**3GPP TSG-RAN WG2 Meeting #124 *R2-231xxxx***

**Chicago, IL, USA, November 13 – 17, 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.300** | **CR** | **0727** | **rev** | **2** | **Current version:** | **17.6.0** |  |
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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 | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Introduction of Mobile IAB |
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| ***Source to WG:*** | Qualcomm |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | NR\_Mobile\_IAB |  | ***Date:*** | 2023-11-20 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** |  |
|  | *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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | Introduction of the Mobile IAB feature to specification |
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| ***Summary of change:*** | Clause 3.2: Add mobile-related termsClause 4.7: Add mobile IAB enhancements and restrictions over those for Rel-16/17 IAB.Clause 9.2.1: Add cell selection for mobile IAB-MT.Clause 9.2.3: Add handover support for mobile IAB-MT |
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| ***Consequences if not approved:*** | No RAN support of mobile IAB. |
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| ***Clauses affected:*** | 3.2, 4.7, 9.2.1, 9.2.3 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.304 CR xxxxTS 38.306 CR 2001TS 38.321 CR yyyyTS 38.331 CR 4457TS 38.331 CR 4476TS 38.340 CR 0033 |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Rev 0: Added mobile IAB based on agreements of R2#123:* Clause 3.2: Adds mobile-IAB-related terms.
* Clause 4.7.x: Adds mobile IAB functionality.
* Clause 47.1.x: Adds principal aspects, enhancements and restrictions over Rel-16/17 IAB.
* Clause 4.7.x.2 Adds RACH-less handover for UEs during DU migration.
* Clause 9.2.1: Adds cell selection for mobile IAB-MT.
* Clause 9.2.3: Adds handover support for mobile IAB-MT

Rev 1: Correction to cover pageRev 2: Added agreements from R2#124 and R2#123bis |

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| *--- Begin of Changes ---* |

## 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].

**BH RLC channel**: an RLC channel between two nodes, which is used to transport backhaul packets**.**

**Boundary IAB-node:** as defined in TS 38.401 [4].

**Broadcast MRB**:A radio bearer configured for MBS broadcast delivery.

**CAG Cell**:a PLMN cell broadcasting at least one Closed Access Group identity.

**CAG Member Cell**:for a UE, a CAG cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN, and for that PLMN, a CAG identifier belonging to the Allowed CAG list of the UE for that PLMN.

**CAG-only cell**: a CAG cell that is only available for normal service for CAG UEs.

**Cell-Defining SSB**: an SSB with an RMSI associated.

**Child node**: IAB-DU's and IAB-donor-DU's next hop neighbour node; the child node is also an IAB-node.

**Conditional Handover (CHO**): a handover procedure that is executed only when execution condition(s) are met.

**CORESET#0**: the control resource set for at least SIB1 scheduling, can be configured either via MIB or via dedicated RRC signalling.

**DAPS Handover**: a handover procedure that maintains the source gNB connection after reception of RRC message for handover and until releasing the source cell after successful random access to the target gNB.

**Direct Path**: a type of UE-to-Network transmission path, where data is transmitted between a UE and the network without sidelink relaying.

**Downstream**: direction toward child node or UE in IAB-topology.

**Early Data Forwarding**: data forwarding that is initiated before the UE executes the handover.

**Earth-centered, earth-fixed**: a global geodetic reference system for the Earth intended for practical applications of mapping, charting, geopositioning and navigation, as specified in NIMA TR 8350.2 [51].

**Feeder link**: wireless link between the NTN Gateway and the NTN payload.

**Geosynchronous Orbit**: earth-centered orbit at approximately 35786 kilometres above Earth's surface and synchronised with Earth's rotation. A geostationary orbit is a non-inclined geosynchronous orbit, i.e. in the Earth's equator plane.

**Group ID for Network Selection**: an identifier used during SNPN selection to enhance the likelihood of selecting a preferred SNPN that supports a Default Credentials Server or a Credentials Holder, as specified in TS 23.501 [3].

**gNB**: node providing NR user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**High Altitude Platform Station**: airborne vehicle embarking the NTN payload placed at an altitude between 8 and 50 km.

**IAB-donor**:gNB that provides network access to UEs via a network of backhaul and access links.

**IAB-donor-CU**: as defined in TS 38.401 [4].

**IAB-donor-DU**:as defined in TS 38.401 [4].

**IAB-DU**: gNB-DU functionality supported by the IAB-node 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.

**IAB-MT**: IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise. IAB-MT function used in 38-series of 3GPP Specifications corresponds to IAB-UE function defined in TS 23.501 [3].

**IAB-node**: RAN node that supports NR access links to UEs and NR backhaul links to parent nodes and child nodes. The IAB-node does not support backhauling via LTE.

**IAB topology**: the unison of all IAB-nodes and IAB-donor-DUs whose F1 and/or RRC connections are terminated at the same IAB-donor-CU.

**Indirect Path**: a type of UE-to-Network transmission path, where data is forwarded via a U2N Relay UE between a U2N Remote UE and the network.

**Inter-donor partial migration:** migration of an IAB-MT to a parent node underneath a different IAB-donor-CU while the collocated IAB-DU and its descendant IAB-node(s), if any, are terminated at the initial IAB-donor-CU. The procedure renders the said IAB-node as a boundary IAB-node.

