**3GPP TSG RAN WG1 Meeting #106bis-eR1-210xxxx**

**e-Meeting, October 11th – 19th, 2021**

|  |
| --- |
| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.213** | **CR** |  | **rev** |  | **Current version:** | **16.7.0** |  |
|  |
| *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)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

|  |
| --- |
|  |
| ***Title:***  | Introduction of R17 eIAB  |
|  |  |
| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_IAB\_enh |  | ***Date:*** | 2021-11-01 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***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 canbe 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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Introduction of enhancements for IAB in NR |
|  |  |
| ***Summary of change:*** | Add description for resource multiplexing (FDM/TDM), timing control (timing case and case6 and7 timing), and for dual-connectivity (indication conflicts) |
|  |  |
| ***Consequences if not approved:*** | Incomplete support for IAB enhancements in NR |
|  |  |
| ***Clauses affected:*** | 14 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.212, TS 38.214, TS 38.331 |
| ***affected:*** |  | **X** |  Test specifications | N/A |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | N/A  |
|  |  |
| ***Other comments:*** | (…) |
|  |  |
| ***This CR's revision history:*** | N/A |

< Unchanged parts are omitted >

14 Integrated access-backhaul operation

Throughout this specification, unless otherwise noted, statements using the term "UE" in clauses 4 through 13 are equally applicable to the IAB-MT of an IAB node.

A procedure for an IAB-MT to perform cell search, system information acquisition, or random access procedure is same as a corresponding one for a UE except for the following.

For initial cell selection, an IAB-MT may assume that half frames with SS/PBCH blocks occur with a periodicity of 16 frames.

For PRACH transmission, an IAB-MT determines frames and subframes/slots within the frames containing PRACH occasions as described in [4, TS 38.211].

The IAB-MT determines an association period for mapping SS/PBCH blocks to PRACH occasions based on a PRACH configuration period as described in clause 8.1 and according to Table 14-1 instead of Table 8.1-1. An association pattern period includes one or more association periods and is determined so that a pattern between PRACH occasions and SS/PBCH blocks repeats at most every 640 msec. A PRACH occasion in a PRACH slot is valid according to the conditions in clause 8.1.

**Table 14-1: Mapping between PRACH configuration period and SS/PBCH block to PRACH occasion association period for an IAB-MT**

|  |  |
| --- | --- |
| **PRACH configuration period (msec)** | **Association period (number of PRACH configuration periods)** |
| 10 | {1, 2, 4, 8, 16, 32, 64} |
| 20 | {1, 2, 4, 8, 16, 32} |
| 40 | {1, 2, 4, 8, 16} |
| 80 | {1, 2, 4, 8} |
| 160 | {1, 2, 4} |
| 320 | {1, 2} |
| 640 | {1} |

If an IAB-node is provided an index $T\_{delta}$ in a Timing Delta MAC CE [11, TS 38.321] from a serving cell, the IAB-node may assume that $\left(N\_{TA}/2+N\_{delta}+T\_{delta}⋅G\_{step}\right)⋅T\_{c}$ is a time difference between a DU transmission of a signal from the serving cell and a reception of the signal by the IAB-MT when $N\_{TA}/2+N\_{delta}+T\_{delta}⋅G\_{step}>0$, where $N\_{TA}$ is obtained as for a "UE" in clause 4.2 for the TAG containing the serving cell and $N\_{delta}$ and $G\_{step}$ are determined as

- $N\_{delta}=-70528$ and $G\_{step}=64$, if the serving cell providing the Timing Delta MAC CE operates in FR1,

- $N\_{delta}=-17664$ and $G\_{step}=32$, if the serving cell providing the Timing Delta MAC CE operates in FR2

The IAB-node may use the time difference to determine an IAB-DU and/or IAB-MT transmission time.

A slot format for an IAB-DU or an IAB-MT includes downlink symbols, uplink symbols, and flexible symbols.

For each cell of an IAB-DU, the IAB-DU can be provided an indication for a slot format over a number of slots by *gNB-DU Cell Resource Configuration* [16, TS 38.473].

