3GPP TSG-RAN WG2 Meeting #123 R2-230xxxx

Toulouse, France, 21– 25 August 2023

**Agenda item: 7.12.1**

**Source: Nokia (Rapporteur)**

**Title: Discussion on UE capability impacts for Rel-18 mobile IAB**

**WID/SID: NR\_mobile\_IAB-Core - Release 18**

**Document for: Discussion and Decision**

# 1 Introduction

This document is to discuss the UE capability impacts related to Rel-18 mobile IAB based on the running agreements after RAN2#123. Following the first phase of the discussion, the running CRs will be drafted for review.

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
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# 3 Discussion

## 3.1 Need for mobile-IAB capability

In RAN2#119bis, the following was agreed:

* 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.

Later, in RAN2#121bis, we agreed to also include a mobile-IAB indication in Msg5:

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

This was to align with SA2 normative text in TS 23.501 that specifies that a mobile-IAB indication is provided to the donor CU to select an AMF that supports an IAB-node with mobility.

For a MBSR node to operate as a MBSR, it provides a mobile IAB-indication to the IAB-donor-CU when the RRC connection is established as defined in TS 38.331 [28]. When the mobile IAB-indication is received, the IAB-donor-CU selects an AMF that supports IAB-node with mobility and includes the mobile IAB-indication in the N2 INITIAL UE MESSAGE as defined in TS 38.413 [34] so that the AMF can perform mobile IAB authorization as described in clause 5.35A.4.

At first it may seem that keeping the mobile-IAB UE capability is not necessary since we already agreed to have a mobile IAB indication in Msg5. However, we wonder if there is some subtlety to the text from 23.501, specifically “for a MBSR node ***to operate as a MBSR***”. It is unclear if the intention behind this text is to allow for a situation where a IAB-MT is *capable* of acting as a mobile IAB-MT but does not wish to *operate* as a mobile IAB-MT, and therefore does not indicate as such during the RRC setup procedure. In that case, it could be necessary to keep the mobile IAB capability despite the Msg5 indication.

Furthermore, we also clarified the following in RAN2#121bis:

* 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.

The first part of this clarification is not essential if mobile-IAB indication is introduced in Msg5 as the donor would already know that the IAB is a mobile IAB. However, the second part of the clarification related to the handover was intended so that the source CU would include the “mobile IAB capability” in the handover request message to the target CU (as UE capabilities are anyway included in handover request messages). Therefore, if we forego the mobile IAB capability there could be some impact on RAN3 (e.g. possibly a need to include a mobile IAB indication in the handover request message).

**Question 1a**: Given the above discussion, should RAN2 keep the mobile-IAB UE capability (in addition to the mobile-IAB indication in Msg5)?

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| --- |
| Answers to Question 1a |
| Company | Yes/No | Comments |
| Apple | Yes | We basically agree with Rapporteur's analysis. In addition, we think UE capability and the indication bit in Msg5 are served for different purposes. So, the UE capability is anyway needed.  |
| Intel | Yes | Agree with rapporteur’s analysis. UE capability is served for the purpose to allow network to know this mobile IAB-node is capable of performing the corresponding functionalities. “*mobileIAB-NodeIndication*” in MSG5 is used to indicate the network the type of one device, hence, serving for different purposes. With the mobile IAB indication in UE capability, during handover, the target NG-RAN node can decide based on the encoded UE capability information, similar as other UEs, without further update of the Xn specification.  |
| Huawei, HiSilicon | No | RAN3 is discussing the Xn indication, similar as R16 for IAB, for the handover purpose. There is no need of this mobile-IAB type in UE capability singling for other purpose, since we already have Msg5.So, from RAN2 perspective, there is no need of explicit mobile-IAB type in UE capability singling, just same as in R16 for IAB-node.At least we should wait for RAN3 progress. |
| Samsung | No | We agree that something needs to be indicated during a handover to know that the IAB DU just received is mIAB-capable, but our understanding is similar to Huaweis in that it should probably be indicated via an indication in Xn signaling (implemented in Xn and not in UE capabilities). We would be fine to wait for RAN3. If RAN3 does not introduce it for whatever reason, then RAN2 can discuss it with RAN3’s conclusion in mind. For the other question of whether it is possible that mIAB sometimes does not indicate mIAB-NodeIndication in msg5, we do not see what scenario that this is useful or makes sense. So we would assume that an mIAB-capable node always indicates this.  |
| ZTE | Yes  | We have the same view as rapporteur a MT may don’t want to operate as a MBSR when accessing the network. Anyway, UE capability signalling is needed to let CU know that the MT is a “mobile-IAB” type.  |
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**Question 1b**: If no to Q1a, do companies think it would be necessary to inform RAN3 that we only intend to use Msg5 and/or check the intention behind the statement “for MBSR to operate as a MBSR” with SA2? Indicate further in comments.