**Intra-system Handover**:handover that does not involve a CN change (EPC or 5GC).

**Inter-system Handover**:handover that involves a CN change (EPC or 5GC).

**Late Data Forwarding**: data forwarding that is initiated after the source NG-RAN node knows that the UE has successfully accessed a target NG-RAN node.

**Mapped Cell ID**: in NTN, it corresponds to a fixed geographical area.

**Mobile IAB-DU**: gNB-DU functionality supported by the mobile IAB-node to terminate the NR access interface to UEs, and to terminate the F1 protocol to the gNB-CU functionality, as defined in TS 38.401 [4], on the IAB-donor.

**Mobile IAB-DU migration**: procedure for a mobile IAB-node as defined in TS 38.401.

**Mobile IAB-MT**: mobile IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise.

**Mobile IAB-MT migration**: procedure for a mobile IAB-MT as defined in TS 38.401.

**Mobile IAB-node**: RAN node that supports NR access links to UEs and NR backhaul links to parent nodes while allowing physical mobility across the RAN area. The mobile IAB-node function used in 38-series of 3GPP Specifications corresponds to the MBSR function defined in TS 23.501 [3].

**MBS Radio Bearer**: A radio bearer configured for MBS delivery.

**MSG1**: preamble transmission of the random access procedure for 4-step random access (RA) type.

**MSG3**: first scheduled transmission of the random access procedure.

**MSGA**:preamble and payload transmissions of the random access procedure for 2-step RA type.

**MSGB**:response to MSGA in the 2-step random access procedure. MSGB may consist of response(s) for contention resolution, fallback indication(s), and backoff indication.

**Multicast/Broadcast Service**: A point-to-multipoint service as defined in TS 23.247 [45].

**Multicast MRB**:A radio bearer configured for MBS multicast delivery.

**Multi-hop backhauling**: using a chain of NR backhaul links between an IAB-node and an IAB-donor.

**ng-eNB**: node providing E-UTRA user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**NG-C**: control plane interface between NG-RAN and 5GC.

**NG-U**: user plane interface between NG-RAN and 5GC.

**NG-RAN node**: either a gNB or an ng-eNB.

**Non-CAG Cell**: a PLMN cell which does not broadcast any Closed Access Group identity.

**Non-Geosynchronous orbit**: earth-centered orbit with an orbital period that does not match Earth's rotation on its axis. This includes Low and Medium Earth Orbit (LEO and MEO). LEO operates at altitudes between 300 km and 1500 km and MEO at altitudes between 7000 km and 25000 km, approximately.

**Non-terrestrial network**: an NG-RAN consisting of gNBs, which provide non-terrestrial NR access to UEs by means of an NTN payload embarked on an airborne or space-borne NTN vehicle and an NTN Gateway.

**NR backhaul link**: NR link used for backhauling between an IAB-node and an IAB-donor, and between IAB-nodes in case of a multi-hop backhauling.

**NR sidelink communication**: AS functionality enabling at least V2X communication as defined in TS 23.287 [40] and the ProSe communication (including ProSe non-Relay and UE-to-Network Relay communication) as defined in TS 23.304 [48], between two or more nearby UEs, using NR technology but not traversing any network node.

**NR sidelink discovery**: AS functionality enabling ProSe non-Relay Discovery and ProSe UE-to-Network Relay discovery for Proximity based Services as defined in TS 23.304 [48] between two or more nearby UEs, using NR technology but not traversing any network node.

**NTN Gateway**: an earth station located at the surface of the earth, providing connectivity to the NTN payload using the feeder link. An NTN Gateway is a TNL node.

**NTN payload**: a network node, embarked on board a satellite or high altitude platform station, providing connectivity functions, between the service link and the feeder link. In the current version of this specification, the NTN payload is a TNL node.

**Numerology**: corresponds to one subcarrier spacing in the frequency domain. By scaling a reference subcarrier spacing by an integer *N*, different numerologies can be defined.

**Parent node**: IAB-MT's next hop neighbour node; the parent node can be IAB-node or IAB-donor-DU

**PC5 Relay RLC channel**: an RLC channel between L2 U2N Remote UE and L2 U2N Relay UE, which is used to transport packets over PC5 for L2 UE-to-Network Relay**.**

**PLMN Cell**: a cell of the PLMN.

**RedCap UE**: a UE with reduced capabilities as specified in clause 4.2.21.1 in TS 38.306 [11].

**Relay discovery**: AS functionality enabling 5G ProSe UE-to-Network Relay Discovery as defined in TS 23.304 [48], using NR technology but not traversing any network node.

**Satellite**:a space-borne vehicle orbiting the Earth embarking the NTN payload.

**Service link**:wireless link between the NTN payload and UE.

**Sidelink Discovery RSRP:** RSRP measurements on PC5 link related to NR sidelink discovery.

**Sidelink RSRP:** RSRP measurements on PC5 link related to NR sidelink communication.

**SNPN Access Mode**: mode of operation whereby a UE only accesses SNPNs.

**SNPN-only cell**: a cell that is only available for normal service for SNPN subscribers.

**SNPN Identity**: the identity of Stand-alone NPN defined by the pair (PLMN ID, NID).

**Transmit/Receive Point**:part of the gNB transmitting and receiving radio signals to/from UE according to physical layer properties and parameters inherent to that element.

