**3GPP TSG-RAN WG2 Meeting #111-e R2-200xxxx**

**E-meeting, August 17-28, 2020**

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| *CR-Form-v11.4* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.300** | **CR** | **293** | **rev** | **1** | **Current version:** | **16.2.0** |  |
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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:*** | CR to 38.300 on Integrated Access and Backhaul for NR | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | (Rapporteur) | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IAB-Core | | | | |  | ***Date:*** | | | 2020-06-20 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Corrections related to NR\_IAB | | | | | | | | |
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| ***Summary of change:*** | | … | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Misalignment with other specification. See Other comments | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.2, 4.7, 6.2, 6.11, 7.4, 9.2, 10.4 | | | | | | | | |
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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:*** | | This CR discusses LS and corrections proposed in the following contributions:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  | | --- | --- | --- | | R2-2006504 | LS on IAB updates to 38.300 (R1-2004872; contact: Qualcomm) | RAN1 | | R2-2006963 | Correction to 38300 for IAB | Qualcomm Incorporated | | R2-2007315 | Miscellaneous Corrections on IAB in 38.300 | ZTE, Sanechips | | R2-2007374 | CR to 38.300 on BH RLC channel | ZTE, Sanechips | | R2-2007509 | IAB-MT capability signalling clarification | Nokia, Nokia Shanghai Bell | | R2-2007536 | Correction to cell selection for IAB SA | Samsung Electronics Romania | | R2-2007539 | Corrections to capability signaling for IAB-MT | Samsung Electronics Romania | | R2-2007545 | Corrections to BH RLF in IAB | Samsung Electronics Romania | |  (R2-2006504) LS from RAN1 on IAB updates to 38.300 (R1-2004872) All changes are already included in TS 38.300 V16.2 (R2-2006963) Correction to 38300 for IAB This contribution proposes to capture in section 6.11.2 that the default routing configuration is used for F1-C rather than for all traffic in compliance with agreements from last meeting. This correction has been adopted in this draft CR. (R2-2007315) Miscellaneous Corrections on IAB in 38.300 This contribution proposes:   * Inclusion of a definition for BH RLC channel. Such as definition is indeed necessary since 38.471 has a reference to 38.300 on this term. The definition proposed in R2-2007315 seems rather long. A shorter, more concise definition is captured in this draft CR. * Removal of a paragraph in sub-section 4.7.3.3. This paragraph is not present in 4.7.3.3. of 38.300 V16.2 so nothing needs to be done here. * Rewordings and editorial changes in multiple subsections. Some of them make sense, others seem questionable. This draft CR holds a revision of the original rewording/editorial proposals.  (R2-2007374) CR to 38.300 on BH RLC channel This contribution proposes rewording in 6.11.3 on the configuration of the BH RLC channel ID. The rewording seems fine and has been included in this draft CR. (R2-2007509) IAB-MT capability signalling clarification This contribution proposes to add a reference to the IAB-MT-specific handling of UE capabilities as agreed in the last RAN2 meeting into section 7.5. The proposed change has been included in this draft CR. (R2-2007536) Correction to cell selection for IAB SA This contribution proposes to change “cell section” to “cell **re-**section” for IAB-specific regulations of access barring in sub section 9.2.1.1 on Cell Selection. The observation that these rules also apply for cell re-selection is correct. However, this should not be covered in sub-section 9.2.1.1 on Cell Selection but in sub-section 9.2.1.2 on Cell Re-selection. However, sub-section 9.2.1.2 does not discuss cell barring for UEs. It therefore doesn’t make sense to add it for IAB-MT’s either. There seems to be the implicit assumption that cell barring rules for cell re-selection are the same as for cell selection. Since this assumption also holds for IAB-MTs, we don’t have to do anything here. The proposed correction has therefore not been included in this draft CR. (R2-2007539) Corrections to capability signaling for IAB-MT This contribution proposes to add a reference to the IAB-MT-specific handling of UE capabilities as agreed in the last RAN2 meeting into a separate sub-section 4.7.4.5. This issue has already been addressed by R2-2007509 above. (R2-2007545) Corrections to BH RLF in IAB This contribution proposes a rewording in section 9.2.7 on RLF. The proposal is based on an old version of 38.300. Since the most recent version of 38300 does not include this reworded text anymore, the rewording cannot be applied. | | | | | | | | |

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| ***This CR's revision history:*** |  |

FIRST CHANGE

## 3.2 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], in TS 36.300 [2] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] and TS 36.300 [2].