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| --- |
| Answers to Question 1b |
| Company | Yes/No | Comments |
| Huawei, HiSilicon | No strong view | Fine to inform the RAN2 agreement. |
| Samsung | yes | We could inform RAN3 of the above issue, that from a RAN2 perspective, we do not see a need for a UE capability.  |
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**Summary 1**: Most companies think there is still need for a mobile-IAB capability in addition to the Msg5 indication. Some companies think this capability is not needed if RAN3 decides to add a mobile IAB indication to Xn and that RAN2 should wait before introducing it; other companies think the capability is needed regardless. Rapporteur suggests keeping capability for now and adding editor note to indicate that we may revisit this based on the RAN3 discussion.

Rapporteur sympathizes with Samsung that the scenario where an IAB indicates it is mobile-IAB in UE capabilities but not in Msg5 is a bit odd, so this should not be the deciding factor for introducing the capability (at least not without further clarifying SA2’s intentions). We can capture this in the same editor note.

**Proposal 1**: RAN2 assumes mobile-IAB capability is introduced in Rel-18. FFS: if requirement for this capability is impacted by RAN3 agreements on Xn signalling. FFS: if any need to clarify with SA2 the intention of “for a MBSR node to operate as a MBSR” from clause 5.35A.1 of TS 23.501.

## 3.2 Optional features (not requiring new capabilities)

Section 5 of TS 38.306 captures optional features that may be supported by UEs without capability signalling. Two agreements for mobile IAB seem appropriate to add to this section of the specification.

RAN2#120:

* A mobile IAB node may camp on and connect to legacy Rel-16/Rel-17 IAB capable cell.

Since we never specified any related behaviour, it seems unnecessary to introduce a capability for mobile IABs that can access Rel-16/Rel-17 IAB-capable cells, but we may wish to at least capture in TS 38.306 section 5.4 that IAB-MTs may optionally camp on legacy IAB-capable cells.

**Question 2a**: Do companies agree that no capability is needed to indicate that mobile IAB can camp on/connect to legacy IAB-capable cells?

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| --- |
| Answers to Question 2a |
| Company | Yes/No | Comments |
| Apple | Yes | Our understanding on this agreement is: it is a requirement (i.e. mandate mobile IAB-MT to be able to camp in both Rel-18 cell and legacy R16/R17 cells) rather than capability.  |
| Intel | Yes | If there’s no “*mobileIAB-Support*” in SIB1, a mobile IAB-node may camp on/connect to a legacy IAB-capable cells based on its implementation/preference. For this part, since mobile IAB-node is an enhanced node on top of legacy IAB-node, therefore, at least mandatory features supported by Rel-16/Rel-17 IAB-nodes should also be supported by mobile IAB-node, except having descendant nodes (which can be identified by above new capability for mobile IAB, also note that DC is also optional for IAB in R16/R17). This allows the mobile IAB-node to camp on/connect to legacy IAB-capable cells. Hence, there’s no new capability is needed to indicate that mobile IAB can camp on/connect to legacy IAB-capable cells |
| Huawei, HiSilicon | Yes |  |
| Samsung | Yes | Agree with what is stated above |
| ZTE | Yes  |  |
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**Question 2b**: Do companies think it is necessary to capture this as an optionally supported behaviour of the mobile IAB-MT in TS 38.306 section 5.4?

