**3GPP TSG RAN WG1 Meeting #109-e R1-22xxxxx**

**9th May *–* 20th May2022**

**Agenda Item:** 8.10

**Source:** Moderator **(**Qualcomm Incorporated)

**Title:** Summary #1 of [109-e-R17-eIAB-01]

**Document for:** Discussion and decision

# Introduction

This contribution provides a summary of the following email discussion:

[109-e-R17-eIAB-01] Issues #3, #11, #12, #15 by May 13 – Luca (Qualcomm)

* 1st check point: May 13
* Final check point: May 20
* RAN2 related issues to be finalized by 1st check point

The referenced issues #3, #11, #12, and #15 were identified in the preparation phase [109-e-Prep-AI8.10-eIAB] based on the contributions [1] – [13] and were prioritized for discussion given their impact on upper layer parameters signaling.

Discussion topics are purple background highlighted.

FL agreements or conclusions from email discussion and/or online sessions are green background highlighted.

Active discussion items for which companies’ input is sought are yellow background highlighted.

Inactive discussion topics are grey highlighted.

New text from the moderator in each round of discussion after the initial revision is highlighted in green.

# Summary

This discussion covers 4 issues identified based on the contributions [1] – [13] submitted for agenda item 8.10.

These issues have been selected because they relate to existing upper layer parameters (priority 1).

**Issue #3: Range of DL Tx power adjustment (MAC-CE issue flagged by RAN2)**

* References: [1], [2], [10], [13]
* Limited upper layer signaling impact – priority 1

**Issue #11. Slot index indication (MAC-CE issue flagged by RAN2)**

* References: [2], [13]
* Limited upper layer signaling impact – priority 1

**Issue #12. Child IAB-DU Restricted Beam indication (MAC-CE issue flagged by RAN2)**

* References: [3], [13]
* Limited upper layer signaling impact – priority 1

**Issue #15. IAB-MT recommended beams (MAC-CE issue flagged by RAN2)**

* References: [13]
* Limited upper layer signaling impact – priority 1

# Discussion

## Issue #3. Range of DL power adjustment

This issue relates to the definition of the numerical value for the endpoints of the DL Tx power adjustment, a FFS point from RAN1#108-e. This issue was flagged in the WI exception [14].

Related input from contributions:

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| Huawei[1] | ***Proposal 3: For the range of DL power adjustment, the following two alternatives can be considered:**** ***Alt 1: Reuse the range of powerControlOffset in NZP-CSI-RS-Resource as [-8, 15]***
* ***Alt 2:*** ***Extend the range of negative part as [-15, 8]***
 |
| Nokia[2] | ***Observation 2.3: RAN4 guidance is necessary to reach agreement on range of values supported for desired and indicated DL Tx power adjustment.*** |
| Ericsson]10] | Proposal 12. DL Tx power adjustment range is [-5 … 5] dB for wide area IAB-nodes and [-10 … 10] dB for local area IAB-nodes. |
| Qualcomm[13] | RAN1 sought further guidance in this regard to RAN4 during RAN1#108-e [R1-2202877] |

**Summary of views:**

* [2], and [13] suggested to wait for further RAN4 guidance.
* [1] proposed two alternatives:
	+ *Alt 1: Reuse the range of powerControlOffset in NZP-CSI-RS-Resource as [-8, 15]*
	+ *Alt 2: Extend the range of negative part as [-15, 8]*
* [10] proposed the following:
	+ *[-5 … 5] dB for wide area IAB-nodes and [-10 … 10] dB for local area IAB-nodes.*

Based on the input on this issue and considering that:

a) in RAN1#108-e RAN1 asked (again) RAN4 to provide guidance on this issue, and

b) the numerical definition of the endpoints does not have a major impact on the signaling design given the bitwidth (5 bits) and resolution (1dB) have been agreed in RAN1#108-e,

it is proposed to wait for the LS reply from RAN4 before finalizing the guidance to RAN2 for the numerical value of the endpoints of the range.

**FL Proposal 3.1a**

**RAN1 to wait for reply LS to R1-2202877 from RAN4 before finalizing the numerical value of the endpoints for the range of the DL Tx power adjustment, and to inform RAN2 of the same.**

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| **Company** | **Do you agree with FL Proposal 3.1a?** | **Comments** |
| ETRI | Yes |  |
| ZTE, Sanechips | Yes |  |
| Ericsson | Agree |  |
| LG | Yes | LG |

##  Issue #11. Slot index indication

This issue relates to some required clarifications for RAN2 on the meaning of “slot index” in the context of MAC-CE signaling defined by RAN1 as part of the upper layer parameters for eIAB. This issue was flagged in the WI exception [14].

