**3GPP TSG-RAN WG1 #104b-e R1-210xxxx**

**e-Meeting, April 12th – 20th, 2021**

**Agenda Item:** **7.2.3**

**Source: Moderator (AT&T)**

**Title: Summary of [Prep-104bis-e-NR\_IAB] Maintenance of Integrated Access and Backhaul for NR**

**Document for:** **Discussion/Approval**

# Introduction

This contribution provides a summary of the contributions to AI 7.2.3 of RAN1#104bis-e and proposals for email discussions.

Note that the email budget for Rel-16 IAB in RAN1#104bis-e is up to 2 email threads.

# Summary of Contributions

## Correction on search space definition for Type-3 CSS and USS

**Source**: R1-2102588

**Background:** In current specification, DCI format 2\_5 with CRC scrambled by AI-RNTI can be transmitted in Type-3 PDCCH CSS and USS, which has been captured in clause 14 in TS38.213 and section 6.3.2 in TS38.331. However, AI-RNTI is missing in the description related to search space definition for Type-3 PDCCH CSS and USS in clause 10.1. Besides, DCI format 2\_5 is also missing for the configuration of Type-3 PDCCH CSS and USS in TS38.213 clause 10.1.

Considering the minimum periodicity for monitoring DCI format 2\_4 and DCI format 2\_5 is 1 slot, UE should not expect to process information from more than one DCI format with CRC scrambled with the CI-RNTI or AI-RNTI per slot.

**Proposed Change:**

## 10.1 UE procedure for determining physical downlink control channel assignment

A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets

- a Type0-PDCCH CSS set configured by *pdcch-ConfigSIB1* in *MIB* or by *searchSpaceSIB1* in *PDCCH-ConfigCommon* or by *searchSpaceZero* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a SI-RNTI on the primary cell of the MCG

- a Type0A-PDCCH CSS set configured by *searchSpaceOtherSystemInformation* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a SI-RNTI on the primary cell of the MCG

- a Type1-PDCCH CSS set configured by *ra-SearchSpace* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a RA-RNTI, a MsgB-RNTI, or a TC-RNTI on the primary cell

- a Type2-PDCCH CSS set configured by *pagingSearchSpace* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a P-RNTI on the primary cell of the MCG

- a Type3-PDCCH CSS set configured by *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common* for DCI formats with CRC scrambled by INT-RNTI, SFI-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, TPC-SRS-RNTI, CI-RNTI, or AI-RNTI and, only for the primary cell, C-RNTI, MCS-C-RNTI, CS-RNTI(s), or PS-RNTI and

- a USS set configured by *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *ue-Specific* for DCI formats with CRC scrambled by C-RNTI, MCS-C-RNTI, SP-CSI-RNTI, CS-RNTI(s), AI-RNTI, SL-RNTI, SL-CS-RNTI, or SL Semi-Persistent Scheduling V-RNTI.

< Unchanged part is omitted >

If a UE is provided

- one or more search space sets by corresponding one or more of *searchSpaceZero, searchSpaceSIB1*, *searchSpaceOtherSystemInformation*, *pagingSearchSpace*, *ra-SearchSpace*, or a CSS set by *PDCCH-Config*, and

- a SI-RNTI, a P-RNTI, a RA-RNTI, a MsgB-RNTI, a SFI-RNTI, an INT-RNTI, a CI-RNTI, a AI-RNTI, a TPC-PUSCH-RNTI, a TPC-PUCCH-RNTI, or a TPC-SRS-RNTI

then, for a RNTI from any of these RNTIs, the UE does not expect to process information from more than one DCI format with CRC scrambled with the RNTI per slot.

< Unchanged part is omitted >

For each DL BWP configured to a UE in a serving cell, the UE is provided by higher layers with $S\leq 10$ search space sets where, for each search space set from the $S$ search space sets, the UE is provided the following by *SearchSpace*:

- a search space set index $s$, $0<s<40$ , by *searchSpaceId*

- an association between the search space set$ s$ and a CORESET $p$ by *controlResourceSetId* or by *controlResourceSetId-v1610*

- a PDCCH monitoring periodicity of $k\_{s}$ slots and a PDCCH monitoring offset of $o\_{s}$ slots, by *monitoringSlotPeriodicityAndOffset*