**>>>>>>>>>>>>>>> Unchanged parts are skipped<<<<<<<<<<<<<<<<**

**BH RLC channel**: RLC channel used on the IAB backhaul link.

**>>>>>>>>>>>>>>> Unchanged parts are skipped<<<<<<<<<<<<<<<<**

NEXT CHANGE

### 4.7.1 Architecture

Integrated access and backhaul (IAB) enables wireless relaying in NG-RAN. The relaying node, referred to as *IAB-node*, supports access and backhauling via NR. The terminating node of NR backhauling on network side is referred to as the *IAB-donor*, which represents a gNB with additional functionality to support IAB. Backhauling can occur via a single or via multiple hops. The IAB architecture is shown in Figure 4.7.1-1.

The IAB-node supports gNB-DU functionality, as defined in TS 38.401 [4], to terminate the NR access interface to UEs and next-hop IAB-nodes, and to terminate the F1 protocol to the gNB-CU functionality, as defined in TS 38.401 [4], on the IAB-donor. The gNB-DU functionality on the IAB-node is also referred to as *IAB-DU*.

In addition to the gNB-DU functionality, the IAB-node also supports a subset of the UE functionality referred to as *IAB-MT*, which includes, e.g., physical layer, layer-2, RRC and NAS functionality to connect to the gNB-DU of next-hop IAB-node or the IAB-donor, to connect to the gNB-CU on the IAB-donor, and to the core network.

The IAB-node can access the network using either SA-mode or EN-DC. In EN-DC, the IAB-node connects via E-UTRA to a MeNB, and the IAB-donor terminates X2-C as SgNB (TS 37.340 [21]).



Figure 4.7.1-1: IAB architecture; a) IAB-node using SA mode with NGC; b) IAB-node using EN-DC

All IAB-nodes that are connected to an IAB-donor via one or multiple hops form a directed acyclic graph (DAG) topology with the IAB-donor as its root (Fig. 4.7.1-2). In this DAG topology, the next-hop neighbour node of the IAB-DU or the IAB-donor-DU is referred to as *child* node and the next-hop neighbour node of the IAB-MT is referred to as *parent* node. The direction toward the child node is referred to as *downstream* while the direction toward the parent node is referred to as *upstream*. The IAB-donor performs centralized resource, topology and route management for the IAB topology.



Figure 4.7.1-2: Parent- and child-node relationship for IAB-node

NEXT CHANGE

4.7.2 Protocol Stacks

Fig. 4.7.2-1 shows the protocol stack for F1-U and Fig. 4.7.2-2 shows the protocol stack for F1-C between IAB-DU and IAB-donor-CU. In these figures, F1-U and F1-C are carried over two backhaul hops.

F1-U and F1-C use an IP transport layer between IAB-DU and IAB-donor-CU as defined in TS 38.470 [32]. F1-U and F1-C need to be security-protected as described in TS 33.501 [5] (the security layer is not shown in the Figures 4.7.2-1/2).

On the wireless backhaul, the IP layer is carried over the backhaul adaptation protocol (BAP) sublayer, which enables routing over multiple hops. The IP layer can also be used for *non*-F1 traffic, such as OAM traffic [4].

On each backhaul link, the BAP PDUs are carried by BH RLC channels. Multiple BH RLC channels can be configured on each BH link to allow traffic prioritization and QoS enforcement. The BH-RLC-channel mapping for BAP PDUs is performed by the BAP entities on each IAB-node and the IAB-donor-DU.

Protocol stacks for an IAB-donor with split gNB architecture are specified in TS 38.401 [4].



Fig. 4.7.2-1: Protocol stack for the support of F1-U protocol



Fig. 4.7.2-2: Protocol stack for the support of F1-C protocol

The IAB-MT further establishes SRBs (carrying RRC and NAS) with the IAB-donor-CU. For IAB-nodes operating in EN-DC, the IAB-MT also establishes one or more DRBs with the IAB-donor-CU, which can be used, e.g., to carry OAM traffic. For SA-mode, the establishment of DRBs is optional. These SRBs and DRBs are transported between the IAB-MT and its parent node over Uu. The protocol stacks for the SRB is shown in Fig. 4.7.2-3.



Figure 4.7.2-3: Protocol stack for the support of IAB-MT’s RRC and NAS connections

NEXT CHANGE

#### 4.7.3.1 Backhaul transport

The IAB-DU’s IP traffic is routed over the wireless backhaul via the BAP sublayer. The BAP sublayer is specified in TS 38.340 [31]. In downstream direction, upper layer packets are encapsulated by the BAP sublayer at the IAB-donor-DU and de-encapsulated at the destination IAB-node. In upstream direction, upper layer packets are encapsulated at the IAB-node and de-encapsulated at the IAB-donor-DU. IAB-specific transport between IAB-donor-CU and IAB-donor-DU is specified in TS 38.401 [4].