Related input from contributions:

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| Nokia[2] | ***Observation 2.2: No further discussion is necessary for slot index association with any of the Rel-17 eIAB MAC-CEs.*** |
| Qualcomm[13] | **Proposal 2.1a****The term “slot index” indicates a list of slots.****Proposal 2.1b****Each slot within the periodicity should be assigned a case value.** **Proposal 2.1c****It is up to RAN2 to decide whether one of the case values is considered the default.****Proposal 2.1d****The starting slot for periodicity needs to be known by the receiving side of the MAC-CE.** **Proposal 2.1e****It is up to RAN2 to decide whether to explicitly convey the starting slot of periodicity, and how.****Proposal 2.1f****RAN1 does not preclude that a large fraction of the slots in the periodicity may use case-6 and/or case-7 timing.** |

**Summary of views:**

* [2]: no further discussion is necessary
* [13] proposed the following clarifications:
	+ The term “slot index” indicates a list of slots.
	+ Each slot within the periodicity should be assigned a case value. It is up to RAN2 to decide whether one of the case values is considered the default.
	+ The starting slot for periodicity needs to be known by the receiving side of the MAC-CE. It is up to RAN2 to decide whether to explicitly convey the starting slot of periodicity, and how.
	+ RAN1 does not preclude that a large fraction of the slots in the periodicity may use case-6 and/or case-7 timing.

**FL Proposal 3.2a**

**RAN1 to inform RAN2 on the following in regard to the term “slot index” for the timing case in the context of the MAC-CEs Time Case Indication, IAB-MT Recommended Beam Indication, Child IAB-DU Restricted Beam Indication, Desired DL Tx Power Adjustment, DL Tx Power Adjustment, and Desired IAB-MT PSD Range:**

* **The term “slot index” indicates a list of slots.**
* **Each slot within the periodicity should be assigned a case value.**
* **It is up to RAN2 to decide whether one of the case values is considered the default.**
* **The starting slot for periodicity needs to be known by the receiving side of the MAC-CE.**
* **It is up to RAN2 to decide whether to explicitly convey the starting slot of periodicity, and how.**
* **RAN1 does not preclude that a large fraction of the slots in the periodicity may use a given timing case value.**

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| **Company** | **Do you agree with FL Proposal 3.2a?** | **Comments** |
| ETRI | Partially yes. | From our understanding, this “slot index” signaling for each feature is optional, which means that the application time is up to IAB node implementation with the absence of the “slot index” indication.(In this case, IAB node does not need any default value for the slot index.)We suggest the following modifications:**RAN1 to inform RAN2 on the following in regard to the term “slot index” for the timing case in the context of the MAC-CEs Time Case Indication, IAB-MT Recommended Beam Indication, Child IAB-DU Restricted Beam Indication, Desired DL Tx Power Adjustment, DL Tx Power Adjustment, and Desired IAB-MT PSD Range:*** **The term “slot index” indicates a list of slots.**
* **~~Each slot within the periodicity should be assigned a case value.~~**
* **~~It is up to RAN2 to decide whether one of the case values is considered the default.~~**
* **~~The starting slot for periodicity needs to be known by the receiving side of the MAC-CE.~~**
* **~~It is up to RAN2 to decide whether to explicitly convey the starting slot of periodicity, and how.~~**
* **~~RAN1 does not preclude that a large fraction of the slots in the periodicity may use a given timing case value.~~**
 |
| ZTE, Sanechips | Agree in principle | ETRI’s update is fine to us |
| Ericsson | Partially agree | Regarding the first bullet, “Slot index” is logically a list, but it does not imply that it is best represented as such.Regarding the fifth bullet, starting slot and periodicity is not up to RAN2 to decide; it should be as for H/S/NA (all these configurations are because of MT/DU half-duplex constraint, the missing full-duplex assumption) |
| LG | Yes | Generally fine with the proposal. It is our understanding that it is up to RAN2 about the details however the principle should be decided in RAN1. About the default cases, we are open to discuss. |

## Issue #12. Child IAB-DU Restricted Beam indication

This issue relates to some clarifications about the child IAB-DU restricted beam indication. One aspect relates to the applicability of the indication to TDM multiplexing mode, since no agreement is precluding it.