For each serving cell, an IAB-MT can be provided an indication for a slot format over a number of slots by *tdd-UL-DL-ConfigurationDedicated-IAB-MT*. If the IAB-MT is provided *tdd-UL-DL-ConfigurationDedicated-IAB-MT*, the statements in clause 11.1 that include "*tdd-UL-DL-ConfigurationDedicated*" apply to the IAB-MT of an IAB node by replacing "*tdd-UL-DL-ConfigurationDedicated*" with "*tdd-UL-DL-ConfigurationDedicated-IAB-MT*" for the IAB-MT, except that the *tdd-UL-DL-ConfigurationDedicated-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-IAB-MT* where

- if *symbols-IAB-MT* = *allDownlink*, all symbols in the slot are downlink

- if *symbols-IAB-MT* = *allUplink*, all symbols in the slot are uplink

- if *symbols-IAB-MT* = *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-IAB-MT* = *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.

An IAB-MT can be provided, by *SlotFormatCombinationsPerCell*, a list of slot format combinations applicable for one serving cell and, by *SlotFormatIndicator*, 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 clause 11.1.1. In addition to the slot formats in Table 11.1.1-1, an SFI field for an IAB-MT in DCI format 2\_0 can indicate to the IAB-MT a slot format from the slot formats in Table 14-2.

**Table 14-2: Slot formats for normal cyclic prefix**

|  |  |
| --- | --- |
| **Slot****Format** | **Symbol number in a slot** |
| **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| 56 | U | U | U | U | U | U | U | U | U | U | U | U | U | F |
| 57 | U | U | U | U | U | U | U | U | U | U | U | U | F | F |
| 58 | U | U | U | U | U | U | U | U | U | U | U | F | F | F |
| 59 | U | U | U | U | U | U | U | U | U | U | F | F | F | F |
| 60 | U | U | U | U | U | U | U | U | U | F | F | F | F | F |
| 61 | U | U | U | U | U | U | U | U | F | F | F | F | F | F |
| 62 | U | U | U | U | U | U | U | F | F | F | F | F | F | F |
| 63 | U | U | U | U | U | U | F | F | F | F | F | F | F | F |
| 64 | U | U | U | U | U | F | F | F | F | F | F | F | F | F |
| 65 | U | U | U | U | F | F | F | F | F | F | F | F | F | F |
| 66 | U | U | U | F | F | F | F | F | F | F | F | F | F | F |
| 67 | U | U | F | F | F | F | F | F | F | F | F | F | F | F |
| 68 | U | F | F | F | F | F | F | F | F | F | F | F | F | F |
| 69 | U | F | F | F | F | F | F | F | F | F | F | F | F | D |
| 70 | U | U | F | F | F | F | F | F | F | F | F | F | F | D |
| 71 | U | U | U | F | F | F | F | F | F | F | F | F | F | D |
| 72 | U | F | F | F | F | F | F | F | F | F | F | F | D | D |
| 73 | U | U | F | F | F | F | F | F | F | F | F | F | D | D |
| 74 | U | U | U | F | F | F | F | F | F | F | F | F | D | D |
| 75 | U | F | F | F | F | F | F | F | F | F | F | D | D | D |
| 76 | U | U | F | F | F | F | F | F | F | F | F | D | D | D |
| 77 | U | U | U | F | F | F | F | F | F | F | F | D | D | D |
| 78 | U | U | U | U | U | U | U | U | U | U | U | U | F | D |
| 79 | U | U | U | U | U | U | U | U | U | U | U | F | F | D |
| 80 | U | U | U | U | U | U | U | U | U | U | F | F | F | D |
| 81 | U | U | U | U | U | U | U | U | U | U | U | F | D | D |
| 82 | U | U | U | U | U | U | U | U | U | U | F | F | D | D |
| 83 | U | U | U | U | U | U | U | U | U | F | F | F | D | D |
| 84 | U | F | D | D | D | D | D | D | D | D | D | D | D | D |
| 85 | U | U | F | D | D | D | D | D | D | D | D | D | D | D |
| 86 | U | U | U | F | D | D | D | D | D | D | D | D | D | D |
| 87 | U | F | F | D | D | D | D | D | D | D | D | D | D | D |
| 88 | U | U | F | F | D | D | D | D | D | D | D | D | D | D |
| 89 | U | U | U | F | F | D | D | D | D | D | D | D | D | D |
| 90 | U | F | F | F | D | D | D | D | D | D | D | D | D | D |
| 91 | U | U | F | F | F | D | D | D | D | D | D | D | D | D |
| 92 | U | U | U | F | F | F | D | D | D | D | D | D | D | D |
| 93 | U | U | U | U | U | U | U | U | U | F | F | F | F | D |
| 94 | U | U | U | U | U | U | F | F | F | F | F | F | D | D |
| 95 | U | U | U | U | U | U | F | F | D | D | D | D | D | D |
| 96 | U | U | U | U | U | U | U | D | D | D | D | D | D | D |

For a serving cell of an IAB-MT, the IAB-MT can be provided by Provided Guard Symbols MAC CE a number of symbols that will not be used for the IAB-MT in slots where the IAB-node transitions between IAB-MT and IAB-node DU and a SCS configuration for the number of symbols [11, TS 38.321].

