**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:**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Is R1-210258 is an essential correction and should be handled in this meeting?** | **Comments**  |
| Samsung | No | Share a view with the FL and we think such correction in section 10.1 is not needed because current 213 spec. section 14 is clear enough as follows:“An IAB-MT monitors PDCCH candidates for a DCI format 2\_5 with CRC scrambled by AI-RNTI in one or both of the following search space sets:- a Type3-PDCCH CSS set configured by *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common*; - a USS set configured by SearchSpace in PDCCH-Config with searchSpaceType = ue-Specific.“ |
| Huawei， HiSilicon | No | This was discussed for IAB-MT before and the agreement is to keep the IAB specific behavior in section 14. We don’t understand why a normal UE should monitor DCI format 2\_5 scrambled by AI-RNTI.  |
| Ericsson | No | We share Samsung’s view. |
| LG | No | As commented by Huawei, this was discussed and concluded to captured in section 14.  |
| Intel | No | We share Samsung and Huawei’s view.  |
| Nokia | No | Similar view as others.  |

## 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:**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Is R1-2103498 is an essential correction and should be handled in this meeting?** | **Comments**  |
| ETRI | No | Agree with FL observation.The TP itself is OK but it is not an essential correction. |
| Samsung | No | OK with the TP itself. But, we think current 331 already provide the reference to 213 section 14 as follow:***availableCombToAddModList***A list of *availabilityCombinations* to add for the IAB-DU’s cells. (see TS 38.213 [13], clause 14).***availableCombToReleaseList***A list of *availabilityCombinations* to release for the IAB-DU’s cells. (see TS 38.213 [13], clause 14). |
| Huawei, HiSilicon | No | The TP only refers to the higher layer parameters which are defined in 38.331. We think this is not strictly needed. There are many cases in current specification that only described the UE behavior without the link to a specific RRC parameter. One example below:With reference to slots of an IAB-DU cell, a symbol in a slot of an IAB-DU cell can be configured to be of hard, soft, or unavailable type. |
| Ericsson | No | We don’t think this is an essential correction. Furthermore, we are not convinced that the provided TP is how a change should be formulated. |
| LG | No | Agree with FL, this is not an essential correction.  |
| Intel | No | We don’t think this is an essential correction. Although the TP looks more specific, the original specification does not make any confusion.  |
| Nokia | No | The spec text is clear enough.  |

## 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:**

- - - - - - - - - - - - - - - - Begin extract from TS 38.213 - - - - - - - - - - - - - - - - - -

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:**

|  |  |  |
| --- | --- | --- |
| **Company**  | **Do you agree with the FL Proposal to consolidate discussion with the related RAN3 LS?** | **Comments**  |
| ETRI | Yes. | Need to discuss with the reply LS.From our understanding, if RAN1 concludes that the current RAN3 signalling on H/S/NA slot configurations is OK, then the proposed TP is not needed. |
| Samsung | Yes | None |
| Huawei, HiSilicon | Yes | We hold a view that the H/S/NA resource configuration is configured per DU cell. The RAN1 and RAN3 specification are aligned. The proposed TP is not needed. Details can be discussed next week.  |
| Ericsson | Yes |  |
| LG | Yes | Agree with ETRI and Huawei |
| Intel | Yes |  |
| Nokia | Yes | We have similar views as ETRI and HW.  |

# Summary

TBD