3GPP TSG-RAN WG1 Meeting #100bis-e R1-200xxxx

e-Meeting, April 20th – April 30th, 2020

**Agenda Item:** **7.2.3.3**

**Source: AT&T**

**Title: Summary on [100b-e-NR-IAB-02] Email discussion/approval regarding IAB-MT Resource/Control Channel Configuration**

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

# Introduction

This contribution provides a summary on maintenance issues for IAB-MT Resource/Control Channel Configuration.

# Resource multiplexing among backhaul and access links

The following issues for maintenance of Rel-16 IAB were identified to be discussed via email in RAN1#100bis-e:

[100b-e-NR-IAB-02] Email discussion/approval regarding IAB-MT Resource/Control Channel Configuration

* Usage of tdd-UL-DL-ConfigDedicated-IAB-MT
* IAB-MT Common Search Space
* IAB-MT Specific Search Space
* Max AI DCI Payload Size

By 4/24, with potential TP/LS by 4/29 (ATT, Thomas)

## Usage of tdd-UL-DL-ConfigDedicated-IAB-MT

**Source**: R1-2001526

**Background:** The higher layer parameter tdd-UL-DL-ConfigDedicated-IAB-MT for an IAB-node MT is similar to the higher layer parameter tdd-UL-DL-ConfigurationDedicated for a UE in Section 11 of TS 38.213 except that new slot formats for an IAB-node MT can be indicated by tdd-UL-DL-ConfigDedicated-IAB-MT.

In Section 11 of TS 38.213, the UE behaviors related to slot format determination with tdd-UL-DL-ConfigurationDedicated are described. However, though it may be straightforward, the IAB-node MT behaviors related to slot format determination with tdd-UL-DL-ConfigDedicated-IAB-MT have not been captured. Consequently, when tdd-UL-DL-ConfigDedicated-IAB-MT is provided, the IAB node MT cannot determine how to use the parameter in order to determine the slot format.

**FL Proposal 2.1:** Adopt the following text proposal for TS 38.213 Section 14:

|  |
| --- |
| < Unchanged parts are omitted > For each serving cell of an IAB-node DU, the IAB-node DU can be provided an indication for a slot format over a number of slots by *IAB-DU-Resource-Configuration*.For each serving cell, an IAB-node MT can be provided an indication for a slot format over a number of slots by *tdd-UL-DL-ConfigDedicated-IAB-MT*. If the IAB-node MT is provided *tdd-UL-DL-ConfigDedicated-IAB-MT*, the parameter *tdd-UL-DL-ConfigDedicated-IAB-MT* overrides only flexible symbols over the number of slots as provided by *TDD-UL-DL-ConfigurationCommon*. The *tdd-UL-DL-ConfigDedicated-IAB-MT* provides  - a set of slot configurations by *slotSpecificConfigurationsToAddModList-IAB-MT*  - for each slot configuration from the set of slot configurations  - a slot index for a slot provided by *slotIndex*  - a set of symbols for a slot by *symbols* where  - if *symbols* = *allDownlink*, all symbols in the slot are downlink  - if *symbols* = *allUplink*, all symbols in the slot are uplink  - if *symbols* = *explicit*, *nrofDownlinkSymbols* provides a number of downlink first symbols in the slot and *nrofUplinkSymbols* provides a number of uplink last symbols in the slot. If *nrofDownlinkSymbols* is not provided, there are no downlink first symbols in the slot and if *nrofUplinkSymbols* is not provided, there are no uplink last symbols in the slot. The remaining symbols in the slot are flexible.  - if *symbols* = *explicit-IAB-MT*, *nrofUplinkSymbols* provides a number of uplink first symbols in the slot and *nrofDownlinkSymbols* provides a number of downlink last symbols in the slot. If *nrofUplinkSymbols* is not provided, there are no uplink first symbols in the slot and if *nrofDownlinkSymbols* is not provided, there are no downlink last symbols in the slot. The remaining symbols in the slot are flexible.  For each slot having a corresponding index provided by *slotIndex*, the IAB-MT applies a format provided by a corresponding *symbols*.  The statements using the term "*tdd-UL-DL-ConfigDedicated*" in clauses 11.1 is replaced with "*tdd-UL-DL-ConfigDedicated-IAB-MT*" for the IAB-node MT of an IAB node.  < Unchanged parts are omitted > |