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| --- |
| Answers to Question 2b |
| Company | Yes/No | Comments |
| Apple | No  | As we mentioned in Q2a, this is a requirement for mobile IAB-MT rather than capability. |
| Intel | No need |  We think it is not needed to capture this as an optional feature for mobile IAB-MT. Alternatively, if companies want to clarify, we can clarify that mandatory features for IAB-MT are also applicable for mobile IAB-MT in section 4.2.15. |
| Huawei, HiSilicon | No |  |
| Samsung | No |  |
| ZTE | No  | It has already been captured in the 38.300 running CR that “ Mobile IAB supports the same functionality as IAB unless explicitly specified.” and “The mobile IAB-node can connect to a RAN that supports mobile IAB as well as a RAN that supports IAB without mobile-IAB enhancements.”. So it seems not necessary to captured it in 38.306 again.  |
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**Summary 2**: Companies share the view that no capability is needed to distinguish IAB-MTs that can access legacy IAB nodes; furthermore, some companies understand this to be a requirement for IAB-MT rather than an optional feature. Hence, it is understood that there are no impacts to TS 38.306.

**Proposal 2**: No spec impact to TS 38.306 related to allowing mobile IAB nodes to access legacy IAB nodes.

We also had the following agreement in RAN2#123:

* 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).

In this case it could be appropriate to add a short description to TS 38.306 section 5.4 to note that it is optional for UEs to support mIAB cell reselection prioritization. There already exists a similar note in the specification for HSDN cell reselection:

| Definitions for feature |
| --- |
| **HSDN cell reselection**It is optional for UE to support HSDN cell reselection priority handling in RRC\_IDLE/RRC\_INACTIVE as specified in TS 38.304 [21] and TS 38.331 [9]. |

**Question 3**: Do companies agree RAN2 should capture in TS 38.306 section 5.4 that a UE may optionally support mIAB cell reselection prioritization (similar to what is already captured for HSDN)?

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| --- |
| Answers to Question 3 |
| Company | Yes/No | Comments |
| Apple | Yes | RAN2 have handled many similar cases before in Section 5.4.  |
| Intel | Yes |  |
| Huawei, HiSilicon | No | This is optional for UE. But, it is UE implementation. There is no need to define as UE capability. BTW, there is no impact to NW side on whether UE supports this or not.Note this is different with HSDN case, which uses “shall” in TS 38.304 (*When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority*). |
| Samsung | No | Agree with Huawei. Besides, if it is a capability, then we wonder how it can be tested. So it is easier to not make it a feature.  |
| ZTE | Yes  | It seems not necessary and there is no such indication for sidelink which has similar situation. Rapporteur thinks answer is “No” based on the comment. |
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**Summary 3**: Huawei and ZTE’s comments demonstrate how similar issues have been handled previously: optional features with *specified UE behaviour* (e.g. HSDN cell reselection prioritization) have been captured in TS 38.306, while optional features *left to UE implementation* (e.g. sidelink cell reselection prioritization) have been omitted from this section of the specification. Since mobile IAB cell reselection prioritization is optional and left to UE implementation, Rapporteur believes it makes sense to take the latter direction, i.e. nothing to be captured in TS 38.306.

**Proposal 3**: No spec impact to TS 38.306 related to mobile IAB cell reselection prioritization.

## 3.3 Measurement/Mobility related capabilities

Legacy IAB supported a relatively small number of measurement and mobility related UE capabilities, given in section 4.2.15.8 of TS 38.306 (and shown below). However, to support mobility for Rel-18 IAB, many of the mandatory/conditional mandatory MeasAndMobParameters from section 4.2.9 of TS 38.306 (listed in Annex A) could also now be applicable to IAB.

#### 4.2.15.8 MeasAndMobParameters Parameters (from Rel-16/Rel-17 IAB)

| Definitions for parameters | Per | M | FDD-TDDDIFF | FR1-FR2DIFF |
| --- | --- | --- | --- | --- |
| *eventA-MeasAndReport*Indicates whether the IAB-MT supports NR measurements and events A triggered reporting as specified in TS 38.331 [9]. | IAB-MT | Yes | Yes | No |
| ***handoverInterF***Indicates whether the IAB-MT supports inter-frequency HO. It indicates the support for inter-frequency HO from the corresponding duplex mode if this capability is included in fdd-Add-UE-NR-Capabilities or tdd-Add-UE-NR-Capabilities. It indicates the support for inter-frequency HO from the corresponding frequency range if this capability is included in fr1-Add-UE-NR-Capabilities or fr2-Add-UE-NR-Capabilities. | IAB-MT | No | Yes | Yes |
| ***mfbi-IAB-r16***Indicates whether the IAB-MT supports multiple frequency band indication. | IAB-MT | No | No | No |
| ***intraAndInterF-MeasAndReport***Indicates whether the IAB-MT supports NR intra-frequency and inter-frequency measurements and at least periodical reporting. | IAB-MT | Yes | Yes | No |

