3GPP TSG-RAN WG2 Meeting #111 Electronic R2-2008105

Elbonia, 17 – 28 August 2020

**Agenda item: 6.2.5**

**Source: Nokia (Summary Rapporteur)**

**Title: Summary of [AT111-e][030][IAB] UE capabilities (Nokia)**

**WID/SID: NR\_IAB - Release 16**

**Document for: Discussion and Decision**

# 1 Introduction

This is to provide a summary of TDocs submitted for IAB UE capabilities under AI 6.2.1 and 6.2.5 which include [1-6].

* [AT111-e][030][IAB] UE capabilities (Nokia)

Scope: Treat R2-2008105, 6959, 7508 7980, 7981

Deadline: Short UE cap

Phase 2 of the email discussion extends the scope to address RAN4 LS in R2-2008444

# 2 Summary

The discussion paper in [1] proposes to introduce the following IAB specific capabilities:

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| ***Proposal 1: Add the following parameter for Feature 4-1 in 38.306:***   |  |  |  |  |  | | --- | --- | --- | --- | --- | | ***Definitions for parameters*** | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF | | ***intraAndInterF-MeasAndReport-IAB-r16***  Indicates whether the IAB-MT supports NR intra-frequency and inter-frequency measurements and at least periodical reporting. Note: It is up to the IAB node to set the capability bit | UE | Yes | Yes | No |   ***Proposal 2: Add the following parameter for Feature 7-1, component 2) in 38.306:***   | Definitions for parameters | Per | M | FDD-TDD  DIFF | FR1-FR2  DIFF | | --- | --- | --- | --- | --- | | ***handoverInterF-IAB-r16***  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 in 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 | |

Companies are invited to provide their views whether they agree with the proposals.

**Q1: Do you agree with the proposals in [1]? If not, please provide comments.**

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| --- | --- | --- |
| **Company** | **Preference (Y/N)** | **Detailed Comments** |
| Ericsson | Y | The ***intraAndInterF-MeasAndReport-IAB-r16*** field should be “Per IAB-MT”.  The word “Note” should also be removed. |
| Nokia, Nokia Shanghai Bell | N | It seems we can just apply the corresponding UE capabilities and add into the existing definition the applicability for the IAB-MT. |
| LG | N | We do not see the need to introduce the same capability bits for IAB MT, since the capability attributes for IAB MT are exactly the same as UE. Instead, we think the existing ***intraAndInterF-MeasAndReport*** *can be reused* |
| AT&T | Y | Agree with Ericsson for Proposal 1. We believe it is better to introduce a new IE since the description text of ***intraAndInterF-MeasAndReport*** is not fully applicable to IAB: “This field only applies to NE-DC and SN configured measurement when (NG)EN-DC is configured. For NR MCG, this feature is mandatory supported,” and would also need to be updated to reflect the RAN Plenary decision.  Also, ***handoverInterF*** cannot be reused becauseit is optional for IAB-MTs and it seems cleaner to have a separate IE. |
| Samsung | Y | Agree with AT&T. |
| Huawei | N | The RP conclusion is   * Rel-15 Layer-2 and Layer-3 UE Feature is mandatory with capability signaling for wide-area and local-area IAB-MTs (it is up to the IAB node to set the capability bit, and the feature will not be captured into the minimum set table specified in TS 38.306):   4-1 Intra-NR measurements and reports  Based on TR 38.822, feature 4-1 only has following IEs/capability: 1) intraAndInterF-MeasAndReport and 2) eventA-MeasAndReport   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 4-1 | Intra-NR measurements and reports | 1) Intra-frequency and inter-frequency measurements and reports  2) Event A-based measurement and measurement report |  | 1) *intraAndInterF-MeasAndReport*  2) *eventA-MeasAndReport* | |   Those two IEs are already captured in the RRC and 306 spec. We should not introduce new IEs. To address the concern from AT&T, clarification to the existing description should be sufficient, as in our CR R2-2007981. |
| ZTE | N | We think existing IE *intraAndInterF-MeasAndReport, eventA-MeasAndReport* and *handoverInterF* for UE could be reused for IAB-MT. And some clarification for IAB-MT could be added in the description of these IEs in TS38.306 to reflect the latest agreements. |
| CATT | N | We also think based on RANP conclusion, the existing IEs should be reused for IAB-MT. To add some clarification for IAB-MT in the description of these existing IE should be sufficient. |

Summary of Q1 is provided together with Q2 and Q5 below.