**Discussion:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree with Proposal 2.1?** | **Comments** |
| **Huawei** | **Yes** | **None** |
| **Intel** | **Yes** | **None** |
| **Qualcomm** | **Yes, in principle** | It should be noted that in 11.1 the actual name is “tdd-UL-DL-ConfigurationDedicated” and not “tdd-UL-DL-ConfigDedicated”. |
| **LG** | **Yes** | None |
| **NTT DOCOMO** | **Yes** |  |
| **vivo** | **Yes** | None |
| **Ericsson** | **Yes** |  |
| **Nokia** | **Yes** | Agree with QC. |

## IAB-MT Common Search Space

**Source**: R1-2001862, R1-2002652

**Background:** In the latest version of the 38.331 running CR capturing RRC impacts of IAB, the following parameter is defined: *commonSearchSpaceListIAB-v16xy* which is a list of additional common search spaces for IAB-MT. While RAN1 agreed there would be a Search Space configuration applicable for IAB-MTs, the size of this parameter was not defined. However, given the expectation that the PDCCH formats would be largely reused for the backhaul link as well as the access link, it is reasonable to that the same number of Search Spaces can be configured for UEs and MTs. Furthermore, an LS should be sent to RAN2 with the agreed value.

FL Proposal 2.2: The length of the list for commonSearchSpaceListIAB-v16xy is 4. Send a LS to RAN2 regarding the agreed value.

**Discussion:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree with Proposal 2.2?** | **Comments** |
| **Huawei** | **Yes** | We observed that *commonSearchSpaceListIAB-v16xy* in the 38.331 running CR is in *PDCCH-ServingCellConfig* but not in *PDCCHConfigCommon* unlike *commonSearchSpaceList* is in *PDCCHConfigCommon* for the UE. We suggest some update below  The length of the list for commonSearchSpaceListIAB-v16xy is 4. Send a LS to RAN2 regarding the agreed value and inform RAN2 that the signaling details are up to RAN2. |
| **Intel** | **Yes** | None |
| **Qualcomm** | **No** | From our understanding the a search space for IAB-MT was introduced in RAN1 only in the context for DCI format 2\_5. And it wasn’t defined as a common search space, although perhaps that was implicitly inherited from the fact we borrowed the structure of DCI format 2\_0 to create DCI format 2\_5. |
| **LG** | **Yes** | Agree with the proposed value.  Apart from the proposal, *commonSearchSpaceListIAB-v16xy* is configured in *PDCCH-ServingCellConfig* IE in the current specification. We think *commonSearchSpaceListIAB-v16xy* does not need to be configured in *PDCCH-ServingCellConfig* IE. Instead, it can be moved to *PDCCH-ConfigCommon* IE. So, it could be included in the LS to RAN2. |
| **NTT DOCOMO** | **Yes** |  |
| **vivo** | **Yes** | Agree with the proposed value. |
| **Ericsson** | **Yes** | It is our assumption that all Rel-15 UE common search space types are also applicable to Rel-16 IAB nodes. |
| **Nokia** | **No** | Agree with QC that this parameter, commonSearchSpaceListIAB-v16xy is not defined by RAN1.  If we are now agreeing on exact number, first we need to understand why this parameter is there in the first place, and the intention of introducing this under PDCCH-ServingCellConfig but not in PDCCHConfigCommon.  We suggest not to suggest anything yet on this until the RAN2 design is finalized. To our knowledge, this is an ongoing discussion in RAN2. |

## IAB-MT Specific Search Space

**Source**: R1-2001862

**Background:** In the latest version of the 38.331 running CR capturing RRC impacts of IAB, the parameter *mt-Specific-v16xy* lists the DCI formats which can be configured specifically for an IAB-MT. While RAN1 agreed that DCI Format 2\_0 may indicate UL-Flexible-DL slot formats specifically for IAB-MTs and DCI Format 2\_5 carries the IAB-MT specific soft resource availability indicator, it was not explicitly agreed in RAN1 that these two DCI Formats should be configured via a different search space compared to the common and UE-specific Search Spaces.

