**3GPP TSG-RAN WG2 Meeting #121bis-e *R2-23xxxxx***

**Electronic, 17th – 26th April 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.300** | **CR** | **0641** | **rev** | **1** | **Current version:** | **17.3.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of stage 2 description for IAB beam management and power control | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Lenovo | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IAB\_enh-Core | | | | |  | ***Date:*** | | | 2023-02-21 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | Beam management, power control, and resource management enhancements for IAB were introduced in Release 17 in order to enable/enhance simultaneous MT-DU Tx/Rx operations at eIAB nodes. However, the stage 2 description of these enhancements have not been properly reflected in TS 38.300 yet. | | | | | | | | |
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| ***Summary of change:*** | | 1. Sections 5.2.3, 8.1, 10.9: Descriptions on soft resource availability have been extended to soft RB sets of an IAB-DU. 2. Section 10.9: Descriptions have been added on:  * Signaling between an IAB node and its parent IAB node/donor for beam recommendation and restriction. * Signaling between an IAB node and its parent IAB node/donor for DL TX power adjustment.   **Impact analysis**  Impacted 5G architecture options:  NR SA  Impacted functionality:  Beam management, power control, resource management for IAB  Inter-operability:  There are no inter-operability issues. | | | | | | | | |
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| ***Consequences if not approved:*** | | Stage 2 description for IAB beam management, power control, and resource management enhancements is incomplete. | | | | | | | | |
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| ***Clauses affected:*** | | 5.2.3, 8.1, 10.9 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
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| ***Other comments:*** | | The CR is based on the changes proposed in R2-2301299 (Clarfication on DL power adjustment for IAB, Ericsson). | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*Start of changes*

### 5.2.3 Physical downlink control channels

The Physical Downlink Control Channel (PDCCH) can be used to schedule DL transmissions on PDSCH and UL transmissions on PUSCH, where the Downlink Control Information (DCI) on PDCCH includes:

- Downlink assignments containing at least modulation and coding format, resource allocation, and hybrid-ARQ information related to DL-SCH;

- Uplink scheduling grants containing at least modulation and coding format, resource allocation, and hybrid-ARQ information related to UL-SCH.

In addition to scheduling, PDCCH can be used to for:

- Activation and deactivation of configured PUSCH transmission with configured grant;

- Activation and deactivation of PDSCH semi-persistent transmission;

- Notifying one or more UEs of the slot format;

- Notifying one or more UEs of the PRB(s) and OFDM symbol(s) where the UE may assume no transmission is intended for the UE;

- Transmission of TPC commands for PUCCH and PUSCH;

- Transmission of one or more TPC commands for SRS transmissions by one or more UEs;

- Switching a UE's active bandwidth part;

- Initiating a random access procedure;

- Indicating the UE(s) to monitor the PDCCH during the next occurrence of the DRX on-duration;

- In IAB context, indicating the availability for soft symbols or soft RB sets of an IAB-DU;

- Triggering one shot HARQ-ACK codebook feedback;

- For operation with shared spectrum channel access:

- Triggering search space set group switching;

- Indicating one or more UEs about the available RB sets and channel occupancy time duration;

- Indicating downlink feedback information for configured grant PUSCH (CG-DFI).

A UE monitors a set of PDCCH candidates in the configured monitoring occasions in one or more configured COntrol REsource SETs (CORESETs) according to the corresponding search space configurations.

A CORESET consists of a set of PRBs with a time duration of 1 to 3 OFDM symbols. The resource units Resource Element Groups (REGs) and Control Channel Elements (CCEs) are defined within a CORESET with each CCE consisting a set of REGs. Control channels are formed by aggregation of CCE. Different code rates for the control channels are realized by aggregating different number of CCE. Interleaved and non-interleaved CCE-to-REG mapping are supported in a CORESET.

The PDCCH repetition is operated by using two search spaces which are explicitly linked by configuration provided by the RRC layer, and are associated with corresponding CORESETs. For PDCCH repetition, two linked search spaces are configured with the same number of candidates, and two PDCCH candidates in two search spaces are linked with the same candidate index. When PDCCH repetition is scheduled to a UE, an intra-slot repetition is allowed and each repetition has the same number of CCEs and coded bits, and corresponds to the same DCI payload.

Polar coding is used for PDCCH.

Each resource element group carrying PDCCH carries its own DMRS.

QPSK modulation is used for PDCCH.

*Next change*

## 8.1 UE Identities

In this clause, the identities used by NR connected to 5GC are listed. For scheduling at cell level, the following identities are used:

- C-RNTI: unique UE identification used as an identifier of the RRC Connection and for scheduling;

- CI-RNTI: identification of cancellation in the uplink;

- CS-RNTI: unique UE identification used for Semi-Persistent Scheduling in the downlink or configured grant in the uplink;

- INT-RNTI: identification of pre-emption in the downlink;

- MCS-C-RNTI: unique UE identification used for indicating an alternative MCS table for PDSCH and PUSCH;

- P-RNTI: identification of Paging and System Information change notification in the downlink;

- SI-RNTI: identification of Broadcast and System Information in the downlink;

- SP-CSI-RNTI: unique UE identification used for semi-persistent CSI reporting on PUSCH.