- a PDCCH monitoring pattern within a slot, indicating first symbol(s) of the CORESET within a slot for PDCCH monitoring, by *monitoringSymbolsWithinSlot*

- a duration of $T\_{s}<k\_{s}$ slots indicating a number of slots that the search space set $s$ exists by *duration*

- a number of PDCCH candidates $M\_{s}^{(L)}$ per CCE aggregation level $L$ by *aggregationLevel1*, *aggregationLevel2*, *aggregationLevel4*, *aggregationLevel8*, and *aggregationLevel16*, for CCE aggregation level 1, CCE aggregation level 2, CCE aggregation level 4, CCE aggregation level 8, and CCE aggregation level 16, respectively

- an indication that search space set $s$ is either a CSS set or a USS set by *searchSpaceType*

- if search space set $s$ is a CSS set

- an indication by *dci-Format0-0-AndFormat1-0* to monitor PDCCH candidates for DCI format 0\_0 and DCI format 1\_0

- an indication by *dci-Format2-0* to monitor one or two PDCCH candidates, or to monitor one PDCCH candidate per RB set if the UE is provided *freqMonitorLocations* for the search space set, for DCI format 2\_0 and a corresponding CCE aggregation level

- an indication by *dci-Format2-1* to monitor PDCCH candidates for DCI format 2\_1

- an indication by *dci-Format2-2* to monitor PDCCH candidates for DCI format 2\_2

- an indication by *dci-Format2-3* to monitor PDCCH candidates for DCI format 2\_3

- an indication by *dci-Format2-4* to monitor PDCCH candidates for DCI format 2\_4

- an indication by *dci-Format2-5* to monitor PDCCH candidates for DCI format 2\_5

- an indication by *dci-Format2-6* to monitor PDCCH candidates for DCI format 2\_6

- if search space set $s$ is a USS set, an indication by *dci-Formats* to monitor PDCCH candidates either for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or an indication by *dci-FormatsExt* to monitor PDCCH candidates for DCI format 0\_2 and DCI format 1\_2, or for DCI format 0\_1, DCI format 1\_1, DCI format 0\_2, and DCI format 1\_2, or for DCI format 2\_5, or for DCI format 3\_0, or for DCI format 3\_1, or for DCI format 3\_0 and DCI format 3\_1

< Unchanged part is omitted >

**FL Observation: Parts of R1-2102588 have been discussed in previous meetings with the conclusion that IAB-specific specification should be kept within Section 14 of 38.213 as much as possible.**

**FL Proposal: Discuss until 4/9 whether R1-2002588 is an essential correction and whether it should be handled in RAN1#104bis-e.**

**Discussion:**

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| **Company**  | **Is R1-210258 is an essential correction and should be handled in this meeting?** | **Comments**  |
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## Clarification on availability indication for IAB-DU cell

**Source**: R1-2103498

**Background:** In TS38.331, two parameters availableCombToAddModList-r16 and availableCombToReleaseList-r16 are used to add and release a list of availabilityCombinations for the IAB-DU’s cells respectively. I.e. two parameters define which set of cells of the IAB-DU is applied for available indicator of soft symbols. However, “a set of cells of the IAB-DU” in TS38.213 is not associated with IAB-DU's cells configured by parameters availableCombToAddModList-r16 and availableCombToReleaseList-r16 in TS38.331. Therefore, it is not clear which set of cells of the IAB-DU is applied for availability indicator of soft symbols. Thus, TS38.213 needs to be modified to be consistent with TS38.331.

**Proposed Change:**

# 14 Integrated access-backhaul operation

**<Unchanged parts are omitted>**

If an IAB-node is provided an AvailabilityIndicator, the IAB-node is provided an AI-RNTI by *ai-RNTI* and a payload size of a DCI format 2\_5 by *dci-PayloadSizeAI*. The IAB-node is also provided a search space set configuration, by *SearchSpace*, for monitoring PDCCH.

