is no need to include routing ID in the type-2 indication. Therefor a simple forwarding is enough. |

#### Proposal 4: FFS when propagation condition is met, the received tye-2 indication is simply forwarded to child nodes without regeneration at the forwarding node.

### 2.1.3 Content of type-2 indication

In principle, two options are available on the content of type-2 indication:

* Option1: Type-2 indication does not include any routing information.
* Option2: Type-2 indication includes some routing information.

As per the current agreements a node triggers type-2 indication only when it cannot serve traffic by any means. That is, type-2 indication itself without any further information therein clearly indicates that UL data forwarding is temporarily unavailable. This observation seems valid for type-2 indications triggered by single-connected node and dual-connected node. Therefore, RAN2 can conclude that, as a baseline, type-2 indication does not include any routing information.

**Q8. Do you agree to option1 as baseline?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Option for type-2 triggered by single-connected node  | Option for type-2 triggered by dual-connected node | Comment |
| Kyocera | **Yes** | No | As the baseline, we’re fine with Option 1 for single-connected node according to the current agreement. But for dual-connected node, we still think it depends on other discussions. Though, we’re fine even for dual-connected node, if Type 2 Indication does not include any information, then the child node considers all the traffics are not re-routed at its parent.  |
| Ericsson | **Yes** | Yes |  |
| ZTE | **No**  | **No**  | It depends on whether further propagation of type 2 indication is supported. If it’s supported, routing ID information needs to be included in the type 2 indication triggered by both single and dual connected MT assuming that its descendant node may be dual-connected. Otherwise, descendant node cannot differentiate which route is not available.  |
| Nokia | **Option 1** | Option 2 | In DC there are different scenarios how the re-routing can be done. Then available routing information would be beneficial. |
| Samsung  | **Option 1** | Option 1 |  |
| vivo | **Yes** | Yes |  |
| Fujitsu | **Option 1** | Option 1 | Agree with rapporteur. |

#### Proposal 5: FFS As a baseline, type-2 indication does not include any routing information (such as unavailable routing IDs)

Assuming that type-2 indication needs to include any routing information as baseline, it is good to elaborate other cases to check the assumption can still hold valid. If companies see any other important case that requires inclusion of some information in type-2 indication, please specify the case. These cases can be discussed in offline phase-II, if time permits.

**Q9. Please specify other cases that require routing information (or other information) to be included in type-2 indication.**

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| --- | --- |
| Company | Description  |
| Kyocera | As in Q1/Q2, if it’s not mandatory to re-route all traffic, we assume it’s an implementation choice not to re-route some traffic due to e.g., congestion on the alternative link. In this case, not all the routes are the affected routes. So, we think Type 2 Indication includes the Routing IDs which the IAB-node does not re-route.  |
| ZTE | The current agreement doesn’t preclude that type 2 indication could be triggered when the node detects BH RLF on a BH link and it cannot perform re-routing for part or all affected traffic in NR-DC non CU-UP separation scenario. Assuming that type 2 indication could be triggered when the node detects BH RLF on a BH link and it cannot perform re-routing in NR-DC non CU-UP separation scenario, routing ID information needs to be included in the type 2 indication. Otherwise, child/descendant node cannot differentiate which route is not available.  |
| Nokia | Destination information could be sufficient. If re-routing at descendant nodes is possible, they would select anyway another entry in the routing table with different path ID. |

#### Proposal 6: FFS To discuss the need for including routing information for special cases, if identified.

### 2.1.4 Behaviour upon reception of type-2 indication

**Whether to specify type-2 RX behaviors**

RAN2 agreed the following for behaviors upon reception of type-2 indication.

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| * Upon reception of type-2 indication, the node should perform local re-routing if possible.
* Upon reception of type
* [032] RAN2 does not specify UL transmission constraints (e.g. SR/BSR) to a node receiving the type-2 indication, i.e., whether the node can transmit uplink transmission is left to implementation of the node and also up to scheduling policy of a node transmitting the type-2 indication. FFS whether we need to add a Note in stage-2/3 CR.
* [032] RAN2 does not specify that IAB-support indicator is toggled by reception of type-2 indication, i.e., when how to set IAB-support indicator it is up to implementation. FFS whether we need to add a Note in stage-2/3 CR.
 |

To resolve FFS, the following questions are asked.

**Q10. Do you support to add a NOTE on the following in specifications, and if so, which spec is most suitable?**

* **type-2 indication may trigger deactivation of IAB-supported in SIB**

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| --- | --- | --- | --- |
| Company | Y/N | Spec # (if Y) | Comment |
| Kyocera | **N** |  | We assume the condition is “Reception of type-2 indication may trigger…”. The IAB-support IE in SIB1 is handled by IAB-DU, so we don’t have strong motivation to add NOTE for this.  |
| Huawei, HiSilicon | **N** |  |  |
| Ericsson | **N** |  | It is something that the implementation can take care of, similar to what happens when type-4 is received/generated. |
| ZTE | **N**  |  | Since these actions are left to implementation. We prefer that they are not captured in the specification.  |
| Nokia | **N** |  | Can be left for implementation |
| Samsung  | **Y** | **38.340 or 38.300** | In 38.340, Type 2 indication’s consequence can be noted, or in 38.300, RLF section can further describe on type 2 indication. |
| vivo | **N** |  |  |
| Fujitsu |  |  | No strong view. |

**Q11. Do you support to add a NOTE on the following in specifications, and if so, which spec is most suitable?**

* **type-2 indication may trigger deactivation/reduction of SR and/or BSR transmissions at the receiving node?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Y/N | Spec # (if Y) | Comment |
| Kyocera | **Y** | **38.300** | We assume the condition is “Reception of type-2 indication may trigger…”. It’s IAB-MT behaviour, so the NOTE is useful to clarify the allowed implementation options.  |
| Huawei, HiSilicon | **N** |  |  |
| Ericsson | **N** |  | Same view as previous question |
| ZTE | **N**  |  | Since these actions are left to implementation. We prefer that they are not captured in the specification.  |
| Nokia | **N** |  | It will be implementation specific solution, thus no strong desire to capture in specification |
| Samsung  | **Y** | **38.321** |  |
| vivo | **Y** | **38.300** |  |
| Fujitsu |  |  | No strong view. |

#### Proposal 7. FFS to add a NOTE in TS xx.xxx that a type-2 indication may trigger deactivation of IAB-supported in SIB and deactivation/reduction of SR and/or BSR transmissions at the receiving node .