On the BAP sublayer, packets are routed based on the BAP routing ID, which is carried in the BAP header. The BAP header is added to the packet when it arrives from upper layers, and it is stripped off when it has reached its destination node. The selection of the packet’s BAP routing ID is configured by the IAB-donor-CU. The BAP routing ID consists of BAP address and BAP path ID, where the BAP address indicates the destination node of the packet on the BAP sublayer, and the BAP path ID indicates the routing path the packet should follow to this destination. For the purpose of routing, each IAB-node and IAB-donor-DU is further configured with a designated BAP address.

On each hop of the packet’s path, the IAB-node inspects the packet's BAP address in the BAP routing ID carried in the packet header to determine if the packet has reached its destination, i.e., matches the IAB-node’s BAP address. In case the packet has *not* reached the destination, the IAB-node determines the next hop backhaul link, referred to as *egress* link, based on the BAP routing ID carried in the packet header and a routing configuration it received from the IAB-donor-CU.

For each packet, the IAB-node further determines the BH RLC channel on the designated egress link. For packets arriving from upper layers the designated egress BH RLC channel is configured by the IAB-donor-CU, and it is based on upper layer traffic specifiers. Since each BH RLC channel is configured with QoS information or priority level, BH-RLC-channel selection facilitates traffic-specific prioritization and QoS enforcement on the BH. For F1-U traffic, it is possible to map each GTP-U tunnel to a dedicated BH RLC channel or to aggregate multiple GTP-U tunnels into one common BH RLC channel. For other than F1-U traffic, it is possible to map UE-associated F1AP messages, non-UE-associated F1AP messages and non-F1 traffic onto the same or separate BH RLC channels.

When packets are routed from one BH link to another, the BH RLC channel on the egress BH link is determined based on the mapping configuration between ingress BH RLC channels and egress BH RLC channels provided by the IAB-donor-CU.

NEXT CHANGE

#### 4.7.3.2 Flow and Congestion Control

Flow and congestion control can be supported in both upstream and downstream directions in order to avoid congestion-related packet drops on IAB-nodes and IAB-donor-DU:

- In upstream direction, UL scheduling on MAC layer can support flow control on each hop;

- In downstream direction, the NR user plane protocol (TS 38.425 [33]) supports flow and congestion control between the IAB-node and the IAB-donor-CU for UE bearers that terminate at this IAB-node. Further, flow control is supported on BAP sublayer, where the IAB-node can send feedback information on the available buffer size for an ingress BH RLC channel or BAP routing ID to its parent node. The feedback can be sent proactively, e.g., when the buffer load exceeds a certain threshold, or based on polling by the parent node.

#### 4.7.3.3 Uplink Scheduling Latency

The IAB-node can reduce UL scheduling latency through signaling of a Pre-emptive BSR to its parent node. The IAB-node can send the Pre-emptive BSR based on UL grants it has provided to child nodes and/or UEs, or based on BSRs it has received from child nodes or UEs (Figure 4.7.3.3-1). The Pre-emptive BSR conveys the data expected rather than the data buffered.

NEXT CHANGE

5.3.4 Random access

Random access preamble sequences, of four different lengths are supported. Sequence length 839 is applied with subcarrier spacings of 1.25 and 5 kHz, sequence length 139 is applied with subcarrier spacings of 15, 30, 60 and 120 kHz, and sequence lengths of 571 and 1151 are applied with subcarrier spacings of 30 kHz and 15 kHz respectively. Sequence length 839 supports unrestricted sets and restricted sets of Type A and Type B, while sequence lengths 139, 571, and 1151 support unrestricted sets only. Sequence length 839 is only used for operation with licensed channel access while sequence length 139 can be used for operation with either licensed or shared spectrum channel access. Sequence lengths of 571 and 1151 can be used only for operation with shared spectrum channel access.

Multiple PRACH preamble formats are defined with one or more PRACH OFDM symbols, and different cyclic prefix and guard time. The PRACH preamble configuration to use is provided to the UE in the system information.

For IAB, additional random-access configurations are defined. These configurations are obtained by extending the random-access configurations defined for UEs via scaling the periodicity and/or offsetting the time domain position of the RACH occasions.

IAB-MTs can be provided with random access configurations (as defined for UEs or after applying the aforementioned scaling/offsetting) different from random access configurations provided to UEs.

The UE calculates the PRACH transmit power for the retransmission of the preamble based on the most recent estimate pathloss and power ramping counter.

The system information provides information for the UE to determine the association between the SSB and the RACH resources. The RSRP threshold for SSB selection for RACH resource association is configurable by network.

NEXT CHANGE

## 6.1 Overview

**>>>>>>>>>>>>>>> Unchanged parts are skipped<<<<<<<<<<<<<<<<**

Radio bearers are categorized into two groups: data radio bearers (DRB) for user plane data and signalling radio bearers (SRB) for control plane data.