The CR in [2] proposes changes to TS 38.306 based on the conclusions agreed by RAN Plenary and captured in [RP-201292](http://3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_88e/Docs/RP-201292.zip). The changes intend to clarify accordingly *eventA-MeasAndReport* and *intraAndInterF-MeasAndReport* features support.

Companies are invited to provide their views whether they agree with the changes.

**Q2: Do you agree with the changes proposed in [2]? If not, please provide comments.**

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| --- | --- | --- |
| **Company** | **Preference (Y/N)** | **Detailed Comments** |
| Ericsson | N | Regarding ***eventA-MeasAndReport,*** this parameter was not discussed during the plenary. Rather only the capability related to intra-NR measurements and inter/intra freq. HO were discussed.  Regarding ***intraAndInterF-MeasAndReport,*** we prefer to create a separate field specific for the “IAB-MT” as in Q1 |
| Nokia, Nokia Shanghai Bell | Y | Please note, the RP-201292 Final Summary: Topic 2-P2:  T2-P2’’: The following Rel-15 Layer-2 and Layer-3 UE Features are is mandatory with capability signaling for wide-area and local-area IAB-MTs (it is up to IAB node to set the capability bit, and the feature will not be captured into the minimum set table specified in TS 38.306):  4-1          Intra-NR measurements and reports  Also 38.822, explicitly listed event A-based measurements. |
| LG |  | We think eventA-MeasAndReport is mandatory with capability signalling for IAB MT. I.e. same as UE. Then we think no changes is needed.  We do not see the need to introduce the same but separate capability bits for IAB MT. Existing capability can be reused. |
| AT&T |  | Ok for ***eventA-MeasAndReport*** to be mandatory with capability signaling. For ***intraAndInterF-MeasAndReport*** see our response to Q1 |
| Samsung | N | Similar reasoning as Ericsson. Please also see our response to Q1. |
| Huawei | N, but | Agree with Nokia on the issue clarification. But, we think our CR is R2-2007981 is more aligned with the “mandatory with capability signalling’. |
| ZTE |  | It was agreed that“Intra-NR measurements and reports”is mandatory with capability signaling for IAB-MTs in RAN#88. According to TS 38.822 table 4.2-1, the following two components: 1) Intra-frequency and inter-frequency measurements and reports; 2) Event A-based measurement and measurement report are included in Feature group 4-1 Intra-NR measurements and reports. And the corresponding field name of the above two components in 38.331 are 1) *intraAndInterF-MeasAndReport* 2) *eventA-MeasAndReport.* So we have already discussed and have reached agreements on the above two IEs indeed.  Maybe we only need to add a clarification like “This field also applies to IAB-MT.” to the description of *intraAndInterF-MeasAndReport* and *eventA-MeasAndReport* IE in 38.306, which is aligned with the case when EN-DC is configured for UE. Actually, the specification of “this feature is mandatory supported” in 38.306 corresponds to the mandatory without signaling case. |
| CATT |  | We share the same view as ZTE. |

Summary of Q2 is provided together with Q1 and Q5 below.

The CR in [3] proposes additions into TS 38.300 to implement the following agreement:

* ***R2 to specify that IAB-MTs can make use of the UE capability signaling framework (including specification of minimum set). Whether it is actually used for e.g. Wide Area IAB-MTs may be up to implementation.***

|  |
| --- |
| 7.5 UE Capability Retrieval framework  The UE reports its UE radio access capabilities which are static at least when the network requests. The gNB can request what capabilities for the UE to report based on band information. The UE capability can be represented by a capability ID, which may be exchanged in NAS signalling over the air and in network signalling instead of the UE capability structure.  In IAB, it is optional for an IAB-MT to support UE capability Retrieval framework and the related signalling. In case IAB-MT does not support UE capability Retrieval framework, IAB-MT capabilities are assumed to be known to the network by other means, e.g. OAM |

Alternatively, the CR in [4] proposes the following change with a new section added into TS 38.300:

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| 4.7.4.5 IAB-node Capability Signaling IAB-MTs can make use of the UE capability signaling framework (including specification of minimum set). Whether it is actually used for e.g. Wide Area IAB-MTs may be up to implementation. |

The companies are invited to provide their views for the above proposals and, especially, which CR should become a baseline for Stage-2 CR reflecting the RAN2#110 agreement.