In [12], it is proposed that a single connected IAB node should suspend routing to a parent node, upon reception of type-2 indication, as excerpted below:

*“IAB-MT with single parent should suspend routing any data to its parent node, upon receiving Type-2 indication on BH link level”*

*“IAB-MT with single parent should suspend routing any data to its parent node, upon receiving Type-2 indication on BH link level”*

However, in the last RAN2 meeting, RAN2 agreed not to specify UL transmission constraints upon type-2 indication:

|  |
| --- |
| * [032] RAN2 does not specify UL transmission constraints (e.g. SR/BSR) to a node receiving the type-2 indication, i.e., whether the node can transmit uplink transmission is left to implementation of the node and also up to scheduling policy of a node transmitting the type-2 indication. FFS whether we need to add a Note in stage-2/3 CR.
 |

It is not clear if the proposal in [12] is contradicting the above RAN2 agreement. According to Huawei comment clarified in [19], the above RAN2 agreement is about MAC layer UL transmission, but the proposal in [12] is about BAP layer routing.

**Q12. Do you support to specify suspending routing data to a parent node, upon receiving type-2 indication, and if so, which spec is most suitable?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Y/N | Spec # (if Y) | Comment (If Y, please describe what to specify) |
| Kyocera | **Y** | 38.340 | We think NOTE is an option to clarify this behaviour, but we think the details would depend on other discussion, i.e., whether Type 2 Indication includes the affected route information.  |
| Ericsson | **N** |  | Not critical issue. Also note that the local routing is not a mandatory action upon type-2 RLF. It could be instead that the IAB node implementation just slows down uplink transmission waiting for the parent to recover. So it is ok to leave to implementation as captured in the agreement above. |
| ZTE | **N** |  | It could be up to implementation. In R17, IAB node is static, which implies that the BH RLF recovery would probably succeed. So suspending routing any date upon receiving type 2 indication may lead to unnecessary service interruption.  |
| Nokia | **N** |  | If RLF indicates routes/destinations unavailable, the other destination would still be available for UL traffic. No need to specify. |
| Samsung  | **Y** | 38.300 | In RLF section, it can be specified “when child node receives type 2 RLF indication from single parent node, it might suspend the routing any data to that parent node.” Putting something in BAP spec, it is subtle and complicated to specify above operation since definition of “available path” should be redefined, and there also should be condition specified on the single parent node.  |
| Fujitsu | **No** |  | Up to implementation, similar to the MAC layer UL transmission. |

#### Proposal 8. FFS to specify suspending routing data to a parent node, upon receiving type-2 indication in TS xx.xxx.

## 2.2 Type-3 indication

### 2.2.1 Triggering type-3 indication

RAN2 agreed that type-3 is triggered upon successful re-establishment

|  |
| --- |
| * A node can transmit type-3 indication if re-establishment is successful. FFS whether to specify a detailed condition for success of re-establishment, e.g., successful transmission of RRC reestablishment complete. FFS whether to also include additional triggering condition such as successful transmission of ReconfigurationComplete, which is for the case the node initiates re-establishment and selects a CHO candidate cell and hence performs CHO successfully.
 |

There are other cases where a node initiates re-establishment but ends up with other procedure such as CHO or RRC setup. This is because the node may execute CHO during re-establishment if configured with CHO candidate(s) or the node may receive RRC setup in response to RRCReestablishmentRequest.

In [3][18], it is proposed to add triggering conditions of type-3 indication for those cases, i.e., there are two candidates for new type-3 triggering conditions.

* A: To trigger type-3 indication upon successful CHO executed during re-establishment [3].
* B: To trigger type-3 indication upon successful RRC setup complete as a result of re-establishment [18]

The rapporteur notes that [1] also addresses the case CHO is executed during re-establishment but takes a different approach, where it proposes to not trigger type-2 indication upon executing CHO to a cell chosen by cell selection during re-establishment. The intention of this proposal seems to avoid triggering unnecessary type-2 indications. From the rapporteur understanding, this proposal complicates triggering condition of type-2 indication; if the node is not configured with CHO, it triggers type-2 indication immediately upon initiation of re-establishment. On the other hand, if the node is configured with CHO, the node needs to *defer* triggering of type-2 indication until checking whether the selected cell during re-establishment is a CHO candidate cell or not. So the rapporteur proposes not to pursue the direction in [1].

**Q13. Do you agree to add A and B as triggering condition of type-3 indication?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Y/N for A | Y/N for B | CommentIf N, please specify desired behaviors for the concerned case.  |
| Kyocera | **Y** | Y |  |
| Huawei, HiSilicon | **N** | N | The general description “upon recovered” is sufficient. |
| Huawei | **N** | N | Agree with Huawei. From a stage-2 perspective it is just enough to state “upon BH link recovery” |
| ZTE | **Y** | N | For condition B, we think it’s already included in the condition of “success of RRC reestablishment”. In TS 38.331, it is specified that:The connection re-establishment succeeds if the network is able to find and verify a valid UE context or, if the UE context cannot be retrieved, and the network responds with an RRCSetup |
| Nokia | **Y** | N | A refers to Re-establishment as recovery procedure, while B (with Setup) seems to refer to the IAB-MT going through IDLE |
| Samsung  | **Y** | Y |  |
| vivo | **N** | N | Agree with Huawei. |
| Fujitsu | **Y** | Y |  |

#### Proposal 9: FFS type-3 indication is triggered upon successful CHO executed during re-establishment or upon successful RRC setup complete as a result of re-establishment.

### 2.2.2 Further propagation of type-3 indication

RAN2 needs to discuss whether to support propagation of type-3 indication accordingly. In principle, if further propagation of type-2 indication is supported, further propagation of type-3 indication should be supported so that the local re-routing at lower descendent nodes triggered by the propagated type-2 indication should be reversed. If type-2 propagation is supported but type-3 propagation is not supported, local re-routing triggered at descendent node cannot be reverted.

**Q14. Do you agree that if further propagation of type-2 indication is supported, further propagation of type-3 indication should be supported. If not, further propagation of type-3 indication is not supported. Received**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment (If N, specify your view) |
| Kyocera | **Y** |  |
| ZTE | **Y** |  |
| Nokia | **Y** | There should be a “clearance” for the Type-2 indication when the re-establishment has been successful. Then the descendant node(s) will become aware of the original link to be again available. |
| Fujitsu | **Y** | Depends on the result of Q6. |
|  |  |  |

If further propagation of type-3 indication is agreed, RAN2 should determine conditions for further propagation of type-3 indications. The rapporteur thinks the following condition can be considered as a baseline.

* Type-3 further propagation condition: A node forwards received type-3 indication, if it previously propagated type-2 indication.