In the capabilities listed in the annex we have colour-coded the capabilities based on the *expected* relevance to mobile IAB:

- **Green**: These capabilities are already included as IAB capabilities in 4.2.15.8. In the case of *handoverInterF,* this capability is mandatory for other UEs but not for legacy IAB, and should be made mandatory for mobile IAB.

- **Yellow**: These capabilities are mandatory or conditional mandatory for UEs and could be relevant to mobile IAB.

- **Grey**: These capabilities are conditional on a (non-mandatory) parameter and therefore seem not needed (but can be optionally supported) in mobile IAB.

- **Pink**: These capabilities are associated with a scenario which is downprioritized in the WI (e.g. MR-DC or NR-DC) or with a specific feature (e.g. NTN). These are not needed for mobile IAB.

The intention would be to eventually capture (in a note or by further adding to the parameters in section 4.2.15.8) that the yellow capabilities are also relevant to Rel-18 IAB; that the grey capabilities are optional; and that the pink capabilities are not supported.

However, we suspect that RAN4 may still be looking into the measurement and mobility-related requirements for mobile IAB (see for example the RAN4 draft CR in [R4-2314490](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_108/Docs/R4-2314490.zip)) and wonder if companies prefer to wait for RAN4 input before discussing this matter further.

**Question 4**: Do companies agree RAN2 should wait for RAN4 feedback (i.e. await an LS from RAN4) before discussing the MeasAndMobParameters impacts for Rel-18 mobile IAB?

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| --- |
| Answers to Question 4 |
| Company | Yes/No | Comments |
| Apple | Yes | Since RAN2 don't agree any new measurement feature in Rel-18 mIAB, it is business as usual to wait RAN4 LS.  |
| Intel | Yes | Wait for RAN4 or ask RAN4 if no input is received after next meeting.One comment on *handoverInterF*, based on our understanding, inter-frequency HO is also not supported by mobile IAB according to R4-2310085.And according to RAN4 progress, at least following features should be supported by mobile IAB as mandatory features:Agreed to reuse or use as baseline the NR UE requirements for **Intra-frequency HO, RRC re-establishment, TCI state switch, RLM, Link recovery, L1-RSRP reporting, L3 intra-frequency measurements, timing, and RA**. |
| Huawei, HiSilicon | Yes | Leave it to RAN4 |
| Samsung | Yes |  |
| ZTE | Yes  |  |
|  |  |  |

**Summary 4**: Companies agree that RAN2 should wait for RAN4 input before further discussing measurement and mobility-related impacts to mobile IAB in TS 38.306. Intel noted certain features RAN4 already agreed to support/not support in Rel-18 mobile IAB; however, Rapporteur expects that RAN4 will provide such information in an LS to RAN2, so there is no need to discuss these at the moment.

**Proposal 4**: RAN2 waits for RAN4 before further discussing measurement and mobility-related capability impacts to Rel-18 mobile IAB.

## 3.4 Other new capabilities

Besides mobile-IAB capability, our view is that, *so far*, no other new capabilities are required to be introduced in this WI, either for UEs or for the IAB-MT. Although RAN2 has now agreed to support RACH-less HO for UEs on board the mobile IAB node, it is not clear yet whether or how this will differ from the Rel-18 NTN RACH-less HO; therefore, it does not make sense to discuss the impact of RACH-less HO on the UE capabilities at this point.

**Question 5**: We wonder if companies share similar views on this matter (i.e. there are no other capabilities to be introduced), ***based on agreements made so far in RAN2*** (running agreements are captured in Annex B).