**Q3: Which CR do you agree to become a baseline to implement the above agreement? If not agreeable, please provide comments.**

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| --- | --- | --- |
| **Company** | **Preference ([3]/[4])** | **Detailed Comments** |
| Ericsson | [3] | In TS 38.300 there is already a section 7.5 which can be used for this purpose as in [3] |
| Nokia, Nokia Shanghai Bell | [3] |  |
| AT&T | [3] |  |
| Samsung | [4] | While [4] is our own submission and our first preference, we can accept [3] as well. |
| Huawei | [3] | It seems this is also discussed in offline 026 |
| ZTE | [3] |  |
| CATT | [3] |  |

Summary of Q3:

* + 5 companies prefer the CR option in [3] while one can also accept it.

**Proposal 1: The CR in R2-2007509 is included in rapporteur Stage-2 CR.**

The CR in [5] proposes to add MAC capability *lcid-ExtensionIAB* of IAB-MT defined in TS 38.306 into TS 38.331. Rapporteur notes that this parameter seems to have been mistakenly left out from TS 38.331.

Companies are invited to provide their views whether they agree with the change.

**Q4: Do you agree with the change proposed in [5]? If not, please provide comments.**

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| --- | --- | --- |
| **Company** | **Preference (Y/N)** | **Detailed Comments** |
| Ericsson | Y |  |
| Nokia, Nokia Shanghai Bell | Y |  |
| LG | Y |  |
| AT&T | Y |  |
| Samsung | Y |  |
| Huawei | Y |  |
| ZTE | Y |  |
| CATT | Y |  |

Summary of Q4:

* + All companies agree with the CR in [5].

**Proposal 2: Agree the proposal in CR in R2-2007980 to be merged into the Draft CR.**

The CR in [6] proposes changes to TS 38.306. The changes intend to clarify:

* Optional features for IAB-MT are: *multipleTCI, pdsch-MappingTypeA, pucch-F2-WithFH, pucch-F3-WithFH*;
* Mandatory features for IAB-MT with capability signalling are: *eventA-MeasAndReport, intraAndInterF-MeasAndReport*
* Support at least one of the two features for IAB-MT is: *drb-IAB-r16* or *non-DRB-IAB-r16*.

Companies are invited to provide their views whether they agree with the changes.

**Q5: Do you agree with the changes proposed in [6]? If not, please provide comments.**

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| --- | --- | --- |
| **Company** | **Preference (Y/N)** | **Detailed Comments** |
| Ericsson | Y to 1st and 2nd change  N to 3rd change | We are fine with the intention of “except for IAB-MT”, but then we wonder what is the reason of having “Per UE”. Is it assumed in this specification that whatever is “Per UE” is also per IAB-MT?  Regarding the change on DRB support, we do not think that is needed. It was agreed that DRB support is not mandatory, hence even with the proposed changes there is no guarantee that the IAB-node will work properly if it only support DRB operations. So in short, the change does not seem to bring any particular value. |
| Nokia, Nokia Shanghai Bell | Intention is OK | In 4.2.15.1 it is already said:  “Table 4.2.11.1-1, Table 4.2.11.1-2 and Table 4.2.11.1-3 capture feature groups, which are mandatory for an IAB-MT. All other feature groups or components of the feature groups as captured in TR 38.822 [24] as well as capabilities specified in this specification are optional for an IAB-MT, except for the features which are explicitly indicated as not applicable to IAB-MT.”  We are in principle OK with 3rd proposal on DRB support but think this is not crucial. |
| LG |  | For those capabilities that are currently mandatory with signalling for both normal UEs and IAB-MTs, existing capabilities can be reused with no change. eventA-MeasAndReport, intraAndInterF-MeasAndReport are as such capabilities.  For those capabilities that are currently mandatory with signalling for UE but now are optional for IAB-MTs, we cannot avoid specification changes. multipleTCI, pdsch-MappingTypeA, pucch-F2-WithFH, pucch-F3-WithFH are as such capabilities. Regarding the changes of specifications, the approach [6] proposing to add “except for IAB-MT” seems fine in general. But with this approach, we may need to discuss how to interpret the “M” field. Or, we can introduce the same capability bits dedicated for IABs for those capabilities. |
| AT&T |  | We prefer to add new capability bits for UE mandatory features which are optional for IAB-MTs in order to avoid impact on the legacy signaling or issues with the “M” field as pointed out by LG. |
| Samsung | Y in principle to all changes, but… | Similar concerns as LG and AT&T. |
| Huawei | Y to all | 2nd change is related to Q1. Again, add clarification in 306 has not impact to legacy signalling. |
| ZTE | Agree with intention of 1st and 2nd change,  N to 3rd change | For the 1st and 2nd change, for *intraAndInterF-MeasAndReport* and *eventA-MeasAndReport* IE, please see our comments to Q2. We think clarification like “This field also applies to IAB-MT.” could be added to the description of *intraAndInterF-MeasAndReport* and *eventA-MeasAndReport* IE in 38.306.  For 3rd change, we are OK with the intention but we think no change is needed. |
| CATT | Y to all | According to the intention of RANP conclusion, the legacy signaling in 331 should not be changed and can be re-used for IAB-MT. Thus, we agree the intention of 1st and 2nd change. Besides the 2nd change, we also think to add ‎“This field also applies to IAB-MT.”‎ could be clearer to the description of *intraAndInterF-MeasAndReport* and *eventA-MeasAndReport* IE in 38.306.  For the 3rd change, we think the intention is correct. We prefer to add the changes to make the spec clearer. |