**Q15. Do you agree that a node forwards received type-3 indication, if it previously propagated type-2 indication?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment (If N, specify your view) |
| Kyocera | **Y** |  |
| ZTE | **Y** |  |
| Nokia | **Y** |  |
| Fujitsu | **Y** |  |

#### Proposal 10: FFS A node forwards received type-3 indication, if it previously propagated type-2 indication.

### 2.2.3 Content of type-3 indication

If RAN2 agree that type-2 indication does not include any routing information, type-3 indication needs to include any routing information as well.

**Q16. Do you agree that type-3 indication does not include any routing information**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment (If N, specify your view) |
| Kyocera | **Y with comment** | We think it still depends on other discussion. Though, we assume Q16 in case it’s concluded Type 2 Indication does not include any information.  |
| Ericsson | **Y** |  |
| ZTE | **N** | It depends on the discussion of the content of type 2 indication.  |
| Nokia | **Y** |  |
| Samsung  | **Y with comment** | Same view with Kyocera |
| Fujitsu | **Y** | Same as type-2 indication. |

#### Proposal 11: FFS Type-3 indication does not include any routing information (such as recovered routing IDs).

### 2.2.4 Clarification of type-3 triggering condition - successful re-establishment

RAN2 discussed whether to further clarify successful re-establishment as type-3 triggering condition, and several contribution [2][3][4][10][14][16] provides proposals on this. Options are given as follows:

* Option1: No further clarification
* Option2: Upon successful transmission of RRCReestablishmentComplete message
* Option3: When RRC sends the RRCReestablishmentComplete message to lower layers for transmission

As summarized in [19], more companies prefer not to further clarify the condition. So it is proposed to agree to Option1. If companies see severe problem with Option1, please express your reasoning.

**Q17. Do you agree that no further clarification is needed for successful re-establishment as triggering condition of type-3 indication?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment (If N, please express your reasoning ) |
| Kyocera | **Y** |  |
| Huawei, HiSilicon | **Y** |  |
| Ericsson | **Y** |  |
| ZTE | **Y** |  |
| Nokia | **Y** | No dedicated additional clarification needs to be agreed, but stage 3 could clarify that the RLF Type-3 can be triggered when RRC sends the *RRCReestablishmentComplete* message to lower layers for transmission. |
| Samsung  | **Y** |  |
| vivo | **Y** |  |
| Fujitsu | **Y** |  |

#### Proposal 12: FFS No further clarification is needed for successful re-establishment as triggering condition of type-3 indication.

## 2.3 Terminology

The terminology of type-4 indication is FFS, i.e., we need to discuss to use either of:

* Option1: BH RLF recovery failure indication
* Option2: BH RLF indication

The summary [x] summarizes the proposals in company contributions:

|  |  |  |
| --- | --- | --- |
| Company | Classification  | Proposal |
| [1] | **Option 1** |  |
| [4] | **Option 1** | **RAN2 use the new terms “BH RLF recovery failure indication” for Type-4 RLF indication.** |
| [12] | **Option 2** | **The terminology of Type-4 indication “BH RLF indication” should NOT be changed in R17****If RAN2 deems to use “BH RLF recovery failure indication” for type 4 indication, R16 CRs should also be agreed** |
| [16] | **Option 1** | **Type-4 indication is referred to as “BH RLF recovery failure indication” from Rel-17. No changes to Rel-16 specifications are needed** |

More companies prefer to use “BH RLF recovery failure indication” for type-4 indication at least from Rel-17. So it is proposed to agree to option1.

Since this name “BH RLF recovery failure indication” is different from “BH RLF indication” which we have used since Rel-16, RAN2 should assess if there is any problem or action to resolve this misalignment across releases.

#### Proposal 13: FFS To use “BH RLF recovery failure indication” for type-4 indication from Rel-17. RAN2 assess if there is any serious issue due to misalignment between Rel-16 and Rel-17 on the name, and if there is any action needed to resolve the misalignment (e.g., having CRs from Rel-16)

**Q18. Do you agree to proposal 13 above?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N  | Comment |
| Kyocera | **N** | We slightly prefer to keep the name as it is. Though, we don’t see any technical problem if the Rel-17 name is different from Rel-16, so we can accept renaming if majority wants. In this case, we’re fine to have Rel-16 CR, if needed.  |
| Huawei, HiSilicon | **N** | We should make decision this meeting.Prefer not to change the term for type4 indication.If changed, R16 CRs are definitely needed. |
|  Ericsson | **N** | Agree with Huawei. We should avoid changing legacy definitions especially if related functionalities are not affected. Since the type-4 indication procedures/definitions are very clear from the legacy stage-2 and RRC, the terminology should be not be changed unnecessarily.  |
| Nokia | **Both options are acceptable** | This is specification clarity issue |
| Samsung  | **Y** | Although we prefer Option 1 above listed, if needed, RAN2 can discuss on the severity on any case.  |
| Vivo | **Option 1 is fine** | Agree with Nokia |
| Fujitsu | **Y** |  |

## 2.4 Other

### 2.4.1 Network controllability

In [17][18] they propose to introduce network (CU) configurability to control whether type-2 indicatin can be triggered or propagated. This issue was discussed during [AT116][32][BH RLF] and most companies think that network configuration for these is unnecessary, but no explicit agreement was captured. Hence, it seems good to explicitly conclude here, and the same applies to network controllability for type-3 indication.

**Q19. Do you agree that no network configurability on type-2 and 3 triggering/propagation is needed?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Kyocera | **N** | We think the network controllability is useful to manage the topology in general. As another example, if it comes to the deployment having Rel-16 node and Rel-17 node, in our understanding the parent node does not know whether its child nodes support Type 2/3 Indications. So, we assume the donor needs to configure the parent nodes whether to send Type 2/3 indication to its child node.  |
| Huawei, HiSilicon | **Y** | Type4 was never controlled by CU in R16. |
| Ericsson | **N** | We agree with Kyocera that it is better to have NW controllability, especially in those cases in which the child node does not perform any action upon type-2/3 reception (e.g. child Rel-16 node). However, we are also ok to follow the majority view. |
| ZTE | **Y** | The same principle as in R16 type 2 indication could be used for type 2/3 indication.  |
| Nokia | **Y** | Network configuration is unnecessary |
| samsung | **N** | We think this type of feature can be used for enhancement of UP latency reduction. In other words, not essential but for the optional feature.  |
| Vivo | **Y** |  |
| Fujitsu | **Y** |  |

#### Proposal 13 FFS No network configurability on type-2 and 3 triggering/propagation is needed.

### 2.4.2 Re-establishment to a different IAB-donor-CU

In [2], it is proposed that

*“If IAB-node re-established to a different IAB-donor-CU, it should send type-4 RLF indication to its child IAB-node”*