**U2N Relay UE**: a UE that provides functionality to support connectivity to the network for U2N Remote UE(s).

**U2N Remote UE**: a UE that communicates with the network via a U2N Relay UE.

**Upstream**: direction toward parent node in IAB-topology.

**Uu Relay RLC channel**: an RLC channel between L2 U2N Relay UE and gNB, which is used to transport packets over Uu for L2 UE-to-Network Relay**.**

**V2X sidelink communication**: AS functionality enabling V2X communication as defined in TS 23.285 [41], between nearby UEs, using E-UTRA technology but not traversing any network node.

**Xn**: network interface between NG-RAN nodes.

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## 4.7 Integrated Access and Backhaul

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### 4.7.X Mobile IAB

#### 4.7.X.1 Principal Aspects

*Mobile IAB* introduces the *mobile IAB-node*, which is a RAN node that provides NR access links to UEs and NR backhaul links to parent nodes while allowing physical mobility across the RAN. The mobile IAB-node includes a *mobile IAB-MT* and a *mobile IAB-DU*. Mobile IAB supports the same functionality as IAB unless explicitly specified. The following enhancements/restrictions *only* apply to mobile IAB:

* The mobile IAB-node uses a separate *mobile-IAB authorization* procedure as defined in TS 38.401 [4] and TS 23.501 [3].
* A RAN node operating as a mobile IAB-node shall not concurrently operate as an IAB-node. During network integration, the RAN node shall indicate whether it intends to operate as a mobile IAB-node or as an IAB-node via an indicator in the *RRCSetupComplete* message.
* The parent node indicates support for mobile IAB-nodes by broadcasting a mobile-IAB-specific indicator in SIB1.
* The mobile IAB-node shall not have descendent nodes. A mobile-IAB cell shall therefore not broadcast any indication that it is a suitable parent node for IAB or mobile IAB.
* The mobile-IAB cell may indicate to UEs that it is hosted by a mobile IAB-DU via an indicator in SIB1.
* The mobile IAB-MT does not support dual-connectivity.
* The mobile IAB-node uses the *mobile IAB-node network integration* procedure as defined in TS 38.401 [4].
* The mobile IAB-MT can perform the *mobile IAB-MT migration* procedures via Xn handover and/or via NG handover as defined in TS 38.401 [4]. The mobile IAB-MT can also perform the *mobile IAB-node recovery* procedure as defined in TS 38.401 [4[.
* The mobile IAB-node can perform the *mobile IAB-DU migration* procedure, where a new logical mobile IAB-DU is established on the mobile IAB-node and the initial logical mobile IAB-DU is released. During this procedure, the UEs connected via the mobile IAB-node are handed over from the initial logical mobile IAB-DU, referred to as the source logical mIAB-DU, to the new logical mobile IAB-DU, referred to as the target logical mIAB-DU. The details of this procedure are defined in TS 38.401 [4]. Enhancements related to BAP for mobile IAB-DU migration are defined in TS 38.340 [31].

#### 4.7.X.2 RACH-less handover

During the mobile IAB-DU migration procedure, RACH-less handover can be configured for a UE that is migrated from the source logical mIAB-DU to the target logical mIAB-DU. The RACH-less handover procedure applies the following functionality:

* The UE uses the same timing advance at the cell of the target logical mIAB-DU as signaled by the cell of the source logical mIAB-DU. The UE restarts the time alignment timer at the reception of the handover command.
* The handover command for the UE contains a beam identifier for the beam to be used by the UE at the target logical mIAB-DU cell. The beam may be determined based on a UE’s measurement report and/or based on implementation, e.g., using the target cell’s knowledge about the beam(s) used by the co-located source cell.
* The handover command may include a pre-allocated UL grant. Alternatively, an UL grant is dynamically signaled by the target logical IAB-DU cell.
* The UE transmits the *RRCReconfigurationComplete message* using the pre-allocated or dynamically signaled UL grant. The UE’s successful UL data reception on the target logical mIAB-DU’s cell terminates the RACH-less handover execution. The UE determines the successful reception of the first UL data by receiving the PDCCH addressing the UE’s C-RNTI in the target cell.
* Further details are defined in TS 38.321 [6]

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## 9.2 Intra-NR

### 9.2.1 Mobility in RRC\_IDLE

#### 9.2.1.1 Cell Selection

The principles of PLMN selection in NR are based on the 3GPP PLMN selection principles. Cell selection is required on transition from RM-DEREGISTERED to RM-REGISTERED, from CM-IDLE to CM-CONNECTED and from CM-CONNECTED to CM-IDLE and is based on the following principles:

- The UE NAS layer identifies a selected PLMN and equivalent PLMNs;

- Cell selection is always based on CD-SSBs located on the synchronization raster (see clause 5.2.4):

- The UE searches the NR frequency bands and for each carrier frequency identifies the strongest cell as per the CD-SSB. It then reads cell system information broadcast to identify its PLMN(s):

- The UE may search each carrier in turn ("initial cell selection") or make use of stored information to shorten the search ("stored information cell selection").

- The UE seeks to identify a suitable cell; if it is not able to identify a suitable cell it seeks to identify an acceptable cell. When a suitable cell is found or if only an acceptable cell is found it camps on that cell and commence the cell reselection procedure:

- A suitable cell is one for which the measured cell attributes satisfy the cell selection criteria; the cell PLMN is the selected PLMN, registered or an equivalent PLMN; the cell is not barred or reserved and the cell is not part of a tracking area which is in the list of "forbidden tracking areas for roaming";

- An acceptable cell is one for which the measured cell attributes satisfy the cell selection criteria and the cell is not barred.

