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

**9th May *–* 20th May2022**

**Agenda Item:** 8.10

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

**Title:** Summary of [109-e-Prep-AI8.10-eIAB]

**Document for:** Discussion and decision

# Introduction

This contribution provides a summary of the email discussion [109-e-Prep-AI8.10-eIAB] for the preparation phase for eIAB (agenda item 8.10), based on the contributions [1] – [13].

# Summary

There are 16 issues identified based on the contributions [1] – [13] submitted for agenda item 8.10.

The issues have been classified with regard to their potential impact to upper layers parameters signaling. Based on the guidance from the Chairman the issues related to upper layer parameters shall be addressed with priority in the first week of RAN#109-e, so that a LS to RAN2/RAN3 can be sent by Friday 5/13.

As a result, it is proposed to prioritize the issues related to existing upper layer parameters (priority 1). The issues with potential impact to signaling are proposed to be addressed as the next level of priority, but still during the first week (priority 2). The third priority level is reserved for all other issues that do not have potential impact to upper layer signaling (priority 3).

The following issues have been identified:

**Issue #1. Coexistence between Rel-16 and Rel-7 H/S/NA configuration**

* References: [1], [2], [3], [4], [5], [6], [8], [9], [10], [11], [12], [13]
* Potential upper layer signaling impact – priority 2

**Issue #2. CSI acquisition with DL Tx power adjustment**

* References: [1], [9], [11]
* Potential upper layer signaling impact – priority 2

**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 #4. Extension of DCI format 2\_5 payload size**

* References: [2], [3], [10], [11], [12]
* Potential upper layer signaling impact – priority 1

**Issue #5.** **Default H/S/NA denomination for RB sets for which the Rel-17 H/S/NA configuration does not specify a value**

* References: [2], [3], [8], [9], [10], [12]
* No upper layer signaling impact – priority 3

**Issue #6.** **Handling of multiple DCI format 2\_5 indications with overlapping durations**

* References: [3], [11]
* No upper layer signaling impact – priority 3

**Issue #7. Brackets in definition of H/S/NA for RB set**

* References: [6], [7], [10], [13].
* No upper layer signaling impact – priority 3

**Issue #8. DCI format 2\_5 for FDM and TDM**

* References: [3], [6], [9], [10]
* Potential upper layer signaling impact – priority 2

**Issue #9. Extension of exception for cell-specific/semi-static signals to soft or not available RB sets**

* References: [7], [9], [13]
* No upper layer signaling impact – priority 3

**Issue #10.** **Update to determination of availability in DC scenario**

* References: [13]
* No upper layer signaling impact – priority 3

**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 #13. DL Tx power adjustment MAC-CE**

* References: [13]
* No upper layer signaling impact – priority 3

**Issue #14. Descriptions of MT’s UL MAC-CEs**

* References: [13]
* No upper layer signaling impact – priority 3

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

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

**Issue #16. Alignment of parameters names**

* References: [13]
* No upper layer signaling impact – priority 3

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| **Priority** | **Issues** |
| 1 | #3, #4, #11, #12, #15 |
| 2 | #1, #2, #8 |
| 3 | #5, #6, #7, #9, #10, #13, #14, #16 |

Additional details on the identified issues are provided in section 3.

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| **Company** | **Comments on the classification and prioritization of the issues?** |
| Ericsson | Regarding Issue #5, depending on the choice of resolution, new signalling may be required for the explicit availability indication. Hence, Issue #5 should be priority 2.Regarding Issue #6, our contribution R1-2204640 is also addressing this matter. |
| NTT DOCOMO | We are fine with the FL assessment. |
| Samsung | Issue #4 should be priority 2 because it is assessed by the moderator that it may have potential upper layer signaling impact. We are OK with priority of other issues. |
| Huawei, HiSilicon | Agree with FL’s analysis. Issue #4 seems to belongs to priority 2 given the “potential” UL layer impact. |
| Vivo | We agree with FL’s observation. However, if the intention is to decide which topic to be discussed from the first week, we can merge the issues in priority 1 and priority 2 in a single priority. |
| ZTE, Sanechips | We support FL’s assessment in principle.For issue #4, we also share similar view with Samsung and Huawei, it should be priority 2. |
| Intel | We support FL’s assessment in general. For Issue#4, we agree with Samsung/Huawei/ZTE that it should be priority 2. Also, regarding the bracket numbers in the following RAN1#108e agreement. We are wondering whether the discussion is included in Issue#4 or a separate issue. * *For the RRC signaling for the configuration of DCI Format 2\_5*
	+ *Number of RB set groups has a max value of [8] within a slot.*
	+ *Number of RB sets for each group has a max value of [8].*
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# Additional details on identified issues