**Q20. Do you support the proposal in [2] that “If IAB-node re-established to a different IAB-donor-CU, it should send type-4 RLF indication to its child IAB-node”?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Kyocera | **Maybe Y** | We think if the IAB-node re-established to a different donor, the routing configurations of the (former) child nodes would be updated by the (original) donor. Also, Rel-17 will support inter-CU re-routing. So, it’s a bit unclear whether Type 4 Indication is needed from the child node’s perspective. Though, we think it’s simple the parent sends Type 4 Indication in this case, since the child node simply declares BH RLF on this link. We’re just wondering how the parent node identifies whether it re-established to a different donor.  |
| Huawei, HiSilicon | **N** | We have the inter-CU partial migration/recovery. There is no impact on the traffic path after partial migration/recovery. |
| Ericsson | **N** | Agree with Huawei. Additionally, even if the partial migration is not supported, the target CU can anyhow reconfigure all the descendant nodes so that they can continue operating under the same migrating node without affecting the underneath topology. |
| ZTE | **N** | In our understanding, the goal of inter-donor RLF recovery procedure discussed in R17 is to avoid reestablishment at descendant nodes.  |
| Nokia | **N** | The RRC re-establishment does not guarantee that BH RLF/re-routing for all traffic is resolved |
| Samsung  | **N** | During R16 discussion, companies didn’t introduce the method to control the cell selection to access the same donor node upon re-establishment procedure, and the reason was that implementation can control the IAB node to select the parent node cell under the same donor. This analogy can be applied here too. |
| Vivo | **N** | There is no need to send such indication |
| Fujitsu | **N** | UL inter-donor-DU re-routing can address this issue. |

#### Proposal 14 FFS If IAB-node re-established to a different IAB-donor-CU, it should send type-4 RLF indication to its child IAB-node

### 2.4.3 Other triggers for reverting local re-routing.

In [11], it proposes to introduce other condition for the IAB-node to revert the actions triggered by a previous Type 2 Indication other than reception of type-3 indication. A possible condition proposed in [11] is

*“when the routing configuration on the IAB-node is updated by the donor, e.g., due to an update for load balancing, handover or RRC Reestablishment. After the configuration update, the parent node may no longer be able to send Type 3 Indication, or the child node cannot receive Type 3 Indication, due to the new configuration, e.g., since the parent node is no longer the parent of child”*

**Q21. Do you support the proposal in [11] that, “if routing configuration update should be able to trigger the IAB-node to revert the actions triggered by a previous Type 2 BH RLF Indication”?**

|  |  |  |
| --- | --- | --- |
| Company | Y/N | Comment |
| Kyocera | **Y** | We think the updated routing configuration solved the BH RLFs within the topology, so it would be straightforward for the IAB-node to revert the actions triggered by reception of Type 2 Indication (i.e., without reception of Type 3 Indication).  |
| Ericsson | **N** | The use case is not very clear. If the parent changes, it means that this child IAB node has been handed-over/re-estblished to another parent, and hence it needs anyhow to be reconfigured. So the previous local routing triggered by type-2 reception will be automatically overridden by the new routing configuration. |
| ZTE | **N** | We are wondering why the actions triggered by a previous Type 2 need to be reverted after routing configuration update if the parent node is no longer the parent of child. In our view, the routing path should be regarded as not available in this case.  |
| Nokia | **N** | This may be a marginal scenario to optimize, while it might be an error prone modification to the basic Rel-17 operations. If CU is involved, it can also re-configure the receiving node of the RLF indication |
| Samsung  | **N** | During recovery of the parent node, the routing configuration cannot be received, or at least, only after the recovery completion the new configuration should be applied. So the concerned scenario seems not valid. |
| Vivo | **N** |  |
| Fujitsu | **N** | The proposal is unclear. If the parent node is no longer the parent of the child, how can the child revert the actions (route to the previous parent) triggered by a previous type-2 indication? |

#### Proposal 15 FFS If routing configuration update should be able to trigger the IAB-node to revert the actions triggered by a previous Type 2 BH RLF Indication

### 2.4.4 Issues not addressed above

Companies can kindly propose other open issues that are not addressed above but considered *important* for completion of R17 IAB BH RLF indication functionality. If time permits, we can discuss the issues during offline phase-II or at least to check if the issue is worth discussing, and if so, we can incorporate the issue into “open issue list” to be complied after the meeting as Chair proposed. To allow a quick and clear understanding of the proposed issue, companies are requested to propose issues by clearly describing that 1) issues to address, 2) solution to propose, 3) consequence if the proposed solution is not adopted in the following table:

**Q22. Issues proposed to discuss:**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Issues to address | Solution to propose | Consequence if the proposed solution is not adopted |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# 3. Conclusion

FFS

# Reference and Proposals therein

### [1] R2-2200196 QC

Open isuses on IAB RLF indications Qualcomm Incorporated discussion Rel-17 NR\_IAB\_enh

**Observation: Based on RAN3 agreement, inter-donor-DU local rerouting can always be configured via a static IP tunnel.**

**Proposal 1: If a dual-connected node observes BH RLF on only one link, which is either the SCG link or it is the MCG link with fast MCG recovery supported, type-2 RLF indication should not be transmitted.**

**Proposal 2: A type-2 indication may be propagated by the receiving node if the node has no alternative path for local rerouting.**

**Proposal 3: Add a note to stage-2 CR that a type-2 indication may trigger deactivation of IAB-supported in SIB and deactivation/reduction of SR and/or BSR transmissions at the receiving node.**

**Proposal 4: Type-2 RLF indication is not sent after RLF detection with subsequent CHO execution.**

**Proposal 5: Type-4 RLF indication is referred to as *BH RLF recovery-failure indication*.**

### [2] R2-2200323 CATT

Discussion on RLF Indications CATT discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: There is no obstacle of IAB capability for data rerouting in intra-CU inter-DU topological redundancy and inter-donor-CU topological redundancy.**

**Observation 2: Since NR DC is used to enable route redundancy in the BH, no reason for IAB-donor-CU to configure DC but not allow data rerouting.**

**Proposal 1: Type-2 RLF indication should not be triggered when one link is failed and the other is available with DC configuration.**

**Proposal 2: BAP control PDU format of type-4 RLF indication can be reused for type-2 and type-3 RLF indications, and 2 new PDU type values should be applied to indicate type-2 and type-3 RLF indication.**

**Observation3: The conditions of successful re-establishment are clear in RRC specification and there is no need to address extra details.**

**Proposal 3: For type-3 RLF indication triggered by successful re-establishment, there is no need to specify detailed conditions for success of re-establishment.**