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| Answers to Question 6 |
| Company | Yes/No | Comments |
| Apple | See comments | For RACH-less HO, we think the capability signalling is needed, and the question is just whether to share the capability of NTN or introduce a separate one. It depends on whether any different (sub)feature for mIAB UE to support RACH-less. For example, if TA calculation requirement is included in the capability of NTN RACH-less, we may need a separate one. But we agree that current agreements may not be sufficient to make decision. So, we suggest to capture a Editor Note on FFS of RACH-less HO capability for mIAB.  |
| Intel | see comment | We understand that some points are not clear between NTN and mIAB RACH-less HO. However, in our understanding, RACH-less HO for mIAB and RACH-less HO for NTN are triggered for different purposes. It would be clearer for a UE, also for IOT purpose to indicate supporting of RACH-less HO using separate capability bits for different purposes, i.e. one for mIAB RACH-less HO and another for NTN RACH-less HO. |
| Huawei, HiSilicon | See comment | For RACH-less, OK to wait for more progress. So, we prefer no proposal on this.Not sure about the capabilities from RAN3 design, e.g. whether a mobile IAB-node supports partial migration and/or DU migration. Maybe it can be OAM or implementation issue. |
| Samsung | Agree | Agree that for current agreements we think it is not good use of time to discuss further capabilities. Our expectation is that RACH-less will be harmonized to work in TN, NTN, mIAB etc, and after that the capabilities can be discussed.  |
| ZTE | Yes  | For RACH-less HO, we prefer to wait for further progress in RAN2.  |
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**Summary 5**:

RACH-less HO: Intel thinks that a mobile IAB-specific capability should be introduced for RACH-less HO, but all other companies prefer to wait to evaluate the capability impact until more progress has been made on this feature. Rapporteur is somewhat sympathetic towards capturing an Editor Note as suggested by Apple, but thinks it will be clear already that we need to revisit this topic.

RAN3-related impacts: Huawei wonders whether certain aspects agreed by RAN3 may also have capability impacts. Rapporteur had similar question but expects RAN3 would inform RAN2 of specific impacts (if any). Companies in RAN2 can also indicate (in the upcoming meetings) if there are any specific agreements from RAN3 that RAN2 should ask RAN3 about.

**Proposal 5**: RAN2 awaits further progress on RACH-less HO before evaluating UE capability impacts for this feature.

# 4 Conclusion

Based on companies’ views on the running agreements for Rel-18 mobile IAB, UE capability-related specification changes are minimal. RAN2 assumes for now that a mobile-IAB capability will be introduced, but this could be impacted by discussions in RAN3. Other capabilities may be introduced later based on further progress in RAN2, RAN3, and RAN4.

The following proposals summarize the discussion.

**Proposal 1**: RAN2 assumes mobile-IAB capability is introduced in Rel-18. FFS: if requirement for this capability is impacted by RAN3 agreements on Xn signalling. FFS: if any need to clarify with SA2 the intention of “for a MBSR node to operate as a MBSR” from clause 5.35A.1 of TS 23.501.

**Proposal 2**: No spec impact to TS 38.306 related to allowing mobile IAB nodes to access legacy IAB nodes.

**Proposal 3**: No spec impact to TS 38.306 related to mobile IAB cell reselection prioritization.

**Proposal 4**: RAN2 waits for RAN4 before further discussing measurement and mobility-related capability impacts to Rel-18 mobile IAB.

**Proposal 5**: RAN2 awaits further progress on RACH-less HO before evaluating UE capability impacts for this feature.

# Annex A: MeasAndMobParameters

The following are the mandatory and conditionally mandatory MeasAndMobParameters for normal UEs.