The second aspect, which has higher priority for the discussion, relates to required clarifications to RAN2 based on the related RAN2 discussion [15]. Specifically, there is uncertainty on the interpretation of the following agreement:

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| RAN1#107-e Agreement**In addition to SSB ID, CSI-RS ID may be additionally used as the RS ID for a restricted beam indication from the parent node to the**IAB**node.*** STC index may be additionally indicated along with SSB ID if more than one STC is configured at the IAB node.
* Note: This does not mean that IAB-specific CSI-RS should be developed and requires no additional specification work
 |

If taken literally, the agreement would allow that *any* of the following 5 alternatives can be configured:

* SSB index
* STC index + SSB index
* CSI-RS index
* SSB index + CSI-RS index
* STC index + SSB index + CSI-RS index

Related input from contributions:

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| ZTE[3] | 1. There is no agreement that restricted beam is only applied to non-TDM multiplexing mode.
2. There are some benefits for CLI if restricted beam is also applied to TDM multiplexing mode.
3. Adopt the following Text proposal on restricted beam in TS38.213:

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| The IAB-node can be provided by the parent node a set of RS resource indexes that indicate quasi co-location properties of an IAB-DU cell where ~~simultaneous transmission/reception from the IAB-MT and~~ transmission from the IAB-DU cells is restricted by Child IAB-DU Restricted Beam Indication MAC CE as described in [11, TS 38.321]. The IAB-DU does not transmit on a cell ~~if the IAB node is operating in a non-TDM multiplexing mode~~ using an indicated RS resource index on a symbol or RB set configured as soft in an IAB-DU cell- when it is not indicated as available by *resourceAvailability* |

 |
| Qualcomm[13] | **Proposal 2.2****For the child IAB-DU Restricted Beam indication, only SSB or STC+SSB or CSI-RS is used for a given beam.**  |

**Summary of views:**

* [3] has a TP to extend the applicability of Child IAB-DU Restricted Beam Indication to TDM mode too since no explicit agreement is precluding this.
* [13] proposed the following clarification:
	+ For the child IAB-DU Restricted Beam indication, only SSB or SSB+STC or CSI-RS is used for a given beam.

**FL Proposal 3.3.1a**

**Adopt the following TP for TS38.213 clause 14:**

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| The IAB-node can be provided by the parent node a set of RS resource indexes that indicate quasi co-location properties of an IAB-DU cell where ~~simultaneous transmission/reception from the IAB-MT and~~ transmission from the IAB-DU cells is restricted by Child IAB-DU Restricted Beam Indication MAC CE as described in [11, TS 38.321]. The IAB-DU does not transmit on a cell ~~if the IAB node is operating in a non-TDM multiplexing mode~~ using an indicated RS resource index on a symbol or RB set configured as soft in an IAB-DU cell- when it is not indicated as available by *resourceAvailability* |

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| **Company** | **Do you agree with FL Proposal 3.3.1a?** | **Comments** |
| ETRI | No | The WI was for non-TDM but not for TDM. |
| ZTE, Sanechips | Yes | The motivation of the update is to allow restricted beam indication form the parent node to its child node for interference management purpose, it will be benefit even when the child node operates in TDM mode. |
| Ericsson | Disagree | Beam restrictions have only been discussed in the context of enhancements for supporting of simultaneous operation. RAN1 already concluded in RAN1#106-bis that RAN1 does not discuss further proposals for IAB interference management enhancements. By agreeing to the above TP, it would mean a completely new purpose for restricted beam indication and an extended interference cancellation relative to gNBs by other means than what is typically the case for gNBs. That is not within the scope of Rel-17 IAB. |
| LG | Need some clarifications. | Some clarification on the agreements seems required.According to the following agreement, it is understood that restricted beam is applied during simultaneous operation.Agreement in RAN1#105-eIn case of simultaneous MT/DU operation, * the parent node can dynamically indicate to the child node at least a set of restricted beams at the IAB-DU of the child node

On the other hand, the restricted beam can be indicated with the associated multiplexing mode.If a restricted beam indication is associated with a multiplexing mode and TDM operation is applied for the multiplexing mode, it seems that the restricted beam indication can be applied even for TDM operation.So, it seems necessary to clarify whether restricted beam indication can be given for multiplexing mode applying TDM. |

**FL Proposal 3.3.2a**

**For the child IAB-DU Restricted Beam indication, only SSB or SSB+STC or CSI-RS is used for a given beam.**

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| **Company** | **Do you agree with FL Proposal 3.3.2a?** | **Comments** |
| ETRI | Yes. |  |
| ZTE, Sanechips | Yes |  |
| Ericsson | Agree |  |
| LG | Agree |  |

##  Issue #15. IAB-MT recommended beams

This issue relates to required clarifications to RAN2 based on the related RAN2 discussion [15]. Specifically, there is uncertainty on the interpretation of the following agreement:

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| RAN1#107-e Agreement**The recommended beam indication from the IAB-MT to the parent node are provided using the following:*** **For DL Rx beam(s)**
	+ DL TCI state ID and RS ID (SSB ID and/or CSI-RS ID)
* **For UL Tx beam(s)**
	+ **SRI**
 |

There seems to be uncertainty on the combinations to be supported with this definition. If taken literally, *any* subset of the following 4 indications can be used for each beam:

* (DL Rx beam indication): TCI index (7 bits)
* (DL Rx beam indication): SSB index (6 bits)
* (DL Rx beam indication): CSI-RS index (8 bits)
* (UL Tx beam indication): SRI index (6 bits)

Moreover, there seems to be uncertainty if even a combination of DL Tx beam indication can be included together with an UL Tx beam indication.

 **Summary of views:**

* [13] proposed the following clarifications:
	+ Only one of DL Rx beam indication or UL Tx beam indication can be used for a specific beam.
	+ For DL RX beam indication, either TCI index or SSB or CSI-RS can be used for a specific beam.

**FL Proposal 3.4.1a**

**The recommended beam indication includes either a DL Rx beam or an UL Tx beam.**

**The recommended beam indication for a DL Rx beam includes either a TCI index or a SSB index or a CSI-RS index.**

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| **Company** | **Do you agree with FL Proposal 3.4.1a?** | **Comments** |
| ETRI | Need some clarifications. | Since we have the following agreements on the number of maximum recommended/restricted beams per MT CC / DU cell, we think the total number of DL/UL beams indicated by the single or multiple recommended beam indication(s) could be equal to or smaller than 8 in a given MT CC.**Agreement*** The maximum number of recommended beams per MT CC in a given indication (including all associated parameters/conditions) is 8.
* The maximum number of restricted beams per DU cell in a given indication (including all associated parameters/conditions) is 8.

Does the proposal preclude IAB-MT recommendations on both DL beams and UL beams?* If yes, what is the reason for such restriction?
* If not, does it mean that there could be four different types of recommended beam indication for each of TCI, SSB, CSI-RS, SRI?

Per the answers for the questions above, we think the following revisions can be considered for more clarity.**Possible revisions on FL Proposal 3.4.1a.*** **~~The~~ Each recommended beam indication includes either a DL Rx beam or an UL Tx beam.**
* **~~The~~ Each recommended beam indication for a DL Rx beam includes either a TCI index or a SSB index or a CSI-RS index.**
* **Note: As agreed in RAN1#107-e, the total number of DL/UL beams indicated by the single or multiple recommended beam indication(s) should be equal to or smaller than 8 in a given MT CC.**
 |
| ZTE, Sanechips |  | We are fine with ETRI’s update. |
| Ericsson | Agree |  |
| LG | Need some clarifications. | It is our understanding that recommended beam for DL Rx beam and UL Tx beam is independently indicated.One of TCI index or SSB ID or CSI-RS ID is used for DL Rx beam indication and SRI is used for UL Tx beam indication.We understand that up to 8 restricted beams can be indicated for each of the DL Rx beam and UL Tx beam. But, it would be good to clarify. |

# References

[1] R1-2203078   Remaining issues on R17 IAB enhancements, Huawei, HiSilicon

[2] R1-2203353   Maintenance on Enhancements to Integrated Access and Backhaul, Nokia, Nokia Shanghai Bell

[3] R1-2203359   Maintenance on enhancements to IAB, ZTE, Sanechips

[4] R1-2203523   Maintenance on Enhancements to Integrated Access and Backhaul, vivo

[5] R1-2203763   Discussions on enhancements to resource multiplexing between child and parent links of an IAB node, CEWiT

[6] R1-2203871   Maintenance on Enhancements to NR IAB, Samsung

[7] R1-2204351   Maintenance on Enhancements to Integrated Access and Backhaul, NTT DOCOMO, INC.

[8] R1-2204413   Resource multiplexing in enhanced IAB systems, Lenovo

[9] R1-2204528   Remaining details on enhancements to IAB, LG Electronics

[10] R1-2204640 Maintenance on enhanced IAB, Ericsson

[11] R1-2204648 Discussions on eIAB maintenance, ETRI

[12] R1-2204777 Remaining details on Frequency-domain Resource Multiplexing for IAB, Intel Corporation

[13] R1-2204992 Remaining issues on eIAB, Qualcomm Incorporated

[14] RP-220519, 3GPP TSG RAN Meeting #95e, Electronic Meeting, March, 2022

[15] R2-224093, 3GPP RAN TSG WG2 Meeting #117-e, Electronic Meeting, February-March, 2022