- The IAB-MT applies the cell selection procedure as described for the UE with the following differences:

- The IAB-MT ignores cell-barring or cell-reservation indications contained in cell system information broadcast;

- The IAB-MT only considers a cell as a candidate for cell selection if the cell system information broadcast indicates IAB support for the selected PLMN or the selected SNPN.

- The mobile IAB-MT applies the cell selection procedure as described for the IAB-MT with the following differences:

- The mobile IAB-MT only considers a cell as a candidate cell for cell selection if the cell system information broadcast indicates mobile IAB support.

Transition to RRC\_IDLE:

 On transition from RRC\_CONNECTED or RRC\_INACTIVE to RRC\_IDLE, a UE should camp on a cell as result of cell selection according to the frequency be assigned by RRC in the state transition message if any.

Recovery from out of coverage:

 The UE should attempt to find a suitable cell in the manner described for stored information or initial cell selection above. If no suitable cell is found on any frequency or RAT, the UE should attempt to find an acceptable cell.

In multi-beam operations, the cell quality is derived amongst the beams corresponding to the same cell (see clause 9.2.4).

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### 9.2.3 Mobility in RRC\_CONNECTED

#### 9.2.3.1 Overview

Network controlled mobility applies to UEs in RRC\_CONNECTED and is categorized into two types of mobility: cell level mobility and beam level mobility. Beam level mobility includes intra-cell beam level mobility and inter-cell beam level mobility.

**Cell Level Mobility** requires explicit RRC signalling to be triggered, i.e. handover. For inter-gNB handover, the signalling procedures consist of at least the following elemental components illustrated in Figure 9.2.3.1-1:



Figure 9.2.3.1-1: Inter-gNB handover procedures

1. The source gNB initiates handover and issues a HANDOVER REQUEST over the Xn interface.

2. The target gNB performs admission control and provides the new RRC configuration as part of the HANDOVER REQUEST ACKNOWLEDGE.

3. The source gNB provides the RRC configuration to the UE by forwarding the *RRCReconfiguration* message received in the HANDOVER REQUEST ACKNOWLEDGE. The *RRCReconfiguration* message includes at least cell ID and all information required to access the target cell so that the UE can access the target cell without reading system information. For some cases, the information required for contention-based and contention-free random access can be included in the *RRCReconfiguration* message. The access information to the target cell may include beam specific information, if any.

4. The UE moves the RRC connection to the target gNB and replies with the *RRCReconfigurationComplete*.

NOTE 1: User Data can also be sent in step 4 if the grant allows.

In case of DAPS handover, the UE continues the downlink user data reception from the source gNB until releasing the source cell and continues the uplink user data transmission to the source gNB until successful random access procedure to the target gNB.

Only source and target PCell are used during DAPS handover. CA, DC, SUL, multi-TRP, EHC, CHO, UDC, NR sidelink configurations and V2X sidelink configurations are released by the source gNB before the handover command is sent to the UE and are not configured by the target gNB until the DAPS handover has completed (i.e. at earliest in the same message that releases the source PCell).

The handover mechanism triggered by RRC requires the UE at least to reset the MAC entity and re-establish RLC, except for DAPS handover, where upon reception of the handover command, the UE:

- Creates a MAC entity for target;

- Establishes the RLC entity and an associated DTCH logical channel for target for each DRB configured with DAPS;

- For each DRB configured with DAPS, reconfigures the PDCP entity with separate security and ROHC functions for source and target and associates them with the RLC entities configured by source and target respectively;

- Retains the rest of the source configurations until release of the source.

NOTE 2: Void.

NOTE 3: Void.

RRC managed handovers with and without PDCP entity re-establishment are both supported. For DRBs using RLC AM mode, PDCP can either be re-established together with a security key change or initiate a data recovery procedure without a key change. For DRBs using RLC UM mode, PDCP can either be re-established together with a security key change or remain as it is without a key change. For SRBs, PDCP can either remain as it is, discard its stored PDCP PDUs/SDUs without a key change or be re-established together with a security key change.

Data forwarding, in-sequence delivery and duplication avoidance at handover can be guaranteed when the target gNB uses the same DRB configuration as the source gNB.

Timer based handover failure procedure is supported in NR. RRC connection re-establishment procedure is used for recovering from handover failure except in certain CHO or DAPS handover scenarios:

- When DAPS handover fails, the UE falls back to the source cell configuration, resumes the connection with the source cell, and reports DAPS handover failure via the source without triggering RRC connection re-establishment if the source link has not been released.

- When initial CHO execution attempt fails or HO fails, the UE performs cell selection, and if the selected cell is a CHO candidate and if network configured the UE to try CHO after handover/CHO failure, then the UE attempts CHO execution once, otherwise re-establishment is performed.

DAPS handover for FR2 to FR2 case is not supported in this release of the specification.

The handover of the IAB-MT in SA mode follows the same procedure as described for the UE. After the backhaul has been established, the handover of the IAB-MT is part of the intra-CU or inter-CU topology adaptation procedures defined in TS 38.401 [4]. Modifications to the configuration of BAP sublayer and higher protocol layers above the BAP sublayer are described in TS 38.401 [4].