### 4.2.9 *MeasAndMobParameters*

| Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF |
| --- | --- | --- | --- | --- |
| ***csi-RS-RLM***Indicates whether the UE can perform radio link monitoring procedure based on measurement of CSI-RS as specified in TS 38.213 [11] and TS 38.133 [5]. This parameter needs FR1 and FR2 differentiation. If the UE supports this feature, the UE needs to report *maxNumberResource-CSI-RS-RLM*. This applies only to non-shared spectrum channel access. For shared spectrum channel access, *csi-RS-RLM-r16* applies. | UE | Yes | No | Yes |
| ***eutra-CGI-Reporting***Defines whether the UE supports acquisition of relevant CGI-information from a neighbouring E-UTRA cell by reading the SI of the neighbouring cell and reporting the acquired information to the network as specified in TS 38.331 [9] when the (NG)EN-DC and NE-DC are not configured or, when consistent DRX is configured in NR-DC. The consistent DRX configuration implies that MN and SN have the same DRX cycle and on-duration configured by MN completely contains on-duration configured by SN. It is mandated if the UE supports EUTRA. It is optional for RedCap UEs. | UE | CY | No | No |
| ***eventA-MeasAndReport***Indicates whether the UE supports NR measurements and events A triggered reporting as specified in TS 38.331 [9]. This field only applies to SN configured measurement when (NG)EN-DC is configured. For NR SA, MN and SN configured measurement when NR-DC is configured, and MN configured measurement when NE-DC is configured, this feature is mandatory supported. | UE | Yes | Yes | No |
| ***eventB-MeasAndReport***Indicates whether the UE supports EUTRA measurement and event B triggered reporting as specified in TS 38.331 [9]. It is mandated if the UE supports EUTRA. | UE | CY | No | No |
| ***eventD1-MeasReportTrigger-r17***Indicates whether the UE supports location-based triggered measurement reporting (i.e., event D1) as specified in TS 38.331 [9]. It is mandated if the UE supports *locationBasedCondHandover-r17* in any NTN band. | UE | CY | No | No |
| ***gNB-ID-LengthReporting-r17***Indicates whether the UE supports acquisition and reporting of gNB ID length from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired gNB ID length to the network as specified in TS 38.331 [9] when (NG)EN-DC and NE-DC are not configured or, when consistent DRX is configured in NR-DC. The consistent DRX configuration implies that MN and SN have the same DRX cycle and on-duration configured by MN completely contains on-duration configured by SN. It is mandated if UE supports NR CGI reporting (NG)EN-DC and NE-DC are not configured or, when consistent DRX is configured in NR-DC. | UE | CY | No | No |
| ***gNB-ID-LengthReporting-ENDC-r17***Indicates whether the UE supports acquisition and reporting of gNB ID length from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired gNB ID length to the network as specified in TS 38.331 [9] when the (NG)EN-DC is configured. It is mandated if UE supports NR CGI reporting when (NG)EN-DC is configured. | UE | CY | No | No |
| ***gNB-ID-LengthReporting-NEDC-r17***Indicates whether the UE supports acquisition and reporting of gNB ID length from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired gNB ID length to the network as specified in TS 38.331 [9] when the NE-DC is configured. It is mandated if UE supports NR CGI reporting when NE-DC is configured. | UE | CY | No | No |
| ***gNB-ID-LengthReporting-NRDC-r17***Indicates whether the UE supports acquisition and reporting of gNB ID length from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired gNB ID length to the network as specified in TS 38.331 [9] when the NR-DC is configured wherein MN and SN have different DRX cycles, or on-duration configured by MN does not contain on-duration configured by SN if the DRX cycles are the same. It is mandated if UE supports NR CGI reporting when NR-DC is configured. | UE | CY | No | No |
| ***gNB-ID-LengthReporting-NPN-r17***Indicates whether the UE supports acquisition of NPN-relevant gNB ID length from a neighbouring intra-frequency or inter-frequency NR NPN cell by reading the SI of the neighbouring cell and reporting the acquired gNB ID length to the network as specified in TS 38.331 [9]. It is mandated if UE supports NPN CGI reporting. | UE | CY | No | No |
| ***handoverLTE-5GC, handoverLTE-5GC-r17***Indicates whether the UE supports HO to EUTRA connected to 5GC. It is mandated if the UE supports EUTRA connected to 5GC. | UE | CY | Yes | Yes(Incl FR2-2 DIFF) |
| ***handoverFDD-TDD***Indicates whether the UE supports HO between FDD and TDD. It is mandated if the UE supports both FDD and TDD. This field only applies to NR SA/NR-DC/NE-DC (e.g. PCell handover). For PSCell change when (NG)EN-DC/NR-DC is configured, this feature is mandatory supported. UEs supporting this shall indicate support of *handoverInterF* for both FDD and TDD. | UE | Yes | No | No |
| ***handoverFR1-FR2***Indicates whether the UE supports HO between FR1 and FR2. Support is mandatory for the UE supporting both FR1 and FR2. This field only applies to NR SA/NR-DC/NE-DC (e.g. PCell handover). For PSCell change when (NG)EN-DC/NR-DC is configured, this feature is mandatory supported. UEs supporting this shall indicate support of *handoverInterF* for both FR1 and FR2. | UE | Yes | No | No |
| ***handoverInterF, handoverInterF-r17***Indicates whether the UE supports inter-frequency HO. It indicates the support for inter-frequency HO from the corresponding duplex mode and from frequency range indicated to be supported as described in Annex B. This field only applies to NR SA/NR-DC/NE-DC (e.g. PCell handover). For PSCell change when (NG)EN-DC/NR-DC is configured, this feature is mandatory supported. | UE | Yes | Yes | Yes(Incl FR2-2 DIFF) |
| ***handoverLTE-EPC, handoverLTE-EPC-r17***Indicates whether the UE supports HO to EUTRA connected to EPC. It is mandated if the UE supports EUTRA connected to EPC. | UE | CY | Yes | Yes(Incl FR2-2 DIFF) |