Summary of Q1, Q2, and Q5:

* + There seems to be different views how the existing parameters defined for UEs could be used for IAB-MTs;
  + Most of the companies (4/7) think that existing UE mandatory capability parameterscan be applied for IAB-MTs in case the capability is mandatory with capability signalling also for the IAB MT, but since existing capability bits meaning is not fully applicable to IAB-MT, either some IAB-specific clarification is needed or or separate parameter (IAB-MT) **can** be defined;
  + Most of the companies (4/7) think that the existing parameters that are mandatory for the UE but would be optional for the IAB MT are not trivial to be used and separate parameter **should** be defined in this case.

Rapporteur would like to propose a compromise where existing UE mandatory features that are also mandatory for the IAB-MTs use the existing UE capability bits. Furthermore, we define new capability bits for UE mandatory features which are optional for IAB-MTs for the use of IAB-MTs only.

**Proposal 3: For identified mandatory features for IAB-MT: *eventA-MeasAndReport, intraAndInterF-MeasAndReport,* signalling of the capabilities is required. Existing UE mandatory features with corresponding UE Capability bits could be re-used. However, it is not clear whether the description text of existing capability bits is fully applicable to IAB and further clarification is needed.**

**Proposal 4: For identified optional features for IAB-MT: *multipleTCI, pdsch-MappingTypeA, pucch-F2-WithFH, pucch-F3-WithFH; handoverInterF-IAB* new capability bits are defined for the use of IAB-MT.**

For Q5, regarding the proposal “Support at least one of the two features for IAB-MT is: *drb-IAB-r16* or *non-DRB-IAB-r16*.”

* + There seems to be no enough support to change anything for now.

Further update after Online discussion on Thursday August 27th:

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| **Thursday 27** |  |  |  |
| 04:00 – 05:30 | CB Continued.  CB R17 some WIs way forward (Johan) | CB (Kyeongin) | CB (Brian/Emre) |

During the online discussion the following principle was agreed:

* UE cap for IAB MT shall reuse existing parameters as much as possible, with additional description for IAB MT (e.g. that it is optional instead of mandatory).

Based on that agreement Proposal 3 and 4 are not agreeable and further concluded as follows:

**Conclusion 1:** For identified mandatory features for IAB-MT: *eventA-MeasAndReport, intraAndInterF-MeasAndReport,* andoptional feature for IAB-MT *handoverInterF* existing UE mandatory features with corresponding UE Capability bits are re-used with further explanation on applicability to IAB-MT.

**Conclusion 2:** For identified optional features for IAB-MT*: multipleTCI, pdsch-MappingTypeA, pucch-F2-WithFH, pucch-F3-WithFH,* no further explanation is needed due to general principle (stated in 4.2.15) that all capabilities are optional for IAB-MT,

# 3 RAN4 LS to RAN2 on IAB-MT feature list

RAN4 has further discussed the support of Rel.15 UE features by the IAB-MT. RAN4 would like to inform RAN2 about the following agreements and seek feedback on the following issues.

Agreements:

Feature 2-8(Power class): not applicable to the IAB-MT.

Feature 2-11(Modified MPR behaviour): not applicable to the IAB-MT

Features 3-1 (Independent measurement gap configurations for FR1 and FR2), 3-2(Simultaneous reception of data and SS block with different numerologies) and 3-3(Short measurement gap): optional

Features related to EN-DC, CA and SUL are postponed until the requirements and support framework becomes clear. Please note RAN4 also agreed that CA should be supported in Rel-16 even though there is no decision on the relevant IAB-MT features.

Feature 2-12 (Multiple NS/P-max) is TBD pending RAN2 feedback.