## Issue #1. Coexistence between Rel-16 and Rel-7 H/S/NA configuration

The following related working assumption, agreement and conclusion were made in previous RAN1 meetings:

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| **RAN1-106bise working assumption:** If both the Rel-16 time domain H/S/NA configuration and Rel-17 frequency domain H/S/NA configuration are provided for a given RB set within a slot, one of the following is selected:* Alt. 1: An IAB node applies the frequency domain H/S/NA only if the IAB node is currently operating in a non-TDM multiplexing mode in the slot, otherwise the Rel-16 time domain H/S/NA configuration is applied.
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| **Agreement: (RAN1-107e)** Whether or not an IAB node can operate under a given non-TDM multiplexing mode (i.e. multiplexing info in 38.473) is left to IAB implementation in Rel-17 |

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| **Conclusion (RAN1-108e)***Defer discussion (contribution driven) about potential specification impact for conflict resolution between parent and child IAB nodes in case the Rel-17 H/S/NA configuration is provided but the IAB node needs to instead operate according to the Rel-16 H/S/NA configuration (based on its implementation as agreed previously in RAN1#107-e) in the slot until RAN#109-e.* |

**Summary of views:**

* Confirmation of the WA
	+ Supported by [4], [5], [6], [10] (and possibly [2], [9], [12])
* Suggesting*“apply Rel-17 frequency domain H/S/NA, when both Rel-16 time domain H/S/NA configuration and Rel-17 frequency domain H/S/NA configuration are provided for a given RB set within a slot”.*
	+ Proposed by [1], [3], [13]
* One company [8] proposed *“Specify rules to determine the HSNA pattern based on a combination of Rel-16 and Rel-17 configurations”*.

**Potential new signaling:**

* A few companies proposed to support new signalling, from IAB-node to parent-node or from parent-node to IAB-node, to indicate/authorize the [expected] multiplexing mode
	+ IAB-node to parent-node: [4], [5], [6], [9], [10], [12]
	+ Parent-node to IAB-node:[4], [5]

## Issue #2. CSI acquisition with DL Tx power adjustment

**Summary of views:**

* [1] observed: “*For a given CSI report, the gNB should be able to differentiate whether DL TX power adjustment is accounted when deriving the CSI*”, and proposed “*either use a separate CSI report for the CSI feedback or extend the CSI report to include results for both assumptions*”
* [9] and [11] have TPs for 38.214.

## Issue #3. Range of DL power adjustment

**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.*

## Issue #4. Extension of DCI format 2\_5 payload size

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| **Conclusion (RAN1-108e)**Defer discussion (contribution driven) about extending the maximum payload size of DCI format 2\_5 to increase the number of IAB-DU cells that can be provided with availability information for soft resources until RAN1#109-e.  |

**Summary of views:**

* [2], [10] proposed to extend the payload size
	+ [140bits]
	+ FFS: introduce group indexing bits
* [11] proposed to extend the payload size *“only if a clear use case requiring more than 14 virtual cell groups can be clarified”*
* [3], [12] suggested no extension is needed.

## Issue #5. Default H/S/NA denomination for RB sets for which the Rel-17 H/S/NA configuration does not specify a value

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| **Conclusion (RAN1-108e)***Defer discussion (contribution driven) about potential specification impact if the configured RB sets of an IAB-DU HSNA resource configuration do not cover the entire carrier bandwidth until RAN1#109-e.* |

**Summary of views:**

* [2] proposed to treat theses RBs as NA
* [3], [8], [9], [12] proposed to adopt Rel-16 HSNA configuration for these RBs
* [10] and [12] also proposed that if these RBs do not overlap with IAB-MT’s active BWPs, treat them as Hard.

## Issue #6. Handling of multiple DCI format 2\_5 indications with overlapping durations

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| **Conclusion (RAN1-108e)***Defer discussion (contribution driven) of potential issues/solutions for multiple DCI Format 2\_5 indications with overlapping durations until RAN1#109-e.*  |

**Summary of views:**

* [3] proposed to reuse Rel-16 mechanism
* [11] proposed to clarify that there is no issue, with proper configuration.