For each cell of an IAB-DU that is included in a set of cells of the IAB-DU configured to the IAB-node by *availableCombToAddModList-r16* and *availableCombToReleaseList-r16*, the IAB-DU can be provided:

- an identity of the IAB-DU cell by *iab-DU-CellIdentity*

- a location of an availability indicator (AI) index field in DCI format 2\_5 by positionInDCI-AI

- a set of availability combinations by availabilityCombinations, where each availability combination in the set of availability combinations includes

- resourceAvailability indicating availability of soft symbols in one or more slots for the IAB-DU cell, and

- a mapping for the soft symbol availability combinations provided by *resource*Availability to a corresponding AI index field value in DCI format 2\_5 provided by availabilityCombinationId

The IAB-DU can assume a same SCS configuration for *availabilityCombinations* for a cell as an SCS configuration provided by *gNB-DU Cell Resource Configuration* for the cell.

**<Unchanged parts are omitted>**

**FL Observation: Potentially only an editorial correction given the context of 38.331 makes it clear where/how the IAB-DU cell identity is configured.**

**FL Proposal: Discuss until 4/9 whether R1-2103498 is an essential correction and whether it should be handled in RAN1#104bis-e.**

**Discussion:**

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| **Company**  | **Is R1-2103498 is an essential correction and should be handled in this meeting?** | **Comments**  |
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## H/S/NA configuration per pair of IAB-DU cell and IAB-MT’s serving cell

**Source**: R1-2103713

**Background:** This contribution addresses the issue of a missing H/S/NA configuration option per IAB-MT carrier. The current specification in TS 38.213 [1] regarding the H/S/NA configuration of a DU cell as well as the reception of DCI 2\_5 do not prevent to have multiple configurations of either. However, no prioritisation or conflict resolution is provided for how an IAB-DU should interpret conflicting configurations or availability information.

Furthermore, presently TS 38.213 is purely assuming operation in a single carrier on parent and child links. RAN1 did not intend this in Rel-16 IAB. Not only is an important Rel-16 agreement left unimplemented; but, since IAB in Rel-17 will also enable multi-parent scenarios, an IAB-node operating on uncoordinated though potentially interacting carriers, there may be backwards compatibility issues with the signalling and IAB node behaviour if not addressed already in Rel-16.

**Proposed Change:**

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With reference to slots of an IAB-DU cell, for each pair of an IAB-DU cell and an IAB-MT serving cell, a symbol in a slot of an IAB-DU cell can be configured to be of hard, soft, or unavailable type.

In a downlink, uplink, or flexible symbol, the IAB-DU cell cannot respectively transmit, receive, or either transmit or receive in the symbol if

- the DU symbol is configured as unavailable (with respect to any MT serving cell), or

- for any MT serving cell for which the DU symbol is configured as soft,

- the IAB-MT does transmit or receive in the symbol, and

- any IAB-MT transmission or reception in the symbol is changed due to a use of the symbol by the IAB-DU, and

- the IAB-MT does not detect a DCI format 2\_5 with an AI index field value indicating the soft symbol as available

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.

If an IAB-node is provided an AvailabilityIndicator, the IAB-node is provided an AI-RNTI by *ai-RNTI* and a payload size of a DCI format 2\_5 by *dci-PayloadSizeAI*. The IAB-node is also provided a search space set configuration, by *SearchSpace*, for monitoring PDCCH.

For each pair of an IAB-DU cell and an IAB-MT serving cell, in a set of pairs of an IAB-DU cell and an IAB-MT serving cell, the IAB-DU can be provided:

- an identity of the IAB-DU cell by *iab-DU-CellIdentity*

- a location of an availability indicator (AI) index field in DCI format 2\_5 by positionInDCI-AI

- a set of availability combinations by availabilityCombinations, where each availability combination in the set of availability combinations includes

- resourceAvailability indicating availability of soft symbols in one or more slots for the IAB-DU cell, and

- a mapping for the soft symbol availability combinations provided by *resource*Availability to a corresponding AI index field value in DCI format 2\_5 provided by availabilityCombinationId

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**FL Observation: This issue is related to an incoming RAN3 LS:**

**R1-2102294 LS on Granularity of the H/S/NA Slot Configurations for the IAB-DU RAN3, Ericsson**

**FL Proposal: Handle this contribution and the related discussion including the draft reply tdocs in AI 5 under a single email thread:**

**Granularity of the H/S/NA Slot Configurations for the IAB-DU (including RAN3 LS response)**

**Discussion:**

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| **Company**  | **Do you agree with the FL Proposal to consolidate discussion with the related RAN3 LS?** | **Comments**  |
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# Summary

TBD