**FL Proposal 2.3.1: Confirm DCI Format 2\_5 can be configured in an IAB-MT specific manner (i.e. via RRC parameter *mt-Specific-v16xy* in *SearchSpace*) with the same number of aggregation levels and candidates as DCI format 2\_0.**

**Discussion:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree with Proposal 2.3?** | **Comments** |
| **Huawei** | **We think some discussions are needed here.** | We think the following issues should be discussed:   1. The search space for DCI format 2\_0    * [Huawei]: DCI format 2\_0 can be monitored by IAB-MT in both common search space and UE-specific search space. Several child IAB nodes supporting the specific UL-Flexible-DL slot formats can monitor DCI format 2\_0 in common search space while it can be monitored only by IAB node. 2. The search space for DCI format 2\_5    * [Huawei]: DCI format 2\_5 can be monitored by IAB-MT in UE-specific search space. There seems no need for IAB-MT to monitor DCI format 2\_5 in common search space since the DU-IA indication is intended for each IAB node 3. The need of IAB-MT specific search space    * [Huawei]: Since the IAB-MT functions like a UE, we think the IAB-MT can monitor DCI format 2\_0 and DCI format 2\_5 in CSS and USS or USS respectively (not necessarily at the same time) instead of a newly introduced search space. Even without introducing the new IAB-MT specific search space, it is still possible to configure separate monitoring periodicity for DCI format 2\_0 and DCI format 2\_5. Hence it is not clear whether IAB-MT specific search space is really needed. 4. The ALs and number of candidates for DCI format 2\_5.    * [Huawei]: The ALs and number of candidates for DCI format 2\_5 can be configured separately from DCI format 2\_0 in UE-specific SS |
| **Intel** | **More discussion needed.** | We think DCI format 2\_5 can be monitored by IAB-MT in both common search space and UE-specific search space as DCI format 2\_0. For example, when cell-specific soft resources becomes available to multiple IAB nodes with the same parent, common search space can be applied. |

**FL Proposal 2.3.1: Confirm DCI Format 2\_0 can be monitored by an IAB-MT in a common and IAB-MT specific (signaling details up to RAN2) search space.**

**Discussion:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree with Proposal 2.3.1?** | **Comments** |
| **Qualcomm** | **More discussion needed** | As noted in our comments to FL Proposal 2.2 it was not clear to us that we had defined IAB-MT specific search spaces except for the newly introduced DCI format 2\_5. |
| **LG** | **More discussion needed.** | Type3-PDCCH CSS seems enough to monitor DCI format 2\_0.  If a network wants to make a DCI format 2\_0 carries an slot format indicator for an IAB-MT, it is still possible in CSS by configuring different monitoring resource, and/or SFI-RNTI for different IAB-MTs while configuring the same positionInDCI. |
| **NTT DOCOMO** | **More discussion needed.** | IAB-MT specific search space for DCI format 2\_0 may be necessary, since IAB node can support U-F-D configuration, and a common search space may be sufficient. |
| **Vivo** | **Not sure** | We share the same view as LG, Type3-PDCCH CSS is enough to monitor DCI format 2\_0. MT-specific configuration is needed, only if TDD configuration of each IAB-MT is totally independent, e.g., one IAB-MT is configured as DL while another IAB-MT is configured as UL in the same slot, however, we do see the possibility for that. In our understanding, all IAB-MTs served by a certain cell should keep (partly) aligned TDD configuration as the serving cell DU, hence, Type3-PDCCH CSS is enough. |
| **Nokia** | **Not sure** | DCI format 2\_0 can be anyways monitored in CSS, as IAB MT may follow UE behaviors in Rel-15.  DCI format 2\_0 monitored in IAB-MT specific search space: This is already captured in RAN2. Not sure what additionally we plan to capture.  mt-Specific-v16xy SEQUENCE {  dci-Formats-r16 ENUMERATED {formats2-0-And-2-5},  ...  } |

**FL Proposal 2.3.2: Confirm DCI Format 2\_5 can be monitored by an IAB-MT in a common and IAB-MT specific (signaling details up to RAN2) search space, with the same number of aggregation levels and candidates as DCI format 2\_0.**

**Discussion:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree with Proposal 2.3.2?** | **Comments** |
| **Qualcomm** | **Yes** | None. |
| **LG** | **More discussion needed.** | Similar to our comments to FL Proposal 2.3.1, it Type3-PDCCH CSS seems enough to monitor DCI format 2\_5.  If needed, a network can transmit DCI format 2\_5 for an IAB-MT in CSS. |
| **NTT DOCOMO** | **Yes** |  |
| **vivo** | **Yes** | IAB-DU resource type configurations can be independent, parent node should control the DU resource type per IAB-DU independently. |
| **Ericsson** | **Yes** |  |
| **Nokia** | **Yes** | Ran2 seems already capturing this. What additionally we suggest here. |