## Issue #7. Brackets in definition of H/S/NA for RB set

RAN1#108-e achieved the following agreement, in which there are some clauses in the brackets that may need further discussions and clarifications.

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| **Agreement (RAN1-108e)**Adopt the following definition for H/S/NA configured in an RB set of a symbol:* FDM Hard: When an RB set of a downlink, uplink, or flexible symbol is configured as hard, the IAB-DU cell can respectively transmit, receive, or either transmit or receive on the RB set in the symbol [provided it does not impact the IAB-MT’s ability to transmit and receive in any other RB set that is configured as *Not Available* or configured as *Soft* and not indicated available].
* FDM Soft: When an RB set of a downlink, uplink, or flexible symbol is configured as soft, the IAB-DU cell can respectively transmit, receive or either transmit or receive on the RB set in the symbol only if
	+ the IAB-MT does not transmit or receive on the RB set during the symbol of the IAB-DU cell, or
	+ with respect to all serving cells,
		- the IAB-MT would transmit or receive on the RB set during the symbol of the IAB-DU cell, and the transmission or reception on the RB set [or any ~~adjacent~~ RB set that is configured as Not Available or configured as Soft and not indicated available] during the symbol of the IAB-DU cell is not changed due to a use of the RB set in the symbol by the IAB-DU, or
	+ if the IAB-MT is not configured with SCG
		- if the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft RB set as available
	+ if the IAB-MT is configured with SCG
		- the IAB-MT detects two DCI formats 2\_5 with an AI index field value indicating the soft RB set as available from MCG and SCG respectively, or
		- the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft ~~symbol~~ RB set as available from one cell group (either MCG or SCG), and, with respect to all serving cells of the other cell group:
			* the IAB-MT would transmit or receive on the RB set during the symbol of the IAB-DU cell, and the transmission or reception on the RB set during the symbol of the IAB-DU cell is not changed due to a use of the RB set in the symbol by the IAB-DU.
* FDM NA: When an RB set of a downlink, uplink, or flexible symbol is configured as unavailable, the IAB-DU neither transmits nor receives at the RB set in the symbol.
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38.213(V17.1.0) currently has the following related clause.

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| When an RB set of a downlink, uplink, or flexible symbol is configured as hard, the IAB-DU cell can respectively transmit, receive, or either transmit or receive on the RB set in the symbol.When an RB set of a downlink, uplink, or flexible symbol is configured as soft, the IAB-DU cell can respectively transmit, receive or either transmit or receive on the RB set in the symbol only if- the IAB-MT does not transmit or receive on the RB set during the symbol of the IAB-DU cell, or- with respect to all serving cells, the IAB-MT would transmit or receive on the RB set during the symbol of the IAB-DU cell, and the transmission or reception on the RB set or any RB set that is configured as unavailable or configured as soft and not indicated as available during the symbol of the IAB-DU cell is not changed due to a use of the RB set in the symbol by the IAB-DU, or- the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft RB set as available if the IAB-MT is not configured with an SCG, or- the IAB-MT detects two DCI formats 2\_5 with an AI index field value indicating the soft RB set as available from the MCG and SCG, respectively, or- the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft RB set as available from one cell group and with respect to all serving cells of the other cell group, the IAB-MT would transmit or receive on the RB set during the symbol of the IAB-DU cell, and the transmission or reception on the RB set during the symbol of the IAB-DU cell does not change due to a use of the RB set in the symbol by the IAB-DU.When an RB set of a downlink, uplink, or flexible symbol is configured as unavailable, the IAB-DU neither transmits nor receives in the RB set in the symbol. |

**Summary of views:**

* Regarding FDM Hard:
	+ Remove *“[provided it does not impact the IAB-MT’s ability to transmit and receive in any other RB set that is configured as Not Available or configured as Soft and not indicated available]”*
		- Supported by [6], [7], [13]
	+ Include *“provided it does not impact the IAB-MT’s ability to transmit and receive in any other RB set that is configured as Not Available or configured as Soft and not indicated available”*
		- Supported by [10]
* Regarding FDM Soft:
	+ Include *“or any RB set that is configured as Not Available or configured as Soft and not indicated available”*
		- Supported by [6], [7], [13]
* [7], [10], and [13] provided related TPs.