| ***intraAndInterF-MeasAndReport***Indicates whether the UE supports NR intra-frequency and inter-frequency measurements and at least periodical reporting. This field only applies to SN configured measurement when (NG)EN-DC is configured. For NR SA, MN and SN configured measurement when NR-DC is configured, and MN configured measurement when NE-DC is configured, this feature is mandatory supported. | UE | Yes | Yes | No |
| ***interSatMeas-r17***Indicates whether the UE supports inter-satellite measurement as specified in TS 38.331 [9]. It is mandatory if the UE supports *nonTerrestrialNetwork-r17*. | UE | CY | No | No |
| ***periodicEUTRA-MeasAndReport***Indicates whether the UE supports periodic EUTRA measurement and reporting. It is mandated if the UE supports EUTRA. | UE | CY | No | No |
| ***maxNumberCLI-RSSI-r16***Defines the maximum number of CLI-RSSI measurement resources for CLI RSSI measurement. If the UE supports *cli-RSSI-Meas-r16*, the UE shall report this capability. | UE | CY | TDD only | No |
| ***maxNumberCLI-SRS-RSRP-r16***Defines the maximum number of SRS-RSRP measurement resources for SRS-RSRP measurement. If the UE supports *cli-SRS-RSRP-Meas-r16*, the UE shall report this capability.NOTE 1: A slot is based on minimum SCS among active BWPs across all CCs configured for SRS-RSRP measurement.NOTE 2: A SRS resource occasion that overlaps with the slot is counted as one measurement resource in the slot. | UE | CY | TDD only | No |
| ***maxNumberCSI-RS-RRM-RS-SINR***Defines the maximum number of CSI-RS resources for RRM and RS-SINR measurement across all measurement frequencies per slot. If UE supports any of *csi-RSRP-AndRSRQ-MeasWithSSB*, *csi-RSRP-AndRSRQ-MeasWithoutSSB*, and *csi-SINR-Meas*, UE shall report this capability.NOTE: A slot is based on minimum SCS among all measurement frequencies configured for RRM and RS-SINR measurement. | UE | CY | No | No |
| ***maxNumberPerSlotCLI-SRS-RSRP-r16***Defines the maximum number of SRS-RSRP measurement resources per slot for SRS-RSRP measurement. If the UE supports *cli-SRS-RSRP-Meas-r16*, the UE shall report this capability. | UE | CY | TDD only | No |
| ***maxNumberResource-CSI-RS-RLM***Defines the maximum number of CSI-RS resources within a slot per spCell for CSI-RS based RLM. If UE supports any of *csi-RS-RLM* and *ssb-AndCSI-RS-RLM*, UE shall report this capability. | UE | CY | No | Yes |
| ***nr-CGI-Reporting***Defines whether the UE supports acquisition of relevant CGI-information from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired information to the network as specified in TS 38.331 [9] when (NG)EN-DC and NE-DC are not configured or, when consistent DRX is configured in NR-DC. The consistent DRX configuration implies that MN and SN have the same DRX cycle and on-duration configured by MN completely contains on-duration configured by SN. It is optional for RedCap UEs. | UE | CY | No | No |
| ***nr-CGI-Reporting-ENDC***Defines whether the UE supports acquisition of relevant CGI-information from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired information to the network as specified in TS 38.331 [9] when the (NG)EN-DC is configured. | UE | Yes | No | No |
| ***reportAddNeighMeasForPeriodic-r16***Defines whether the UE supports periodic reporting of best neighbour cells per serving frequency, as defined in TS 38.331 [9]. It is optional for RedCap UEs. | UE | CY | No | No |
| ***nr-CGI-Reporting-NEDC***Defines whether the UE supports acquisition of relevant information from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired information to the network as specified in TS 38.331 [9] when the NE-DC is configured. | UE | Yes | No | No |
| ***nr-CGI-Reporting-NPN-r16***Defines whether the UE supports acquisition of NPN-relevant CGI-information from a neighbouring intra-frequency or inter-frequency NR NPN cell by reading the SI of the neighbouring cell and reporting the acquired information to the network as specified in TS 38.331 [9]. If UE supports NPN, UE shall report this capability. It is optional for RedCap UEs. | UE | CY | No | No |
| ***nr-CGI-Reporting-NRDC***Defines whether the UE supports acquisition of relevant information from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired information to the network as specified in TS 38.331 [9] when the NR-DC is configured wherein MN and SN have different DRX cycles, or on-duration configured by MN does not contain on-duration configured by SN if the DRX cycles are the same. | UE | Yes | No | No |
| ***ssb-RLM***Indicates whether the UE can perform radio link monitoring procedure based on measurement of SS/PBCH block as specified in TS 38.213 [11] and TS 38.133 [5]. This field shall be set to *supported*. This applies only to non-shared spectrum channel access. For shared spectrum channel access, *ssb-RLM-DynamicChAccess-r16* or *ssb-RLM-Semi-StaticChAccess-r16* applies. | UE | Yes | No | No |
| ***supportedGapPattern***Indicates measurement gap pattern(s) optionally supported by the UE for NR SA, for NR-DC, for NE-DC and for independent measurement gap configuration on FR2 in (NG)EN-DC. The leading / leftmost bit (bit 0) corresponds to the gap pattern 2, the next bit corresponds to the gap pattern 3, as specified in TS 38.133 [5] and so on. The UE shall set the bits corresponding to the measurement gap pattern 13, 14, 17, 18 and 19 to 1 if the UE is an NR standalone capable UE that supports a band in FR2 or if the UE is an (NG)EN-DC capable UE that supports *independentGapConfig* and supports a band in FR2. | UE | CY | No | No |
| ***supportedGapPattern-NRonly-r16***Indicates measurement gap pattern(s) optionally supported by the UE for NR SA and NR-DC when the frequencies to be measured within this measurement gap are all NR frequencies. The leading / leftmost bit (bit 0) corresponds to the gap pattern 2, the next bit corresponds to the gap pattern 3 and so on. The UE shall set the bits corresponding to the measurement gap pattern 2, 3 and 11 to 1. | UE | FD | No | No |