For power and slot format control, the following identities are used:

- SFI-RNTI: identification of slot format;

- TPC-PUCCH-RNTI: unique UE identification to control the power of PUCCH;

- TPC-PUSCH-RNTI: unique UE identification to control the power of PUSCH;

- TPC-SRS-RNTI: unique UE identification to control the power of SRS.

During the random access procedure, the following identities are also used:

- RA-RNTI: identification of the Random Access Response in the downlink;

- Temporary C-RNTI: UE identification temporarily used for scheduling during the random access procedure;

- Random value for contention resolution: UE identification temporarily used for contention resolution purposes during the random access procedure.

For NR connected to 5GC, the following UE identity is used at NG-RAN level:

- I-RNTI: used to identify the UE context in RRC\_INACTIVE.

For UE power saving purpose during DRX, the following identity is used:

- PS-RNTI: used to determine if the UE needs to monitor PDCCH on the next occurrence of the connected mode DRX on-duration.

For IAB the following identity is used:

- AI-RNTI: identification of the DCI carrying availability indication for soft symbols or soft RB sets of an IAB-DU.

For MBS, the following identities are used:

- G-RNTI: Identifies dynamically scheduled PTM transmissions of MTCH(s);

- G-CS-RNTI: Identifies configured scheduled PTM transmissions of MTCH(s) scheduled with configured grant;

- MCCH-RNTI: Identifies transmissions of MCCH and MCCH change notification.

*Next change*

## 10.9 IAB Resource Configuration

If the IAB-DU and the IAB-MT of an IAB-node are subject to a half-duplex constraint, correct transmission/reception by one cannot be guaranteed during transmission/reception by the other and vice versa, e.g., when collocated and operating in the same frequency. If an IAB-node supports enhanced frequency or spatial multiplexing capabilities, additional multiplexing modes can be supported, i.e., simultaneous operation of IAB-MT Rx / IAB-DU Rx, IAB-MT Tx / IAB-DU Tx, IAB-MT Rx / IAB-DU Tx, IAB-MT Tx / IAB-DU Rx. An IAB-node can report its duplexing constraints between the IAB-MT and the collocated IAB-DU via F1AP. An IAB-node can indicate via F1AP whether or not FDM is required for an enhanced multiplexing operation.

The scheduler on an IAB-DU or IAB-donor-DU complies with the gNB-DU resource configuration received via F1AP, which defines the usage of scheduling resources to account for the aforementioned duplexing constraint.

The resource configuration assigns an attribute of hard, soft or unavailable to each symbol or RB set of each DU cell. Transmission/reception can occur for symbols or RB sets configured as hard, whereas scheduling cannot occur, except for some special cases, for symbols or RB sets configured as unavailable. For symbols or RB sets configured as soft, scheduling can occur conditionally on an explicit indication of availability by the parent node via DCI format 2\_5, or on an implicit determination of availability by the IAB-node. The implicit determination of availability is determined by the IAB-node depending on whether or not the operation of the IAB-DU would have an impact on the collocated IAB-MT.

The resource configuration can be shared among neighbouring IAB-nodes and IAB-donors to facilitate interference management, dual connectivity, and enhanced multiplexing.

To facilitate transitioning from IAB-MT to IAB-DU operation and vice versa, guard symbols can be used to overcome potentially misaligned symbol boundaries between the IAB-MT operation and the IAB-DU operation (e.g., IAB-MT Rx boundaries are not aligned with the IAB-DU Tx boundaries). Specifically, an IAB-node can indicate to a parent node a number of desired guard symbols, while the parent node can indicate to the IAB-node the number of actually provided guard symbols for specific transitions.

An IAB-node supporting enhanced multiplexing capabilities, i.e., IAB-MT Rx / IAB-DU Rx, IAB-MT Tx / IAB-DU Tx, IAB-MT Rx / IAB-DU Tx, IAB-MT Tx / IAB-DU Rx, can provide via MAC-CE to a parent node information to facilitate scheduling for enhanced multiplexing operation by the IAB-node, specifically:

- recommended IAB-MT's Tx/Rx beams;

- desired IAB-MT Tx PSD range;

- desired parent node's IAB-DU Tx power adjustment;

- required IAB-MT's uplink transmission timing mode.

Correspondingly, the parent node can provide information via MAC-CE to the IAB-node to facilitate enhanced multiplexing at the IAB-node and/or at the parent node:

- restricted IAB-DU Tx beams;

- actual parent node's IAB-DU Tx power adjustment;

- IAB-MT's uplink transmission timing mode.

Signaling for beam recommendation and restriction are supported between an IAB node and its parent node/donor. The IAB node may indicate to the parent node/donor, via MAC CE, spatial recommendations and associated time resources. The parent node/donor may indicate to the IAB node, via MAC CE, restrictions on the use of spatial and frequency resources for simultaneous transmission/reception by an IAB-MT of the IAB node and transmission by an IAB-DU of the IAB node.

Signaling for PDSCH EPRE adjustment is supported between an IAB node and its parent node/donor to enable simultaneous transmission/reception at IAB-MT and IAB-DU of the IAB node. The IAB node may indicate to the parent node/donor, via MAC CE, recommendations and associated time resources for a DL TX power adjustment. The parent node/donor may indicate to the IAB node, via MAC CE, spatial and frequency resources to which the DL TX power adjustment contained in the MAC CE applies, as specified in TS 38.321 [6].

*End of changes*