3GPP TSG-RAN WG1 Meeting #101-e R1-200xxxx

e-Meeting, May 25th – June 5th, 2020

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

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

**Title: Summary of [101-e-NR-IAB-04]: Email discussion on potential 38.213 and 38.331 editorial issues for IAB**

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

# Introduction

This contribution provides a summary of [101-e-NR-IAB-04]: Email discussion on potential 38.213 and 38.331 editorial issues for IAB.

# Alignment of 38.331 and 38.213 parameters related to DCI Format 2\_5

**Source**: R1-2003732, R1-2004133, R1-2004582

**Background:** During RAN1#100bis-e the following agreements were reached:

Agreements: Confirm that from a RAN1 perspective all Rel-15 UE common search space types are also applicable to Rel-16 IAB nodes. Signaling details are left to RAN2.

Agreements: Confirm DCI Format 2\_0 and DCI Format 2\_5 can be monitored by an IAB-MT in at least a common search space. The same number of aggregation levels and candidates can be separately configured for both DCI Format 2\_0 and DCI Format 2\_5.

Agreements: DCI Format 2\_0 is not monitored by an IAB-MT in a UE(MT)-specific search space. DCI Format 2\_5 can be additionally monitored by an IAB-MT in a UE(MT)-specific search space. Signaling details (e.g. whether the configuration is in the existing UE-specific search space configuration or a new MT-specific search space configuration is left up to RAN2).

Based on these agreements there is a need to align RAN1 specifications with the RRC configurations for an IAB-MT related to DCI Format 2\_0 and 2\_5. Specifically for RAN1#101-e two issues were identified as potential editorial corrections to be handled by the 38.213 and 38.331 editors.

## Issue 1: Add reference SCSs for soft resource availability indication configuration in the RRC IE AvailabilityCombinationPerCell (R1-2003732)

Current, the reference SCS for a DCI Format 2\_5 availability indication can be derived from the IAB-DU resource configuration. However, when DCI Format 2\_5 is sent in the common search space instead of the UE(MT)-specific search space, if multiple IAB nodes are the intended recipients of the availability indication and some of the IAB-DUs have different reference SCS configurations, the time duration applicability of the availability indication will vary across the IAB nodes, which may not be the intended behavior.

One solution proposed in R1-2003732 is to align the DCI Format 2\_5 configuration with DCI Format 2\_0 and add reference SCSs for soft resource availability indication configuration in the RRC IE AvailabilityCombinationPerCell.

* For unpaired spectrum operation, a reference SCS configuration µ\_AI is provided by subcarrierSpacing-AI and, when a supplementary UL carrier is configured for the serving cell, a reference SCS configuration µ\_(AI,SUL) is provided by subcarrierSpacing2-AI for the supplementary UL carrier.
* For paired spectrum operation, a reference SCS configuration µ\_(AI,DL) for a DL BWP is provided by subcarrierSpacing-AI and a reference SCS configuration µ\_(AI,UL) is provided for an UL BWP by subcarrierSpacing2-AI.