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 by *HSNA Slot Configuration List* in *gNB-DU Cell Resource Configuration* [16, TS 38.473]. When a downlink, uplink, or flexible symbol is configured as hard, the IAB-DU cell can respectively transmit, receive, or either transmit or receive in the symbol.

When a downlink, uplink, or flexible symbol is configured as soft, the IAB-DU cell can respectively transmit, receive or either transmit or receive in the symbol only if

- the IAB-MT does not transmit or receive during the symbol of the IAB-DU cell, or

- the IAB-MT would transmit or receive during the symbol of the IAB-DU cell, and the transmission or reception during the symbol of the IAB-DU cell is not changed due to a use of the symbol by the IAB-DU, or

- the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft symbol as available for at least one serving cell

When a symbol is configured as unavailable, the IAB-DU neither transmits nor receives in the symbol.

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.

 For each cell of an IAB-DU, the IAB-DU can be provided an indication of hard, soft or unavailable type per RB set for symbols configured as downlink, uplink or flexible in a slot by *Rel-17 frequency-domain IAB-DU-Resource-Configuration-H/S/NA-Config* [16, TS 38.473]. The IAB-DU may assume that a single value for the RB set size is configured per cell by the parameter *RB Set Configuration* provided by higher layers. The IAB-DU may assume a same SCS configuration for all RBs in the RB sets as an SCS configuration provided by the parameter *Frequency Domain H/S/NA Configuration Reference SCS.*

If no indication of hard, soft or unavailable type is provided for an RB set of a symbol in a slot, the IAB-DU shall apply the configuration of hard, soft or unavailable type provided by *HSNA Slot Configuration List* in *gNB-DU Cell Resource Configuration* [16, TS 38.473]. If an indication of hard, soft, or unavailable type is provided for an RB set of a symbol in a slot, the IAB-node may apply the configuration of hard, soft, or unavailable type provided by *HSNA Slot Configuration List*.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 in a set of cells of the IAB-DU, 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 *resourceAvailability* 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.

An AI index field value in a DCI format 2\_5 indicates to an IAB-DU a soft symbol availability in each slot for a number of slots starting from the earliest slot of the IAB-DU which overlaps in time with the slot of the IAB-MT where the IAB-MT detects the DCI format 2\_5. The number of slots is equal to or larger than a PDCCH monitoring periodicity for DCI format 2\_5 as provided by *SearchSpace*. The AI index field includes  bits where maxAIindex is the maximum of the values provided by corresponding *availabilityCombinationId*. An availability for a soft symbol in a slot is identified by a corresponding value *resourceAvailability* as provided in Table 14-3.

**Table 14-3: Mapping between values of *resourceAvailability* elements and types of soft symbol availability in a slot**

|  |  |
| --- | --- |
| **Value** | **Indication** |
| 0 | No indication of availability for soft symbols |
| 1 | DL soft symbols are indicated available No indication of availability for UL and Flexible soft symbols |
| 2 | UL soft symbols are indicated available No indication of availability for DL and Flexible soft symbols |
| 3 | DL and UL soft symbols are indicated available No indication of availability for Flexible soft symbols |
| 4 | Flexible soft symbols are indicated available No indication of availability for DL and UL soft symbols |
| 5 | DL and Flexible soft symbols are indicated available No indication of availability for UL soft symbols |
| 6 | UL and Flexible soft symbols are indicated available No indication of availability for DL soft symbols |
| 7 | DL, UL, and Flexible soft symbols are indicated available |

If a PDCCH monitoring periodicity for DCI format 2\_5is smaller than a duration of an availability combination of soft symbols over a number of slots that the IAB-MT obtains at a PDCCH monitoring occasion for DCI format 2\_5 by a corresponding AI index field value, and the IAB-MT detects more than one DCI formats 2\_5 indicating an availability combination of soft symbols in a slot, the IAB-MT expects that each of the more than one DCI formats 2\_5 indicates a same value for the availability combination of the soft symbols in the slot. 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.

< Unchanged parts are omitted >