**Observation 4: If IAB-node re-established to a different IAB-donor-CU, the sub-tree cannot be identified by the new IAB-donor-CU.**

**Proposal 4: If IAB-node re-established to a different IAB-donor-CU, it should send type-4 RLF indication to its child IAB-node.**

**Proposal 5: Propagation of type-2/type-3 RLF indication should not be supported.**

### [3] R2-2200351 INTEL

Open issues on IAB-node RLF indication Intel Corporation discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1 If local rerouting is supported at dual-connected IAB-node which detects BH RLF on any BH link, local rerouting can be performed first without sending type-2 RLF indication. Triggering local rerouting at both IAB-node which detects BH RLF and its child IAB-node is not necessary.**

**Observation 2 Local rerouting at dual-connected IAB-node can always be supported via configuration/reconfiguration by IAB-donor CU.**

**Observation 3The alternative BH link for local rerouting is considered as unavailable if it is congested. A dual-connected IAB-node should also trigger type-2 RLF indication if alternative BH link is congested.**

**Observation 4MCG link in EN-DC is not available for local rerouting, as it’s a LTE link. A dual-connected IAB-node should also trigger type-2 RLF indication if alternative BH link is MCG link in EN-DC.**

**Observation 5 Define unavailable BH link for local rerouting when any of the following conditions apply:**

**1) BH RLF; 2) receives type-4 RLF indication; 3) receive type-2 RLF indication; 4) receive flow-control feedback for congestion indication; 5) only available link is MCG link in EN-DC.**

**Proposal 0: Define unavailable BH link for local rerouting when any of the following conditions apply:**

**1) BH RLF; 2) receives type-4 RLF indication; 3) receive type-2 RLF indication; 4) receive flow-control feedback for congestion indication; 5) only available link is MCG link in EN-DC.**

**Proposal 1 Type 2 indication by dual-connected node is triggered when the node initiates RRC re-establishment resulting from BH RLF on both CGs or BH RLF on MCG with no fast MCG recovery or alternative BH link for local rerouting is unavailable.**

**Proposal 2 For inter-donor DU re-routing, local rerouting at dual-connected IAB-node can only be configured by IAB-donor CU when IP tunnel between source and target IAB-donor DU is successfully established.**

**Observation 6 The IAB-node which receives the type-2 RLF indication will not generate a type-2 RLF indication to its child IAB-node, as BH RLF is not detected on both CGs or MCG with no fast MCG recovery.**

**Observation 7 UL congestion can be avoided by deactivation of iab-support in SIB or reduction of SR/BSR transmission. There’s no need to further propagate type-2 RLF indication for the same purpose.**

**Proposal 3 IAB-node will not propagate type-2 RLF indication to its child IAB-node.**

**Proposal 4 Detailed condition for successful of re-establishment refers to “upon successful transmission of RRCReestablishmentComplete message”.**

**Proposal 5 Type-3 RLF indication is triggered upon successful transmission of RRCReconfigurationComplete message if the selected target cell during re-establishment is a CHO candidate cell.**

### [4] R2-2200405 NEC

Discussion on left issue of Type-2/3 RLF indication NEC discussion Rel-17 NR\_IAB\_enh-Core

**Proposal 1: It should be supported that type 2 indication by dual-connected node can be triggered when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic.**

**Proposal 2: BAP routing ID(s) of the traffic which needs to be re-routed is contained in the type 2 BH RLF indication.**

**Proposal 3: Propagation of type-2 indication should not be supported.**

**Proposal 4: RAN2 does not need to specify the detailed condition of successful re-establishment for transmitting Type-3 RLF indication.**

**Proposal 5：RAN2 use the new terms “BH RLF recovery failure indication” for Type-4 RLF indication.**

### [5] R2-2200562 Fujitsu

Control plane behavior at receiving BH RLF detection indication Fujitsu discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: Local re-routing cannot handle IAB-MT’s SRB.**

**Proposal 1: If a split SRB is configured, pdcp-Duplication of its PCDP entity is not configured, and the BH RLF detection indication is from MCG, then set the primaryPath to refer to SCG.**

**Proposal 2: ULInformationTransferMRDC is enhanced to carry the RRC messages which was intended to send on the link towards the parent who sends the BH RLF detection indication.**

**Proposal 3: F1-C can be enhanced to carry RRC messages.**

### [6] R2-2200563 Fujitsu

A mechanism to avoid a storm of BH RLF indication Fujitsu discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: There is no security protection for Type 2 BH RLF indication.**

**Observation 2: The trigger(s) to generate a Type 2 BH RLF indication should be restricted.**

**Proposal 1: A mechanism is introduced to avoid a storm of Type 2 BH RLF indications.**

**Proposal 2: RAN2 to select one from the following options to avoid a storm of Type 2 BH RLF indications:**

* **Option 1: only one type 2 BH RLF indication is triggered before a Type 3 BH RLF indication is generated**
* **Option 2: a prohibit timer-based mechanism**

### [7] R2-2200564 Fujitsu

RLF indication and flow control feedback from boundary node Fujitsu discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: The buffer for the previous routing ID and that for the corresponding new routing ID in the inter- -CU BAP Header Rewriting info should be shared.**

**Proposal 1: If the available buffer size of a routing ID among the new routing IDs in the inter-CU BAP Header Rewriting info for DL is low, the IAB node:**

* **Look up the previous routing ID of this routing ID in inter-CU BAP Header Rewriting info.**
* **Deliver the flow control BAP PDU containing the buffer size of this routing ID as well as the previous Routing ID to the egress link corresponding to the non-F1-terminating CU.**

**Proposal 2: If the available buffer of a routing ID is low and there is no inter-CU BAP Header Rewriting info for DL or the routing ID is not among the new routing IDs, the IAB-node delivers the flow control BAP PDU containing that routing ID to the egress link corresponding to the F1-terminating CU.**

**Proposal 3: If RLF is detected on the link corresponding to the non-F1-terminating CU, the boundary node:**

* **Determine the Routing ID(s) affected.**
* **Look up the previous routing ID(s) of the affected routing ID(s) in the inter-CU BAP Header Rewriting info for UL.**
* **Deliver the type-2 RLF indication including the previous routing ID(s) to child node.**

**Proposal 4: If RLF is detected on the link corresponding to the F1-terminating CU, or the inter-CU BAP Header Rewriting info for UL is not configured, the IAB-node determines the routing ID(s) affected and includes the routing ID(s) in the type-2 RLF indication to child node.**