**Discussion:**

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| **Company** | **Do you agree that the monitoring DCI Format 2\_5 in a common search space results in the issue described above? If so, is the solution proposed in R1-2003732 acceptable?** | **Comments** |
| ZTE, Sanechips | No. The concerned issue can be avoided. | As mentioned in our response in preparation phase, the table entry (set of slots holding availability indications) pointed by the index contained in DCI 2\_5 can be configured and interpreted on a per IAB-node basis. The combination of individual ref-SCS and individual table entry interpretation could reach the same time duration applicability of availability indication. This is even the mechanism supported by DCI 2\_0 as well.  The solution in the current spec does not need to change anything in 38.213 and 38.331. But the proposed solution needs to modify both specs. |
| Intel | Yes. | Let’s first look at DCI 2\_0 configuration, which has reference SCS configuration. The propoed reference SCS configuration for DCI 2\_5 is inherited from DCI 2\_0 configuration.  Copied below is DCI 2\_0 reference SCS configuration in TS38.331  SlotFormatCombinationsPerCell ::= SEQUENCE {  servingCellId ServCellIndex,  subcarrierSpacing SubcarrierSpacing,  subcarrierSpacing2 SubcarrierSpacing OPTIONAL,  slotFormatCombinations  SEQUENCE (SIZE (1..maxNrofSlotFormatCombinationsPerSet)) OF SlotFormatCombination OPTIONAL,  positionInDCI INTEGER(0..maxSFI-DCI-PayloadSize-1) OPTIONAL,  ...,  [[  enableConfiguredUL-r16 ENUMERATED {enabled} OPTIONAL  ]]  }  Copied below is DCI 2\_0 reference SCS description in TS38.213 11.1.1 (unpaired spectrum reference SCS is listed below; paired spectrum reference SCS operation can also be found in the spec)  - for unpaired spectrum operation, a reference SCS configuration  by *subcarrierSpacing* and, when a supplementary UL carrier is configured for the serving cell, a reference SCS configuration  by *subcarrierSpacing2* for the supplementary UL carrier  - For unpaired spectrum operation for a UE on a serving cell, the UE is provided by *subcarrierSpacing* a reference SCS configuration  for each slot format in a combination of slot formats indicated by a SFI-index field value in DCI format 2\_0. The UE expects that for a reference SCS configuration  and for an active DL BWP or an active UL BWP with SCS configuration , it is . Each slot format in the combination of slot formats indicated by the SFI-index field value in DCI format 2\_0 is applicable to  consecutive slots in the active DL BWP or the active UL BWP where the first slot starts at a same time as a first slot for the reference SCS configuration  and each downlink or flexible or uplink symbol for the reference SCS configuration  corresponds to  consecutive downlink or flexible or uplink symbols for the SCS configuration .  The propoed reference SCS configuration for DCI 2\_5 is similar to DCI 2\_0 reference SCS configuration. We don’t know without reference SCS configuration for DCI 2\_5, how individual SCS interpretation can achieve same time duration applicability of availability indication. Among multiple IAB nodes receiving the same DCI 2\_5, one IAB node cannot know other IAB nodes’ SCS configuration. |
| Nokia | Yes | Tend to agree with Intel.  DCI 2-5 was introduced mainly following the same framework as DCI 2-0, and AvailabilityCombinationsPerCell-r16 contained similar parameter set as SlotFormatCombinationsPerCell. We think that introducing subcarrierSpacing and subcarrierSpacing2 also within AvailabilityCombinationsPerCell-r16 is cleaner solution to configure the reference sub-carrier spacing applied with the DCI 2-5 indication. ZTE suggestion may work when the indication of DCI 2-5 mainly targeting single IAB node. But as FL summarized, it may not solve the issue when the DCI 2-5 is sent for multiple IAB nodes. |
| Huawei | No | Agree with ZTE that each IAB node can follow each the SCS of DU to interpret DCI format 2\_5. As another alternative, DCI format 2\_5 is a group-common PDCCH, one can always group the IAB nodes with same SCS together at cost of the control signaling overhead at the gNB. |
| Qualcomm | Yes to the first question.  No to the second question in the context of Rel-16 | We acknowledge there is a potential issue. However it is questionable, particularly when sending an AI with sub-slot resolution, whether grouping IAB-nodes with different IAD-DU SCS has any value. So the issue can be avoided by grouping IAB-nodes with the same IAB-DU SCS, as Huawei suggested.  We think this is acceptable in Rel-16. At this point we do not want to introduce any signaling change except to address a critical issue. This particular one does not seem to raise to that level. |
| LG | No | Agree with ZTE that DCI format 2\_5 can be interpreted per-IAB-node basis as described in TS 38.213: “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-Config* for the serving cell.” So, we don’t see critical problem on this issue. |
| Samsung | No | We understand a comment that DCI format 2\_5 was introduced by following the same framework as DCI format 2\_0. On the other hand, it was already specified that a SCS for DCI format 2\_5 is implicitly determined by a SCS of DU resource configuration. As commented by several companies, we also think grouping IAB nodes with a same DU SCS can address a concern when DCI format 2\_5 is transmitted on the common search space. |
| Intel2 | Yes | We understand that we are trying not to introduce new signaling as much as possible at this stage.  It seems most companies suggest to resolve the issue by sending DCI2\_5 in CSS to a group of IAB nodes with a same IAB DU SCS. We are ok with this solution and propose to mention the following in the spec:  “In case of DCI format 2\_5 is transmitted to multiple IAB nodes on the common search space, grouping IAB nodes with a same IAB DU SCS is required.” |
| Ericsson | No | We acknowledge that introducing reference sub-carrier is a cleaner solution. However, we don’t see critical problem on this issue and in rel-16, the issue can be handled by grouping IAB nodes with the same IAB-DU SCS, as Huawei suggested. |