The handover of the mobile IAB-MT follows the same procedure as described for the UE. After the backhaul has been established, the handover of the mobile IAB-MT is part of the mobile IAB-MT migration procedure defined in TS 38.401 [4].

**Beam Level Mobility** does not require explicit RRC signalling to be triggered. Beam level mobility can be within a cell, or between cells, the latter is referred to as inter-cell beam management (ICBM). For ICBM, a UE can receive or transmit UE dedicated channels/signals via a TRP associated with a PCI different from the PCI of a serving cell, while non-UE-dedicated channels/signals can only be received via a TRP associated with a PCI of the serving cell. The gNB provides via RRC signalling the UE with measurement configuration containing configurations of SSB/CSI resources and resource sets, reports and trigger states for triggering channel and interference measurements and reports. In case of ICBM, a measurement configuration includes SSB resources associated with PCIs different from the PCI of a serving cell. Beam Level Mobility is then dealt with at lower layers by means of physical layer and MAC layer control signalling, and RRC is not required to know which beam is being used at a given point in time.

SSB-based Beam Level Mobility is based on the SSB associated to the initial DL BWP and can only be configured for the initial DL BWPs and for DL BWPs containing the SSB associated to the initial DL BWP. For other DL BWPs, Beam Level Mobility can only be performed based on CSI-RS.

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| *--- End of Changes ---* |

# Running CR Annex: Meeting Agreements

Highlighted below are the meeting agreements that have been considered for the CR.

*RAN2#119 agreements:*

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| **8.12.1 Organizational*** The following Points are Endorsed, i.e. for the plan for next meeting (after one round of discussion at R2 119-e):

P1: RAN2 to discuss scenarios, if and where enhancements to cell (re-)selection to/from the mobile IAB-node apply, e.g. based on mobile IAB-node broadcast parameter (this point doesn’t preclude other potential usage of Bcast info).P2: Can discuss whether The mobile IAB-MT need to send a mobile-IAB indication (capability or mobility) to the IAB-donor-CU,P3: For “dual-DU-way” of doing full migration, RAN2 may discuss whether the legacy UE should see the two logical cells/DUs as separate or same physical cell(s), and what procedure(s) the legacy UE needs to perform in either case. P4: RAN2 may discuss whether there are issues with PCI partitioning that needs to/can be addressed (to be used in applicable scenario), if any found within R2 scope. May discuss need for and feasibility from R2 point of view of a dynamic PCI change mechanism. May also discuss whether enhancements to/vs current UE/MT reporting are useful/necessary to improve PCI collision detection. P5: RAN2 may discuss whether there is a problem of RACH configuration collision between mobile IAB and stationary network from RAN2 perspective and/or whether RAN2 should ask RAN1 to consider RAN1-related aspects. **8.12.2 Mobility Enhancements***Basic Aspects** The method of not broadcasting “iab-Support” indication, is sufficient to prevent other IAB-node from accessing mobile IAB (without further spec impact).
* R2 assumes RACH-less procedure may be considered for on-board RRC\_CONNECTED UEs, which are to be handed over together with the mobile IAB-node (would depend also on the assumptions for UL synch).

*Group Mobility** R2 assumes that CHO or delayed RRC config could be the baseline for group mobility (FFS if could be applicable for mobility of IAB MT), i.e. with a preparation in advance (not immediately) of the execution.
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*RAN2#119-bis-e agreements:*

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| **8.12.2 Mobility Enhancements*** UE capability signalling is the baseline to let CU know that the MT is a “mobile-IAB” type. FFS early mobile-IAB indication, e.g. in Msg5.
* Regarding moving status/mode indication, R2 observes that legacy reporting of mobility state (e.g. mobilityState-r16) could be reused, and maybe also current location reporting from the UE. FFS whether any of this need to be enhanced or complemented, e.g. for the potential purpose of predictive mobility.
* FFS if to Introduce that stationary network broadcasts indication of “supporting mobile-IAB” (into intended for the Mobile IAB MT)
* RAN2 confirms that Mobile IAB need to work with legacy UEs.
* RAN2 observes that a UE could potentially consider itself on-board of a mobile-IAB cell, if the UE camps on/connects to a mobile IAB cell during a long period (i.e. the UE then need to know that this is such a cell). FFS the time. FFS if this is needed.
* RAN2 assume below for the UEs working in the mobile IAB cell (may be obvious):

Assumption 1: From the NW perspective of mobile-IAB cell, the principle of setting the legacy parameters (including cell (re)selection, cell reservations and access restrictions) does not change, compared to the legacy IAB cell.Assumption 2: No spec impact to legacy UEs behaviors.Assumption 3: Any R18 newly broadcasted info of mobile-IAB cell (if agreed) does not forbid/control the access of legacy UEs.Assumption 4: Non-enhanced UEs (including legacy UEs and R18 UEs not supporting the enhancement) just ignore the R18 newly broadcasted info of mobile-IAB cell (if agreed).* RAN2 assumption: For the mobile IAB cell broadcasting info:

1 bit mobile-IAB cell type indication is introduced, to assist mobility in Idle/Inactive mode for Rel-18 UEs (FFS if to assist UE to know it is onboard, if this need to be known)FFS how this is used (might be implementation specific).* RAN2 has from the Mobile IAB WI perspective not identified any modifications to prevent the surrounding UE from accessing the mobile IAB-node, but believes that SA2 may be working on Rel-18 solutions that may be applicable (wait for SA2)

*Group Handover** RAN2 assumes that O1 and O3 above could work, and FFS if O2 above (new trigger etc) is needed.