### [8] R2-2200806 vivo

Remaining Issues of BH RLF vivo discussion Rel-17 NR\_IAB-Core

**Proposal 1 Where type-2 indication by dual-connected node can be triggered when (1) the node detects BH RLF on any BH link and (2) it cannot perform re-routing for affected traffic Type-2 indication may carry information of the BAP routing ID**

**Proposal 2 Type-2 indication may carry information of the BAP routing ID**

**Proposal 3 In case the IAB node cannot perform traffic re-routing on a configured link, the type-2 indication should not be propagated**

**Proposal 4 If Type-2 indication is triggered and if no alternative path is available, the node may perform re-establishment.**

**Proposal 5Type 3 BH RLF indication can be triggered in case of successful ReconfigurationComplete message transmission.**

**Proposal 6Type 3 BH RLF indication should indicate if the donor-DU has switched or not.**

**Proposal 7 When Type 3 BH RLF indicating with no topology change (i.e. no donor-DU switch) has been received, an IAB node can perform data transmission/routing as before receiving the corresponding Type 2 BH RLF indication.**

**Proposal 8 When Type 3 BH RLF indication indicating the donor-DU switch is received, the IAB node is allowed generate new BAP data PDU for UL transmission only after its BAP routing table is reconfigured.**

### [9] R2-2200837 CANON

Discussion on RLF indication enhancements CANON Research Centre France discussion Rel-17 NR\_IAB\_enh-Core D:\LG 전자\1. 3GPP 표준화 업무\3GPP WGs\3GPP RAN2\3GPP RAN2 기고문\MY\_TDOC\docs\R2-2110344.zip

**Proposal 1: A BH RLF indication may convey a list of BAP path ID(s) or BAP Routing ID(s) impacted by the RLF.**

**Proposal 2: Upon reception of a BH RLF indication from a parent IAB-node, an IAB node without any alternative path should forward the RLF indication to its own child IAB node(s).**

### [10] R2-2201051 Nokia

RLF indications and re-routingenhancements Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_IAB\_enh-Core

**Observation 1: If all possible traffic with MCG as the primary next hop can be rerouted via SCG, there is no need to send a BH RLF Type-2 indication provided that the fast MCG recovery is supported.**

**Observation 2: If all possible traffic with SCG as the primary next hop can be rerouted via MCG, there is no need to send a BH RLF Type-2 indication.**

**Observation 3: If an IAB node in DC, regardless of whether it detects MCG RLF or SCG RLF, indicates to its child nodes nothing more than that it is trying to recover from RLF, its child nodes may trigger local re-routing (and/or alter IAB-support indication in SIB, or reduce SR/BSR transmissions) unnecessarily.**

**Observation 4:Rel-16 IAB does not allow re-routing of downstream data having reached an IAB node with all downlink hops toward a given destination unavailable.**

**Observation 5: Local rerouting can be done at the IAB node if there is an alternative route to the same destination node.**

**Observation 6:In case of BH RLF, BH RLF indication may be sent to the child nodes. Rerouting may be possible at a child IAB node if an alternative path exists when the BH RLF indication is received.**

**Observation 7:Since the BAP entity may only reroute the BAP Data PDUs, which were not acknowledged by the lower layer, to an alternative path, it is not possible at the child IAB node to locally reroute the BAP PDUs which were successfully sent to the parent IAB node but not to the ancestor in case of a BH failure between the parent and ancestor nodes.**

**Proposal 1. Type-3 indication does not need to carry additional information for re-routing (CU sends routing re-configuration to the child/descendant nodes, if needed).**

**Proposal 2. The success of the re-establishment can be declared when RRC sends the RRCReestablishmentComplete -message to lower layers for transmission.**

**Proposal 3. To cover EN-DC scenarios and to have proper support for CP-UP split (Scenario 1), the RLF Type-2 indication is triggered also in case SCG fails and MCG cannot provide connection for BH data.**

**Proposal 4: In case MCG failure has been detected (i.e., for a node in DC when RRC sends the MCG failure to the MN and T316 is started) and not all possible traffic can be locally rerouted, the IAB-node shall transmit a BH RLF Type 2 indication to its child nodes.**

**Proposal 5: In case SCG failure has been detected (i.e., for a node in DC when RRC sends the SCG failure to the MN) and not all possible traffic can be locally rerouted, the IAB-node shall transmit a BH RLF Type 2 indication – “Trying to recover” to its child nodes.**

**Proposal 6: In case the SCG failure has been solved or is no longer relevant (e.g., after Secondary Node Modification or Secondary Node Change or after a Secondary Node Release with a change of the BH routing configuration so that all BAP destinations are reachable) and the node has previously sent a BH RLF Type 2 indication, the IAB-node shall transmit a BH RLF Type 3 indication – “BH link recovered” to its child nodes.**

**Proposal 7: To cope with all RLF scenarios the IAB-node should send RLF indication when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic, as suggested with Option 2b.**

**Proposal 8: For the case that only part of the traffic cannot be rerouted, the type-2 RLF indication shall contain a list of BAP-destinations (from the indicating node’s routing configuration) that are unreachable due to the RLF. The absence of this list indicates that no upstream destination is reachable via the indicating node.**

**Proposal 9: In case the MCG failure has been solved or is no longer relevant (e.g., after RRCReconfiguration with reconfigurationwithSync for the PCell or after MobilityFromNRCommand when all BAP destinations are reachable again) and the node has previously sent a BH RLF Type 2 indication, the IAB-node shall transmit a BH RLF Type 3 indication – “BH link recovered” to its child nodes.**

**Proposal 10: If a received Type-2 RLF indication contains a list of unreachable BAP destinations, local re-routing is allowed only for traffic addressed to the listed destinations.**

**Proposal 11. RAN2 to select Opt.2 (Upon reception of type-2 indication, the node should further propagate type-2 indication to the child if it has no alternative path available) as the IAB-node behaviour when receiving Type-2 RLF indication.**

**Proposal 12. Destination/routing information can be omitted in the Type-2 indication if all destinations are unreachable via that link.**

**Proposal 13. Forwarded Type-2 indication is not changed in the intermediate IAB-node(s) forwarding the indication.**

**Proposal 14: Re-routing of downstream data having reached an IAB node with all downlink hops toward a given destination unavailable is supported by:**

* **1) BAP-routing paths with a parent node as next hop, or**
* **2A) uplink indication (not accompanying data) that certain destinations are unreachable, or**
* **2B) undeliverable-indication in the header of a BAP PDU returned to parent node.**

**Proposal 15: BAP PDUs are not discarded by the BAP entity until the expiry of a BAP discard timer despite the received RLC ACKs. In case of a received type-2 or type-4 BH RLF indication, buffered PDUs are rerouted by the child IAB node via an alternative path.**