For IAB, the Layer 2 of NR also includes: Backhaul Adaptation Protocol (BAP).

- The BAP sublayer supports routing across the IAB topology and traffic mapping to BH RLC channels for enforcement of traffic prioritization and QoS.

Figures 6.1-3 below depicts the Layer-2 architecture for downlink on the IAB-donor. Figure 6.1-4 and 6.1-5 depict the Layer-2 architecture for downlink and uplink on the IAB-node, where the BAP sublayer offers routing functionality and mapping to BH RLC channels.

NEXT CHANGE

### 6.11.2 Traffic Mapping from Upper Layers to Layer-2

In upstream direction, the IAB-donor-CU configures the IAB-node with mappings between upstream F1 and non-F1 traffic originated at the IAB-node, and the appropriate BAP routing ID, next-hop BAP address and BH RLC channel. A specific mapping is configured:

- for each F1-U GTP-U tunnel;

- for non-UE associated F1AP messages;

- for UE-associated F1AP messages;

- for non-F1 traffic.

Multiple mappings can contain the same BH RLC channel and/or next-hop BAP address and/or BAP routing ID. In case the IAB-MT uses NR-DC, the mapping may include two separate BH RLC channels, where the two BH RLC channels are established toward different parent IAB-DUs.

In case the IAB-node is configured with multiple IP addresses for F1-C on the NR leg, multiple mappings can be configured for non-UE-associated F1AP messages or UE-associated F1AP messages. The appropriate mapping is selected based on the IAB node’s implementation.

These traffic mapping configurations are performed via F1AP. During IAB-node integration, a default BH RLC channel and a default BAP routing ID may be configured via RRC, which can be used for F1-C traffic including IKE signaling and SCTP chunks. These default configurations may be updated during topology adaptation scenarios as discussed in TS 38.401 [4].

In downstream direction, traffic mapping occurs internal to the IAB-donor. Transport for IAB-donors that use split-gNB architecture is handled in TS 38.401 [4].

NEXT CHANGE

6.11.3 Routing and BH-RLC-channel mapping on BAP sublayer

**>>>>>>>>>>>>>>> Unchanged parts are skipped<<<<<<<<<<<<<<<<**

When routing a packet from an ingress to an egress BH link, the IAB-node derives the egress BH RLC channel on the egress BH link through an F1AP-configured mapping from the BH RLC channel used on the ingress BH link. The BH RLC channel IDs used for ingress and egress BH RLC channels are generated by the IAB-donor-CU. Since the BH RLC channel ID only has link-local scope, the mapping configurations also include the BAP addresses of prior and next hop:

Table 6.11.3-2: BH RLC channel mapping configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Next-hop BAP address | Prior-hop BAP address | Ingress RLC channel ID | Egress RLC channel ID |
| Derived from routing configuration | Derived from packet’s ingress link | Derived from packet’s ingress BH RLC channel | BH RLC channel on egress link to forward packet |

The IAB-node resolves the BH RLC channel IDs from logical channel IDs based on the configuration by the IAB-donor-CU. The IAB-MT obtains the BH RLC channel ID in the RRC configuration of the corresponding logical channel. The IAB-DU obtains the BH RLC channel ID in the F1AP configuration of the BH RLC channel.

NEXT CHANGE

## 7.5 UE Capability Retrieval framework

The UE reports its UE radio access capabilities which are static at least when the network requests. The gNB can request what capabilities for the UE to report based on band information. The UE capability can be represented by a capability ID, which may be exchanged in NAS signalling over the air and in network signalling instead of the UE capability structure.

In IAB, it is optional for an IAB-MT to support UE capability Retrieval framework and the related signalling. In case IAB-MT does not support UE capability Retrieval framework, IAB-MT capabilities are assumed to be known to the network by other means, e.g. OAM.

NEXT CHANGE

## 8.1 UE Identities

**>>>>>>>>>>>>>>> Unchanged parts are skipped<<<<<<<<<<<<<<<<**

For IAB, the following identity is used:

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

**>>>>>>>>>>>>>>> Unchanged parts are skipped<<<<<<<<<<<<<<<<**

NEXT CHANGE

9.2.7 Radio Link Failure

**>>>>>>>>>>>>>>> Unchanged parts are skipped<<<<<<<<<<<<<<<<**

In case the RRC connection re-establishment procedure fails, the IAB-node may transmit a BH RLF indication to its child nodes. The BH RLF indication is transmitted as BAP Control PDU.

**>>>>>>>>>>>>>>> Unchanged parts are skipped<<<<<<<<<<<<<<<<**

END OF CHANGES