**8.12.3 Other** * RAN2 focuses on the scenario where, during full migration, the UE sees the two logical DU cells as different physical cells (e.g. with different PCI if same carrier), and where the two logical DU cells use separate physical resources (i.e., different carriers, or orthogonal time and frequency resources of the same carrier, as supported by legacy L1).
* No LS is needed
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*RAN2#120 agreements:*

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| **8.12.2 Mobility Enhancements**Mobile IAB Node to Network IndicationMobile IAB Node CampingUE usage of the Mobile IAB indication* R2 assumes that It is up to RAN3 or SA2 to decide whether to support early mobile IAB indication in Msg5 because it depends whether donor CU needs to select an AMF supporting mobile IAB.
* R2 assumes that Donor CU can determine mobile IAB node's moving status via legacy reporting (e.g. mobility state and UE location / velocity specified in SON/MDT), i.e. R2 assumes enhanced / new reporting is not needed.
* A mobile IAB node may camp on and connect to legacy Rel-16/Rel-17 IAB capable cell.
* R2 assumes "supporting mobile-IAB" indication is provided by Rel-18 Mobile IAB capable parent cell.
* Regarding the assumed mobile-IAB cell type indication, RAN2 assumes is may be specified if some related UE behaviour is specified.

**8.12.3 Other** RACH* RAN2 understands that RACH interference and collisions may be avoided by RACH configuration, and RACH configurations can e.g. be exchanged by Xn, so RACH interference and collisions better be handled between RAN3 and RAN1, if needed.

PCI collision* RAN2 assumes that PCI collision can be avoided, by reconfigurations, and this may be handled by RAN3. If RAN3 finds issues that RAN2 should work on then RAN2 can work. e.g. based on LS.
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*RAN2#121 agreements:*

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| **8.12.2 Mobility Enhancements**mIAB indicator UE to Network* Postponed, AMF selection in the base-station is a Ran3 function, Ran2 expect RAN3 to ask for it if support for this is needed

mIAB cell type ind * Working Assumption: support to have UE prioritization in cell reselection for mIAB cell(s), at least for inter-frequency cell-reselection.
* FFS if UE search and measure for mIAB cells on different frequencies is unspecified (autonomous search), FFS if such search can be done without assistance frequency information.
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*RAN2#121bis-e agreements:*

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| **7.12.2 Mobility Enhancements****7.12.2.1 Connected mode***General** RACH-less for mIAB scenario, if agreed in the end, will cover only the case of same-TA.
* Feasibility of beam handling during RACH-less HO in the mIAB WI is FFS (and this need to be addressed for RACH-less to be supported for mIAB).
* RAN2 discuss further the following options to support beam operation for the first UL transmission/DL reception towards the target logical DU in RACH-less HO during DU migration:

Option 1: (Explicit approach) Explicit beam information is included in HO command. FFS the details. Option 2: (Implicit approach) UE re-uses the same beam status as in the source cell (the beam information is not carried explicitly in HO command).* RACH-less HO with same TA with security key change is in scope for served UEs during mIAB DU migration. FFS UL grant and HO completion procedure in mIAB RACH-less HO.

Barring* noted, Barring or similar issue postponed

Group handover* FFS: May support CHO with CondT1 if it is “for free”, i.e. if TS impact is just to slightly modify the description to make it also applicable to TN.

Signaling* The mobile IAB-MT to include a mobile-IAB indication in Msg. 5.

BAP* R2 assumes that a mobile IAB node is not required to receive the system information of neighbour cells for reporting of measurements (i.e. it will not refrain from reporting measurements of cells that are not broadcasting the “mobile iab Support” indication, and this is acc to current R2 TS).
* R2 clarifies that A donor broadcasting the “supporting mobile-IAB” indication first checks the UE capability of an IAB node before configuring child nodes for the IAB node or sending a handover request for the node, no impact to RAN2 TS.
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*RAN2#122 agreements:*

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| **7.12.2 Mobility Enhancements****7.12.2.1 Connected mode**Handover Enhancements* RAN2 think that to have a fast handover from UE point of view for legacy UEs it is important that the target cell is known to the UE (detected and measured).
* For RACH-less, if supported, there would need to be a beam indication (in RRC HO command), which seems feasible in this release from R2 perspective. R2 assumes that the network can know/select the beam, either from network impl specific knowledge or from UE measurement report (legacy report).
* for the UL grant and HO completion in RACH-less HO:

1. Both type-1 configured grant and dynamic grant are supported2. FFS handling of supervision timer and when HO is considered successfully complete (expect to align with other WI). * Send LS to RAN3 to check whether there are issues / feasibility concerns

**7.12.2.2 Idle/Inactive mode*** We will send LS, will just ask SA2 to provide more details using CAG for mIAB, in order to determine AS impacts, if any.