## Max AI DCI Payload Size

**Source**: R1-2001862

**Background:** In the RAN1 RRC parameter spreadsheet the following parameter positionInDCI-AI was defined as the (starting) position (bit) of the availabilityCombinationId (AI-Index) for the indicated IAB-DU cell (iabDuCellId-AI) within the DCI payload. It has a value range of INTEGER(0..maxAI-DCI-PayloadSize-1), however maxAI-DCI-PayloadSize was not defined. Given that the design of the availability indicator (DCI Format 2\_5) followed the SFI design (DCI Format 2\_0), it should be straightforward that they have the same value.

**FL Proposal 2.4: Confirm *maxAI-DCI-PayloadSize* = *maxSFI-DCI-PayloadSize* = 128.**

**Discussion:**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree with Proposal 2.4?** | **Comments** |
| **Huawei** | **Yes** | **None** |
| **Intel** | **Yes** | **None** |
| **LG** | **Yes** | None |
| **NTT DOCOMO** | **Yes** |  |
| **vivo** | **Yes** |  |
| **Ericsson** | **Yes** |  |
| **Nokia** | **Yes** |  |

# Summary

T**BD**

Additional editorial corrections for RAN1 specifications are summarized in Appendix A.

# Appendix A Editorial corrections to existing specifications

**A.1 MT Slot Formats**

From 38.213:

“An IAB-node MT can be provided, by SlotFormatCombinationsPerCell-IAB-MT, a list of slot format combinations applicable for one serving cell and, by SlotFormatIndicator-IAB-MT, a configuration for monitor a DCI format 2\_0 indicating a slot format combination, from the list of slot format combinations, over a number of slots as described in Subclause 11.1.1.”

The two parameters, SlotFormatCombinationsPerCell-IAB-MT and SlotFormatIndicator-IAB-MT, are not yet agreed to be included in the higher layer parameters list for RAN2.

**A.2 DU Resource Configuration**

The DU resource configuration is given by higher layer parameter gNB-DU Resource Configuration while the parameter name in 38.213 does not match:

|  |
| --- |
| For each serving cell of an IAB-node DU, the IAB-node DU can be provided an indication for a slot format over a number of slots by *~~IAB-DU-Resource-Configuration~~gNB-DU Cell Resource Configuration* |
| The IAB-node DU can assume a same SCS configuration for *availabilityCombinations* for a serving cell as an SCS configuration provided by *~~IAB-DU-Resource-Configuration-TDD-Confi~~gNB-DU Cell Resource Configuration* for the serving cell |

**A.3 DCI Format 2\_5: *resourceAvailability***

One issue about DU-IA configuration is that the 2nd sub-bullet below is used to describe availability combination, while the parameter used for direct mapping the soft symbol availability combination is resourceAvailability in *AvailabilityCombination*. The current text was modified from the Rel-15 text for DCI 2\_0, but the change of “slotFormats” to “*resourceAvailability*” is not consistently applied in the 2nd sub-bullet.

***-------------------------------------part of 38.213 text for DCI 2\_5 ----------------------------------***

For each serving cell of an IAB-node DU in a set of serving cells of the IAB-node DU, the IAB-node DU can be provided:

- an identity of the IAB-node DU serving cell by iabDuCellId-AI

- 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-node DU serving cell, and

- a mapping for the soft symbol availability combination provided by AvailabilityCombination to a corresponding AI index field value in DCI format 2\_5 provided by availabilityCombinationId

***--------------------------------------------------------------------------------------------------------***

***-------------------------------------part of 38.213 text for DCI 2\_0 ----------------------------------***

- a set of slot format combinations by *slotFormatCombinations*, where each slot format combination in the set of slot format combinations includes

- one or more slot formats indicated by a respective *slotFormats* for the slot format combination, and

- a mapping for the slot format combination provided by *slotFormats* to a corresponding SFI-index field value in DCI format 2\_0 provided by *slotFormatCombinationId*

***--------------------------------------------------------------------------------------------------------***