**FL Observation 2.1.1 It does appear that lack of the reference SCS was an oversight when porting the DCI Format 2\_0 design to DCI Format 2\_5. However, given that the scenario where this becomes an issue is not expected to be very relevant for Rel-16 IAB deployments and also that there is impact to the RRC parameters, it is not desirable to address it at this stage of the WI. It does seem potentially worthwhile to capture this as a conclusion in RAN1.**

**FL Conclusion 2.1.2: In Rel-16, an RRC-configured reference SCS configuration for DCI Format 2\_5 is not introduced. In case DCI Format 2\_5 is transmitted to multiple IAB nodes in the CSS, it is expected that the same reference SCS is applied by all IAB-DUs.**

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| **Company** | **Do you agree with FL Conclusion 2.1.2? Should this be captured by either RAN1 or RAN2 specifications?** | **Comments** |
| LG | Yes, but some modification is needed. | We are generally fine with the FL’s conclusion. But, we suggest some modification as:  **In Rel-16, an RRC-configured reference SCS configuration for DCI Format 2\_5 is not introduced. In case DCI Format 2\_5 is transmitted to multiple IAB nodes in the CSS, it is expected that the same reference SCS is applied by all IAB-DU cells associated with the same AI-fields.**  And we don’t think above conclusion needs to be captured in the spec. |
| ZTE, Sanechips | Agree the 1st sentence, but the 2nd is not necessary. | Assume two IAB nodes, A and B, are configured to monitor DCI 2\_5 in CSS.  For IAB node-A:   * ref-SCS is u1; and * the number of slots in each “*resourceAvailability*” is configured as N1   For IAB node-B:   * ref-SCS is u2; and * the number of slots in each “*resourceAvailability*” is configured as N2.   By setting proper (u1,N1) for IAB node-A and (u2, N2) for IAB node-B, the two nodes can have the same time length for the availability indications coming from the same DCI 2\_5.  Therefore, u1=u2 is not necessarily required. It should be noted even DCI 2\_0 does not have such requirement. |
| Ericsson | Agree to 1st sentence. Not captured in spec. | We agree with LG that this does not need to be captured in the specification |

## Issue 2: positionInDCI-AI/dci-PayloadSize-AI used for USS (R1-2004133)

Based on RAN1#100bis-e agreements, DCI Format 2\_5 can be monitored in a CSS and additionally in a USS by an IAB-MT. It is not clear whether DCI Format 2\_5 can be monitored simultaneously by an IAB-MT in a CSS and USS. In case of simultaneous monitoring, R1-2004133 proposes that *positionInDCI-AI* and *dci-PayloadSize-AI* which may be based on the number of availability combinations configured should be separately configured for the CSS and USS:

In addition to dci-PayloadSize-AI and positionInDCI-AI used for CSS, introduce new RRC parameters dci-PayloadSize-AI-MSS and positionInDCI-AI-MSS used for the UE(MT)-specific search space.