General* R2 considers that UEs can use the mIAB-cell indication, to prioritize (cell and/or freq) when the UE is camped on the mIAB cell, and FFS to prioritize when the UE is not yet camped on the mIAB cell. FFS if it can be specified the detailed condition for when to apply such prioritization (for either case), RAN2 considers condition based on cell dwelling timer or Mobility state.
* R2 direction (solution agreements at later stage, no other directions will be considered):

RAN2 acknowledges following two problems to be addressed for idle/inactive UEs:- Problem 1: For a UE that is physically on a moving vehicle but not camped on its mobile IAB-cell yet (i.e. the UE is camped on a stationary cell), how to help such UE(s) to identify a neighbour mobile IAB-cell, prioritize mobile IAB-cell (frequency and cell) and to be “pulled” into this mobile IAB-cell, especially for inter-frequency scenario where the mobile IAB-cell’s frequency priority is low.- Problem 2: After the UE physically on a moving vehicle is camped on the mobile IAB cell, how to avoid it reselecting other non-mIAB-(stationary) cells.- Such UE may prioritize a highest ranked cell at a frequency, if it broadcasts a mIAB-cell type indicator in SIB1 for cell reselection. UE may use the SIB4 assistance information to identify the presence of such mobile IAB-cell(s), if broadcasted. A SIB4 assistance information may include mIAB-cell frequencies. FFS on stage-2/3 to clarify the UE in problem 1 and 2.**7.12.3 Other** BAP* P1a: RAN2 assumes that there is no need to introduce logical-DU-specific default BAP configuration in mobile IAB from RAN2 perspective, unless requested by RAN3 otherwise (no LS for now).
* P1b: RAN2 understands that the F1AP (re)configured BAP configuration to one DU will not impact/override the usage of default BAP configuration by another DU.
* P2: RAN2 assumes there may be redundant BAP configuration entries for non-F1-U traffic and it is up to IAB node's implementation to decide which entry is selected. FFS if there is any specification impact.
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*RAN2#123 agreements:*

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| **7.12.2 Mobility Enhancements****7.12.2.1 Connected mode**Handover Enhancements* RACH-less HO to be supported for UEs connected to a mIAB node (intended case: DU migration)
* RACH-less HO for mIAB is expected to reuse most parts from other WI, such as NTN.
* R2 assumes that RACH-less HO for mIAB can largely adopt the steps of the agreed NTN RACH-less HO procedure:

1. Receive a RACH-less HO command which can include pre-allocated grant optionally2. Start time T304 for the target cell (RRC)3. Perform DL and UL synchronization.4. Start time alignment timer (MAC)5. Monitor target cell PDCCH for dynamic grant if pre-allocated grant is not configured in RACH-less HO command (MAC, PHY)6. Send initial UL transmission including RRCReconfigurationComplete message using the available UL grant (RRC, MAC, PHY)7. Consider RACH-less HO is completed upon receiving NW configuration.8. Stop timer T304 for the target cell (RRC).**7.12.2.2 Idle/Inactive mode*** Confirm the WA for inter-frequency cell reselection (scenarios: For a UE that is "on-board", irrespective whether it is camped on the mobile IAB cell or a stationary cell, it can prioritize another frequency for which a mobile IAB cell is the best cell).
* No enhancement is needed for intra-frequency and equal-priority cell reselection.
* The procedure that UE searches and measure for mIAB cells on different frequencies is unspecified. RAN2 assumes that As assistance information, the NW can optionally provide inter-frequency mIAB list in SIB4, details FFS.
* It is left to UE implementation to determine whether the UE is physically on a moving vehicle and when it applies mobile IAB cell reselection prioritization for agreed scenarios.

**7.12.3 Other** BAP* 1a: When both donor-CUs configure the F1AP BAP configuration (i.e., the BH RLC) for BAP control PDU, it’s up to mobile IAB-node’s implementation which configuration is used.
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*RAN2#123bis agreements:*

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| **7.12.2 Mobility Enhancements****7.12.2.1 Connected mode**Handover Enhancements* R2 assumes that for MAC we will work on a joint NTN mIAB CR, FFS if we split into separate CRs in the end.
* R2 assumes that for RRC there will be separate NTN and mIAB CRs that need to be kept consistent.
* UE caps FFS (can discuss next meeting)
* P1a. timeAlignmentTimer is restarted at every reception of HO command containing the RACH-less configuration (confirms existing mIAB agreement; excludes any further NTN-specific changes such as TA value range).
* P1b-1. The network indicates that NTA in the target cell is identical to the source cell (confirms existing mIAB agreement).
* P1c. Unchanged PCI scenario (as discussed for NTN) is not applicable to mIAB.
* P3a. Configured uplink grant (type1) should be discarded when the corresponding configured uplink grant configuration is released by RRC.
* P3d. When rach-LessHO is configured, and if configured grant is not configured, the UE will monitor the PDCCH.
* P4a. For mIAB RACH-less HO, the target cell beam information is explicitly included in HO command (confirms existing mIAB agreement).
* P4b. For RACH-less HO in mIAB, it is left to network implementation whether the network selects a beam (to indicate to the UE) based on the UE measurement report, or the network uses implicit knowledge to select a beam (to indicate to the UE).
* P1b-2 The case where NTA explicitly provided by the network is 0 is not applicable to mIAB.
* (Follow NTN WI:) successful reception of UE’s first UL data based on receiving a PDCCH addressing the UE’s C-RNTI in the target cell scheduling a new transmission as the first UL transmission (can be either DL assignment or UL grant addressed to same HARQ process for the new transmission)
* Observation: for mIAB, the network can always provide a beam indication

**7.12.2.2 Idle/Inactive mode*** P1: mIAB PCI list is optional present (i.e., not mandatory) for indicated mIAB frequency (confirming that mIAB PCI list is introduced)
* P7: it is left to UE implementation to determine an actual prioritized frequency among frequencies that can be prioritized for mIAB cell/HSDN/MBS/SL/V2X?
* P8: Existing Note 0c in TS 38.304 is applicable for the prioritization between mIAB cell/HSDN/MBS/SL/V2X. So, no or marginal additional specification work is needed.
* FFS: P2: To discuss further  if mIAB PCI list is not necessarily exclusive, i.e., the PCI list may or may not include PCIs of non-mIAB cell.