## Issue #8. DCI format 2\_5 for FDM and TDM

**Summary of views:**

* Regarding FDM Hard:
	+ [3] has a TP to capture *“one resourceAvailability indicating availability of soft resource of the all RB sets in one or more slots for the IAB-DU cell”*
* *availabilityCombinations* tables for TDM and FDM
	+ Configure two separate tables.
		- Supported by [6], [9], (and possibly [10])
		- How to determine which table to use?
			* [6] (and possibly [10]) *“based on whether the IAB-node is currently operating TDM multiplexing mode or non-TDM multiplexing mode in the slot”*
			* [9] via AI index field

## Issue #9. Extension of exception for cell-specific/semi-static signals to soft or not available RB sets

RAN1#104-e agreed to the following.

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| **Agreement (RAN1-104e)**Regardless of simultaneous operation, the same cell-specific/semi-static signals and channels of the IAB-DU considered as hard time/frequency resources in Rel-16 are also considered as hard time/frequency resources in Rel-17.FFS: IAB-MT behavior in case of conflicts between cell-specific signals/channels and other resource configurations of the IAB-MT (e.g., dedicated slot configurations) |

38.213 has the following clause (from Rel-16)

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| A symbol of a slot is equivalent to being configured as hard if an IAB-DU would transmit a SS/PBCH block, PDCCH for Type0-PDCCH CSS sets configured by *pdcchConfigSIB1*, or a periodic CSI-RS in the symbol of the slot, or would receive a PRACH or a SR in the symbol of the slot. |

**Summary of views:**

* [7], [9] and [13] have TPs to extend the above 38.213 clause to the RB sets.

## Issue #10. Update to determination of availability in DC scenario

38.213(V17.1.0) currently has the following related clauses.

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| When a downlink, uplink, or flexible symbol is configured as soft, the IAB-DU cell can respectively transmit, receive or either transmit or receive in the symbol only if- the IAB-MT does not transmit or receive during the symbol of the IAB-DU cell, or- with respect to all serving cells, the IAB-MT would transmit or receive during the symbol of the IAB-DU cell, and the transmission or reception during the symbol of the IAB-DU cell is not changed due to a use of the symbol by the IAB-DU, or- the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft symbol as available if the IAB-MT is not configured with an SCG, or- the IAB-MT detects two DCI formats 2\_5 with an AI index field indicating the soft symbol as available from the MCG and SCG, respectively, or- the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft symbol as available from one cell group and with respect to all serving cells of the other cell group, the IAB-MT would transmit or receive during the symbol of the IAB-DU cell, and the transmission or reception during the symbol of the IAB-DU cell does not change due to a use of the symbol by the IAB-DU. |

**Summary of views:**

* [13] has a TP to correct the case, where availability indication is received from one cell group and not from the other one.

##  Issue #11. Slot index indication

**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.

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

**Summary of views:**

* [3] has a TP to extend the applicability of Child IAB-DU Restricted Beam Indication to TDM mode too.
* [13] proposed the following clarification:
	+ For the child IAB-DU Restricted Beam indication, only SSB or STC+SSB or CSI-RS is used for a given beam.

##  Issue #13. DL Tx Power Adjustment MAC-CE

**Summary of views:**

* [13] has a TP to capture the indication of the associated configurations.

##  Issue #14. Descriptions of MT’s UL MAC-CEs

38.213(V17.1.0) has the descriptions of the Child IAB-DU Restricted Beam Indication MAC CE and DL Tx Power Adjustment MAC-CE but does not have any description for IAB-MT Recommended Beam Indication, Desired DL Tx Power Adjustment, and Desired IAB-MT PSD Range.

**Summary of views:**

* [13] proposed to capture the descriptions of the following MC-CE messages in 38.213
	+ IAB-MT Recommended Beam Indication
	+ Desired DL Tx Power Adjustment
	+ Desired IAB-MT PSD Range

##  Issue #15. IAB-MT recommended beams

 **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.

##  Issue #16. Alignment of parameters names

Given the name of some of the related upper-layer messages and parameters are getting finalized, 38.213 should be updated to correctly reflect them.

**Summary of views:**

* [13] has TPs for the following
	+ Use “*Frequency-Domain HSNA Configuration List*” instead of “*Rel-17 frequency-domain IAB-DU-Resource-Configuration-H/S/NA-Config*”
	+ Reflect the RRC parameters (such as “*availabilityCombinationsRBGroups*”, “*RbSetGroups*”) related to the availability indication.

# 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