### [11] R2-2201242 Kyocera

Remaining issues of BH RLF Indications for eIAB Kyocera discussion Rel-17 D:\LG 전자\1. 3GPP 표준화 업무\3GPP WGs\3GPP RAN2\3GPP RAN2 기고문\MY\_TDOC\docs\R2-2110204.zip

**Observation 1 In EN-DC, Type 2 BH RLF Indication needs to be sent upon SCG RLF (i.e., NR link), since local rerouting cannot be performed via MCG (i.e., LTE link), whereby this scenario does not experience BH RLF from both CGs (i.e., RRC Reestablishment is not initiated).**

**Observation 2 In NR-DC with CP/UP separation, e.g., MCG is only for CP while SCG is for UP, Type 2 BH RLF Indication needs to be sent upon SCG RLF (i.e., UP link) even if MCG is still good, similar to the EN-DC case in Observation 1.**

**Observation 3 The FFS solution “Type 2 indication by dual-connected node can be triggered when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic” is applicable to all the scenarios.**

**Proposal 1 RAN2 should agree that Type 2 BH RLF Indication is sent when at least one route is unavailable upon BH RLF on any link, i.e., when local re-routing cannot be performed, regardless of whether the IAB-node is configured with single connection or dual connection, and also regardless of whether EN-DC or NR-DC.**

**Observation 4 Upon reception of Type 2 BH RLF Indication, the child node can have the option if the “partial” local rerouting is performed for better load balancing (i.e., Option B).**

**Proposal 2 RAN2 should discuss whether the "partial” local rerouting is performed at the child node (i.e., Option B), when its parent in dual connectivity experiences BH RLF.**

**Proposal 3 RAN2 should agree that Type 2 BH RLF Indication indicates the Routing IDs that are unavailable due to BH RLF.**

**Proposal 4 RAN2 should agree that the child node considers the Routing IDs to be unavailable, if these Routing IDs are indicated in received Type 2 BH RLF Indication.**

**Proposal 5 RAN2 should agree that Type 3 BH RLF Indication is sent when at least one route becomes re-available upon successful BH RLF recovery.**

**Proposal 6 RAN2 should agree that Type e BH RLF Indication indicates the Routing IDs that are re-available due to successful BH RLF recovery.**

**Proposal 7 RAN2 should agree that the child node considers the Routing IDs to be available, if these Routing IDs are indicated in received Type 3 BH RLF Indication.**

**Proposal 8 RAN2 should discuss if there is any condition, other than Type 3 BH RLF Indication, for the IAB-node to revert the actions triggered by a previous Type 2 BH RLF Indication, e.g., when the routing configuration is updated.**

**Proposal 9 RAN2 should agree that the propagation of Type 2 Indication to descendant nodes is supported. FFS on detailed condition, e.g., forwarding only if the IAB-node does not perform any local rerouting.**

**Proposal 10 RAN2 should agree to add a Note in Stage-2/3 specifications that the IAB-MT deactivates or reduces SR and/or BSR transmissions when it receives Type 2 BH RLF Indication.**

**Observation 5 The handling of IAB-Support IE is up to IAB-DU implementation, as in Rel-16.**

### [12] R2-2201301 Huawei

RLF indication and local re-routing based on flow control Huawei, HiSilicon discussion Rel-17 NR\_IAB\_enh-Core

**Proposal 1: The terminology of Type-4 indication “BH RLF indication” should NOT be changed in R17.**

**Proposal 2: If RAN2 deems to use “BH RLF recovery failure indication” for type 4 indication, R16 CRs should also be agreed.**

**Proposal 3: For the dual connected IAB-node configured with CP-UP separation, the trigger condition to send type 2 indication on the BH link level should be upon RLF on the CG configured with “F1 over BAP”.**

**Proposal 4: IAB-node may trigger the Type-2 indication upon RLF on any CG.**

**Proposal 5: The granularity of Type-2 indication can include per routing ID level.**

**Proposal 6: When constructing the Type-2 indication BAP control PDU:**

**IAB-node includes the “BH link level” in the triggered Type-2 indication, in case of RRC re-establishment.**

**IAB-node includes the “routing ID level” in the triggered Type-2 indication, in case only some routing ID(s) is not be able to be routed to the next hop (e.g. not being able to be routed due to one CG RLF in NR-DC case).**

**Proposal 7: As in R16, the trigger conditions for type 2/3 will be captured in BAP specification, rather than in RRC, with just some general descriptions.**

**Proposal 8a: IAB-MT with single parent should suspend routing any data to its parent node, upon receiving Type-2 indication on BH link level.**

**Proposal 8b: IAB-MT with single parent should suspend routing data with the indicated routing ID to its parent node, upon receiving Type-2 indication on routing ID level.**

**Proposal 9a: IAB-MT with NR-DC dual parent does not consider the BH link as available for the purpose of local re-routing, upon receiving Type-2 indication on BH link level.**

**Proposal 9b: IAB-MT with NR-DC dual parent does not consider the BH link for the indicated routing ID as available for the purpose of local re-routing, upon receiving Type-2 indication on routing ID level on the BH link.**

**Proposal 10: RAN2 does not support the propagation of Type-2 indication (i.e. child node can trigger type-2 indication based on its own radio condition).**

**Proposal 11: The granularity of flow control feedback triggered local re-routing is per routing ID.**

**Proposal 12: An egress link may be not considered to be available for a BAP routing ID, if it is determined as congested based on the received flow control feedback.**

### [13] R2-2201306 Samsung

RLF indication related issues Samsung R&D Institute UK discussion

**Proposal 1. RAN2 agree that successful transmission of RRCReestablishmentComplete message can trigger type 3 indication to the former parent IAB node which sent type 2 indication.**

**Proposal 2. RAN2 agree that successful transmission of RRCReconfigurationComplete message can trigger type 3 indication to the former parent IAB node which sent type 2 indication when attemptCondReconfig was configured to this IAB node.**

**Observation 1. In the inter donor redundancy case, new routing ID written by header rewriting configuration cannot be understood by the source path topology since new routing ID is configured for the target path topology**

**Proposal 3. RAN2 discuss and conclude the availability of the new routing ID written by header rewriting configuration when local rerouting is executed with this routing ID.**

**Proposal 4. RAN2 discuss the solution and agree one of two: not executing the header rewriting (or fallback to the original routing ID) OR sending type 2 RLF indication to the child node(s).**

**Proposal 5. RAN2 discuss the pros and cons on propagation of type 2 indication, and decide the adoption of type 2 indication propagation feature.**