**7.12.3 Other**General* From R2 perspective It is not supported that Rel-18 mobile IAB-node concurrently operate as a Rel-16/17 IAB-node, as e.g. mobile-IAB doesn’t support child IAB nodes.
* This means that there are restrictions for the network in configuring concurrent use of R-18 mIAB feature(s) and rel-16/17 IAB features (details FFS).
* FFS if an IAB-node may send both MSG5 indications to the network, and the network decides (or if the IAB-node should decide).

UE capabilities* RAN2 assumes that the mobileIAB-NodeIndication-r18 in Msg5 implies a preference/intention, with the purpose to help gNB select core network node at initial registration.
* RAN2 assumes that the MT Idle mode behaviours is reflected by a Cap wo signalling in 38306.
* FFS if a separate mobile-IAB capability (signalled) is introduced in Rel-18.
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*RAN2#124 agreements:*

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| **7.12.1 Organizational Stage-2 and high-level open issues**mIAB or IAB operation* A parent node indicates support of mobile IAB but not Rel-16/17 IAB by broadcasting the “mobile IABsupported” indicator but not the “IABsupported” indicator in SIB1.
* A parent node indicates support of both, mobile IAB and Rel-16/17 IAB, by broadcasting “mobile IABsupported” and “IABsupported” in SIB1.
* From AS / R2 point of view, an IAB-node indicates capabilities to the network and the use of these are configured by the network.
* R2 assumes that the device can know whether it is intended to operate as R18 mIAB or R16/17-IAB node, (how the device knows is outside R2 scope, e.g. subscription, device internal param etc), the MSG5 indication is an indication of this intended mode of operation. This agreement is not intended to mandate that a mIAB node must support R16/17 operation (FFS pending cap discussion)
* R2 assumes that the IAB-node only indicates either mobile IAB or Rel-16/17 IAB for MSG5, not both.

Dual Connectivity* mIAB features are not intended to work with DC, i.e. not supported together.

**7.12.2 Stage-3**MAC* Editor’s Note referring to Unchanged PCI (labelled Change #1 in the referenced version of the running NTN MAC CR in the Appendix below) is not applicable to mIAB, and can further be left to NTN to resolve.
* Changes corresponding to timeAlignmentTimer and HO confirmation (labelled Changes #2, #3 and #4 in the referenced version of the running NTN MAC CR in the Appendix below) are agreeable to mIAB as-is.
* Restriction that NTA = 0 does not apply to mIAB shall be captured in RRC spec only (i.e. not in MAC).
* For submission to the Plenary, we will have both mIAB and NTN WI codes for the joint MAC CR for RACH less.
* If a threshold for DG, e.g. for validation, is agreed (for NTN) the usage of the threshold is configurable and whether to support it is a UE cap. (it is assumed that for mIAB this is not needed).
* 1: CG RACH less and DG RACH less are separate UE caps
* 2: CG RACH less is not assumed to be important for IAB and need not to be optimized for the IAB scenario (but also no strict need to prohibit).
* Remove “NTN” from the threshold name as it is assumed to be general
* Confirmed: If rach-lessHO is configured for mIAB-MT, in cases where a pending SR cannot be sent, Random Access shall not be initiated.

With the understanding that CG is not optimized for mIAB case: Confirm also the following for the joint CR: * When CG is configured for the initial uplink transmission for an mIAB-MT configured with rach-lessHO, the initial uplink transmission shall be performed in the first available CG occasion for RACH-less handover.
* The CG-LTM-retransmission timer for the initial UL transmission using CG is introduced for mIAB. Range of values can be discussed during the CR check phase.

SIB4 info (and SIB1)For mIAB frequencies in SIB4: * If PCI-list, PCI-range is provided, for a frequency, then the UE is expected to consider only cells withing this list/range for this frequency for cell reselection evaluation for mIAB.
* If PCI-list, PCI-range is not provided, for a frequency, then the UE is expected to consider all cells for this frequency for cell reselection evaluation for mIAB.
* Assume no change to SIB1 reading at cell reselection, i.e. a UE implementation where the UE reads SIB1 only from the highest ranked cell right before cell reselection is a valid impl.
* The following TP is agreed: “A UE on a vehicle with a mobile IAB-cell may consider the frequency for which a mobile IAB cell is the best cell to be the highest priority. The UE identifies a mobile IAB cell by the mIAB-cell type indicator [ref 38.331] in SIB1. The UE may narrow its search scope for mobile IAB cell(s) by assistance information (frequency and PCI list) if broadcasted in SIB4. A non-mIAB cell may be excluded from mobile IAB frequency prioritization for up to 300 seconds.”

CAG related potential impact* The following note is agreed NOTE 0y: mIAB Frequency prioritization is applicable for a mobile IAB cell irrespective of whether the cell is a CAG cell or not. (can polish the wording)
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