A screenshot of a cell phone

Description automatically generated

**Figure 1**. **Location of availability indicator field for an IAB-node DU-cell in DCI format 2\_5 (R1-2004133)**

**Discussion:**

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| **Company** | **Do you agree that monitoring DCI Format 2\_5 in a CSS and USS is(should be) supported? If so, is the solution proposed in R1-2004133 necessary?** | **Comments** |
| ZTE, Sanechips | No | We do not see strong motivation to support simultaneous monitoring of DCI 2\_5 in both CSS and USS.  It seems RAN1 needs to Inform RAN2 of such, if agreed, by either an LS or a note in higher layer signaling spreadsheet. |
| Intel | No | As our comments in preparation stage:   1. RRC parameter *iabDuCellId-AI* is configured in case of multiple cells in one IAB DU. Accordingly, RRC parameter *positionInDCI-AI* is pointing at DCI format 2\_5 payload for different cells in one IAB DU. Those two parameters already exist for DCI format 2\_5 sending to one IAB MT. They are not parameters to differentiate different DUs in case of one DCI format 2\_5 sending to multiple MTs. 2. When CSS is used for DCI format 2\_5, the configuration is supposed to be common for multiple MTs; when USS is used for DCI format 2\_5, the configuration is supposed to be MT-specific. So there will be no case that part of DCI format 2\_5 payload is used for one MT, and part of DCI format 2\_5 payload is used for another MT.   Hence, there is no intention to define different *dci-PayloadSize-AI* and *positionInDCI-AI* for UE(MT)-specific search space and CSS. |
| Nokia | No | Agree with ZTE and Intel. |
| Huawei | No | Agree with ZTE. |
| Qualcomm | No | Agree with ZTE. |
| LG | More clarification is needed. | As we expressed in the preparation phase, according to current specification, *positionInDCI-AI can be* configuredIAB-node DU cell specifically even in case of CSS is used for DCI format 2\_5. In other word, depending on the network configuration for *positionInDCI-AI,* the AI-field in DCI format 2\_5 monitored in CSS can be applied to a certain IAB-node DU cell or IAB-node DU cell group. Obviously, DCI format 2\_5 monitored in USS can be consists of AI fields corresponding to IAB-node DU cells associated with IAB-node MT monitoring that DCI format 2\_5. So, depending on the monitoring search space (i.e. CSS or USS), AI-fields construction in DCI format 2\_5 can be different. In that sense, if simultaneous monitoring of DCI 2\_5 in both CSS and USS is allowed, *positionInDCI-AI* and *dci-PayloadSize-AI* should be distinguishable according to the monitoring search space.  If the majority companies (given this situation☺) think simultaneous monitoring of DCI 2\_5 in both CSS and USS is not needed, we can at least make a conclusion as “simultaneous monitoring of DCI 2\_5 in both CSS and USS is not supported”. |
| Samsung | No | Share a similar view with ZTE and Intel. But, OK with having RAN1 conclusion as LG suggested. |
| Ericsson | No | We agree with ZTE that the need to support simultaneous monitoring of DCI 2\_5 in both CSS and USS is not motivated. |

**FL Conclusion 2.2.1: In Rel-16, no additional specification impact is introduced for monitoring DCI Format 2\_5 simultaneously in both a CSS and a USS by an IAB-MT.**

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| **Company** | **Do you agree with FL Conclusion 2.2.1? Should this be captured by either RAN1 or RAN2 specifications?** | **Comments** |
| LG | Yes to first one, and No to second one | As we expressed previous discussion, we could accept the FL’s conclusion since majority companies does not want to optimize the configuration of DCI format 2\_5 according to monitoring search space. So, we think making some conclusion is enough, and capturing in the spec is not needed. |
| ZTE, Sanechips | Agree. Nothing to be additionally specified in either RAN1 or RAN2 spec. | As we mentioned in email thread, the simultaneous monitoring of DCI 2\_5 in both CSS and USS based on a single pair of < *PayloadSize-AI* , *positionInDCI-AI* > is still possible, just resulting with possibly quite an amount of resource waste in one of search space, which usually discourages the network to configure the simultaneous monitoring in both SS. But it is just a matter of “not optimized”, rather than “not supported”. |
| Ericsson | Agree to conclusion, disagree to capture in spec. |  |

# Summary

TBD