RAN4 would also like to ask RAN2 for feedback on the following issues:

For feature 2-8, is there any impact to the RAN2 design/signaling if this feature is not applicable? Please note that the Tx output power capabilities of wide area IAB-MT and local area IAB-MT are different based on declaration basis.

For feature 2-12, RAN4’s understanding is that the IAB-MT needs to understand at least one of the NS values advertised by the parent gNB in order to perform initial access and not bar the cell. If this is indeed the case, RAN4 would like to ask RAN2 if the initial access procedure can be modified for IAB-MT such that the IAB-MT can ignore the advertised NS values. Because the IAB-MT is in Rel-16, the regulatory requirements imposed by the advertised NS values would be already known by the IAB-MT, and hence, the NS signaling is not needed. RAN4 also thinks IAB-MT may ignore the P-max for the commercial UE considering the different deployment scenarios.

Companies are invited to provide their views on the following:

**Q6: Do you think the agreement: Feature 2-8(Power class): not applicable to the IAB-MT has an impact on RAN2 specifications?**

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| **Company** | **Preference (Y/N)** | **Detailed Comments** |
| Huawei | N, but | It seems the only impact is we need some clarification on exception for IAB-MT in 38.306. We are not sure if any procedure part in 38.331 needs to be changed. |
| Nokia | Y | But marginal, with no ASN.1 changes |
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**Q7: Do you think RAN2 specification can easily support the case IAB-MT ignores the advertised NS values?**

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| --- | --- | --- |
| **Company** | **Preference (Y/N)** | **Detailed Comments** |
| Huawei | Yes | Based on R4 LS, IAB-MT will not be able to read the *NR-NS-PmaxList* in SIB1. We need to update sec 5.2.2.4.2 in TS 38331 to allow IAB-MT to skip that. Some CR like below is needed. But, the impact should be easy and minor.  2> if the UE supports one or more of the frequency bands indicated in the *frequencyBandList* for downlink for TDD, or one or more of the frequency bands indicated in the *frequencyBandList* for uplink for FDD, and they are not downlink only bands, and  2> if the UE supports at least one *additionalSpectrumEmission* in the *NR-NS-PmaxList* for a supported band in the downlink for TDD, or a supported band in uplink for FDD, or UE is an IAB-MT, and  2> if the UE supports an uplink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which  - is smaller than or equal to the *carrierBandwidth* (indicated in *uplinkConfigCommon* for the SCS of the initial uplink BWP), and which  - is wider than or equal to the bandwidth of the initial uplink BWP, and  2> if the UE supports a downlink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which  - is smaller than or equal to the *carrierBandwidth* (indicated in *downlinkConfigCommon* for the SCS of the initial downlink BWP), and which  - is wider than or equal to the bandwidth of the initial downlink BWP: |
| Nokia | Y | But marginal, with no ASN.1 changes |
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# 4 Conclusion

**Conclusion 1:** For identified mandatory features for IAB-MT: *eventA-MeasAndReport, intraAndInterF-MeasAndReport,* andoptional feature for IAB-MT *handoverInterF* existing UE mandatory features with corresponding UE Capability bits are re-used with further explanation on applicability to IAB-MT.

**Conclusion 2:** For identified optional features for IAB-MT*: multipleTCI, pdsch-MappingTypeA, pucch-F2-WithFH, pucch-F3-WithFH,* no further explanation is needed due to general principle (stated in 4.2.15) that all capabilities are optional for IAB-MT,

# References

[1] [R2-2006959](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_111-e/Docs/R2-2006959.zip), *Remaining details of UE capabilities for IAB*, AT&T

[2] [R2-2007508](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_111-e/Docs/R2-2007508.zip), *Update to IAB-MT capabilities*, Nokia, Nokia Shanghai Bell

[3] [R2-2007509](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_111-e/Docs/R2-2007509.zip), *IAB-MT capability signalling clarification*, Nokia, Nokia Shanghai Bell

[4] [R2-2007539](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_111-e/Docs/R2-2007539.zip), *Corrections to capability signaling for IAB-MT*, Samsung Electronics Romania

[5] [R2-2007980](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_111-e/Docs/R2-2007980.zip), *Correction on IAB-MT capability for TS 38.331*, Huawei, HiSilicon

[6] [R2-2007981](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_111-e/Docs/R2-2007981.zip), *Correction on IAB-MT capability for TS 38.306*, Huawei, HiSilicon

[7] R2-2008444, *LS to RAN2 on IAB-MT feature list,* RAN4