### [14] R2-2201349 ZTE

Remaining issues on RLF indication ZTE, Sanechips discussion Rel-17

**Proposal 1: Type 2 indication by dual-connected node can be triggered when the node detects BH RLF on any BH and it cannot perform re-routing for affected traffic, so that local re-routing or other actions could be taken at its child/descendant nodes if possible.**

**Proposal 2: There is no need to specify a detailed condition for success of re-establishment, i.e. it could be up to MT implementation.**

**Proposal 3: Type 2/3 indication should be propagated to descendant nodes so that corresponding actions could be taken at descendant nodes, e.g., local rerouting.**

**Proposal 4: BAP routing ID information needs to be included in the type2 indication sent by a single-connected node or a dual-connected node.**

**Proposal 5: BAP routing ID of path that has recovered needs to be included in type 3 RLF indication.**

**Proposal 6: For descendant nodes, if type 2 RLF indication has been sent to child IAB-MT, type 3 RLF indication needs to be transmitted to child IAB-MT after reception of type 3 RLF indication which includes BAP routing ID.**

### [15] R2-2201388 Futurewei

Open Issues for RLF indications for dual-connected IAB nodes Futurewei Technologies discussion

**Observation 1: A BH RLF detection indication (Type-2 BH RLF indication) warns descendant nodes of a transient condition which the IAB node is likely to recover from quickly.**

**Observation 2: To achieve preferential rerouting at an IAB node in response to receiving a BH RLF detection indication, it suffices for the indication to identify which of the parent IAB node’s UL BH links (MCG or SCG BH link) is not available. The IAB donor can configure the routing table of each child to trigger rerouting of specific routing IDs, if needed, in response to the BH RLF detection indication.**

**Proposal 1: RAN2 will minimize the complexity of the BH RLF detection indication solution.**

**Proposal 2: A dual-connected IAB node does not transmit a BH RLF detection indication if all the traffic routed via a backhaul link experiencing RLF can be rerouted via an alternate BH link.**

**Proposal 3: The BH RLF detection indication does not indicate routing ID information of traffic that can not be rerouted by an IAB node.**

**Proposal 4: Both the BH RLF detection indication and the BH RLF recovery indication transmitted by a dual-connected IAB node shall indicate the availability of its MCG and SCG BH links. The details of how this information is reported within the BH RLF indications, and how a child node is configured to react to this information is FFS.**

### [16] R2-2201468 LGE

 Resolving open issues on BH RLF indications LG Electronics discussion Rel-17

**Proposal 1: A dual-connected node triggers type-2 indication when if both conditions are met: a) when the node detects BH RLF on any BH and b) it cannot perform re-routing for affected traffic.**

**Proposal 2: Type-2 indication triggered by dual-connected node includes routing ID information indicating which routing IDs are not available.**

**Proposal 3: Type-2 indication triggered by single-connected node does not include routing ID information.**

**Proposal 4: Upon reception of type-2 indication, the node does not propagate type-2 indication, regardless of whether the node has no alternative path available.**

**Proposal 5: Type-3 indication can be triggered no earlier than submission of RRCReestablishmentComplete from RRC to lower layers.**

**Proposal 6: Type-3 indication can be triggered no earlier than a successful CHO to a cell during re-establishment procedure.**

**Proposal 7: Type-4 indication is referred to as “BH RLF recovery failure indication” from Rel-17. No changes to Rel-16 specifications are needed.**

### [17] R2-2201607 Ericsson

On Local Routing and Type 2/3 RLF Handling Ericsson discussion NR\_IAB\_enh-Core

**Observation 1 If IAB Rel-16 mechanism for local re-routing (due to RLF) is adopted for link congestion scenario, then IAB-donor-CU does not need to configure specific alternative egress link to be used for local congestion mitigation.**

**Observation 2 When a dual-connected parent IAB node experiences an RLF in one of the two upstream links, it can perform local re-routing of the traffic from the problematic link to the other available link.**

**Proposal 1 RAN2 agree to adopt the IAB Rel-16 re-routing mechanism for local link congestion case, i.e. the alternative link is selected among the entries in the routing table matching the BAP destination in the BAP header.**

**Proposal 2 RAN2 to ask RAN3 to introduce a threshold on the available buffer size for the purpose of local re-routing, that may be provided by the CU to the IAB node DU.**

**Proposal 3 The IAB node may enable local re-routing if the available buffer size is below the configured threshold.**

**Proposal 4 How to deal with the case in which all links in the DL are congested is left to the IAB node DL scheduler implementation.**

**Proposal 5 Local routing can imply re-routing of congested BH RLC channel ID(s) or of congested BAP routing IDs.**

**Proposal 6 Whether type-2 RLF can be transmitted or not by an IAB node is configurable by the CU.**

**Proposal 7 For a dual-connected parent IAB node, the type-2 RLF should be transmitted to the child IAB node only when both upstream links are unavailable due to BH RLF.**

**Proposal 8 The granularity of the type-2 RLF indication is per BH link, as the type-4 RLF.**

**Proposal 9 If the IAB node performs local routing upon reception of type-2 RLF or BH RLF, Rel-16 re-routing principles are used, i.e. the alternative link is selected among the entries in the routing table matching the BAP destination in the BAP header.**

**Proposal 10 A received type-2 RLF is not propagated.**

**Proposal 11 Specify in the stage-2 and BAP specification that the type-3 indication is transmitted upon successful BH RLF recovery.**

### [18] R2-2201644 InterDigital

On BH RLF indications in IAB InterDigital discussion Rel-17 NR\_IAB\_enh-Core Late

**Observation 1: Even if one of the backhaul links of a dual connected IAB node is functioning well, the IAB node may not be able to re-route the packets that were mapped originally mapped to the link being recovered.**

**Proposal 1: A dual connected IAB node will send a type-2 RLF indication to a child node upon detecting an RLF on the MCG or SCG link, if any destination BAP routing ID that is mapped to the failed link can not be rerouted via the other functioning link.**

**Proposal 2: Type-2 RLF indication may include information regarding the impacted destination BAP routing ID(s). If no such information is provided, child nodes will assume that all destination BAP routing IDs are not temporarily routable via the IAB node that sent the type-2 indication.**

**Proposal 3: A node receiving a type-2 RLF indication may propagate the indication further to a child node, if it is not able to reroute packets via an alternate link/path.**

**Proposal 4: The propagation of type-2 RLF indication is network configurable.**

**Proposal 5: A node that has sent a type-2 RLF indication will send a type-3 indication to child nodes upon sending one of the following messages to a target cell:**

* **RRCReestablishmentComplete**
* **RRCSetupComplete**
* **RRCReconfigurationComplete**

### [19] R2-2201692 Summary of AI 8.4.2.1 (BH RLF indication)