# Annex B: Agreements from RAN2 meetings

Relevant agreements to the above discussion are highlighted.

**RAN2#119:**

* 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.

* 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).
* 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.
* R2 assumes that Mobile IAB connecting to a stationary (intermediate) IAB node is/can be supported. R2 assumes this can be supported with no (or limited) impact.

**RAN2#119bis:**

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

**RAN2#120:**

* 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.
* 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.
* 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.

**RAN2#121:**

* Postponed, AMF selection in the base-station is a Ran3 function, Ran2 expect RAN3 to ask for it if support for this is needed
* 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.
* For the upstream data handling at the BAP of mobile IAB MT, one common default BAP configuration to be used by both logical DUs is the baseline. RAN2 to further discuss the need of using logical-DU-specific default BAP configuration (e.g. when the two logical DUs use different donor-DUs).
* For the upstream data handling at the BAP of mobile IAB MT, RAN2 assume that the F1AP BAP configuration for each logical DU should be configured/controlled by the DU’s respective donor-CU via the corresponding F1AP connection (To be confirmed by RAN3).
* For the downstream data handling arriving at the mobile IAB node, RAN2 assume upper layers (e.g. IP layer) can differentiate the data to different logical DUs based on e.g. the IP address, i.e. no need to introduce logical-DU-specific BAP address. (To be confirmed by RAN3).

**RAN2#121bis:**

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

**RAN2#122:**

* 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 supported

2. 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
* We will send LS, will just ask SA2 to provide more details using CAG for mIAB, in order to determine AS impacts, if any.
* 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.

* 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.

**RAN2#123:**

* 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 optionally

2. 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).

* 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.
* 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.