**3GPP TSG RAN Meeting #88e DRAFT RP-201292**

**June 29th – July 3rd, 2020**

**Electronic Meeting**

**Agenda item:** **9.3.11**

**Source: AT&T**

**Title: Summary of email discussion on IAB\_UE\_features**

**Document for:** **Discussion/Decision**

# Introduction

During RAN#87e the following agreements were reached:

1. RAN WGs to investigate which of the mandatory Rel-15 UE features (as defined in TR 38.822) can be

optional for basic operation (and if found useful, for different classes of IAB-MTs as defined by RAN4).

1. RAN WGs should strive to minimize specification impact.

As a result, during the May/June WG e-meetings, RAN1/RAN2/RAN3/RAN4 all discussed and reached various agreements on the mandatory/optional support of features for IAB-MTs and IAB-DUs of an IAB-node as well as the applicability of capability signaling for IAB nodes. However there were several remaining issues that could not be resolved and the goal of this email discussion is to address them in a unified approach to ensure consistency of the handling of IAB features across WGs.

**Discussion:** Based on the input contributions 725/916 there are two categories of proposals – **1) Capability signaling and feature lists for IAB nodes** and **2) Mandatory support for topology adaptation.**

**Topic 1:** **Capability signaling and feature lists for IAB nodes**

Key agreements from RAN2**:**

* 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.
* Local-Area IAB-MTs have to support the UE capability signaling framework.
* Mandatory IAB-MT features (minimum set of capabilities) are defined (indicated) in a dedicated sub-section in TS 38.306.
* Introduce capability bits for IAB-MT to allow support indication for the features which are mandatory without capability signaling for Rel-15 UEs, but are optional for IAB-MT.

Key agreements from RAN3**:**

**IAB-DU capabilities are not exchanged between IAB-DU/IAB-donor-DU and IAB-donor-CU via F1 interface.**

**In Rel-16, how the donor-CU and/or parent node are aware of the appropriate capabilities of a given child IAB-DU is left up to network implementation (e.g. via OAM)**

Summary: Given the agreements, it should be clarified that the same signaling framework and specification of the mandatory features for Wide-area and Local Area IAB-MTs is applied across WGs. In addition, how IAB-DU capabilities are handled in Rel-17 should be formally captured to avoid a similar situation as at the end of Rel-16.

Proposals from input contributions**:**

**916-Proposal 1: RAN1&4 take into account the signaling framework used by RAN2 and finalize the IAB-MT feature list.**

**916-Proposal 2: A set of mandatory features are defined which are common for both IAB-MT classes.**

**725-Proposal 2: Local-area IAB-MTs support the same Rel-15 layer-1 mandatory UE features (as defined in TR 38.822) as wide-area IAB-MTs.**

**725-Proposal 5: Support for exchange of IAB-DU capabilities between IAB-DU/IAB-donor-DU and IAB-donor CU via F1 interface should be included in the Rel-17 IAB WID objectives.**

# Discussion

Companies were asked to provide their views on the above proposals as well as any supporting comments or questions for clarification below:

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| **Company** | **Which proposals do you support?** | **Comments** |
| AT&T | All proposals | Given that RAN2 will extend the UE capability signaling framework for IAB-MTs as well, it is important that it can apply to all features across RAN1/RAN2/RAN4. Capability signaling is essential for scalable testing and inter-operability of multi-vendor IAB nodes independent of class and should be fully supported for both IAB-MT and IAB-DU features, which is why we believe 725-Proposal 5 is important to address an unfortunate gap in Rel-16 where exchange/coordination of IAB-DU related features is unspecified and left up to OAM.  Also, although certain optimizations could be considered in terms of feature differentiation between wide-area and local-area IAB-MTs, it seems sufficient in Rel-16 to align the minimum sets of mandatory features between the two classes (assuming topology adaptation is included as discussed in Topic #2). |
| LG | 916-Proposal 1  725-Proposal 2  725-Proposal 5 | We think that Local area IAB-MT should be considered more like a UE and needs much more additional mandatory features than Wide area IAB-MT. So, defining a common set of mandatory features for both IAB-MT classes as in 916-Proposal 2 is inappropriate. It is better to have a separate set of mandatory features for Local area IAB-MT and Wide area IAB-MT. Most of existing Rel-15 UE mandatory features should be included as mandatory for Local area IAB-MT. |
| KDDI | 916-Proposal 1  725-Proposal 2  725-Proposal 5 | We have the same view as LG. |
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| Huawei | 916-Proposal 1  916-Proposal 2  725-Proposal 2 | RAN2 has agreed the principle of how to select features of the minimum set for IAB, regardless of IAB node types, and has agreed a minimum set based on this principle:   * Minimum set of IAB-MT capabilities should contain:  1. Features which are indispensable for IAB-MT to perform initial access and establish an RRC connection and OAM connection with the network. 2. Basic BAP procedures, i.e. routing, bearer mapping 3. IP signalling over RRC   Regardless of local or wide area type, the minimum feature set should enable the IAB node to access the network and connect to OAM. And then it is up to network whether to request the IAB node to report its capability signaling, based on whether the capabilities of this IAB node have already been available in OAM.  In this sense, we see no need to differentiate the minimum feature sets for local area and wide area IAB node types. Note that our view is based on the agreed RAN2 principle, i.e. only these features indispensable for initial access and OAM connection are considered in the minimum feature set (i.e. topology adaptation in topic 2 is not included). |
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| Huawei | Object 725-Proposal 5 | The agreements from RAN3 ”IAB-DU capabilities are not exchanged between IAB-DU/IAB-donor-DU and IAB-donor-CU via F1 interface.” should be a general principle, not just for R16. |
| Ericsson | 916-P1  725-P2 | 916-P1: We support the principle to take into account the work in other WGs, but this proposal is a bit vague. WGs should decide on optional/mandatory regardless of current signaling for “their” features. If the signaling does not exist, RAN2 will add it if needed.  916-P2: We do not support this proposal. Wide-area IAB nodes are deployed in a planned and orderly fashion, whereas local-area IAB nodes are not. This means that local-area IAB nodes must support more features (e.g. for mobility) which are not required for the wide-area IAB nodes.  725-P2: As mentioned above, local-area IAB nodes may be deployed in an unplanned fashion and therefore need to support features similar to a UE.  725-P5: We think the current focus should be on completing the UE features and capabilities for Release 16 before discussing to extend the scope for Rel-17. It is not urgent to decide this and it can be resolved in RAN#89. |
| Nokia, NSB | 916-Proposal 1, 725-Proposal 2 | It is not completely clear in 916-Proposal 2 which set of features are considered in here, and hence we are not fine as a general proposal given that the two IAB-MT classes correspond to different deployments. As for 725-Proposal 2 we are fine to assume that particular set of features is common among the two IAB-MT classes.  As for proposal 725-Proposal 5 we do not see it as necessary. |
| Intel | All Proposals | We agree with AT&T’s views. Note that 916 Proposal 2 implies 725 proposal 2. |

**Intermediate summary – Topic 1:**

**The following proposals are considered:**

**T1-P1: RAN1&4 take into account the signaling framework used by RAN2 and finalize the IAB-MT feature list.**

**T1-P2: Local-area IAB-MTs support the same Rel-15 layer-1 mandatory UE features (as defined in TR 38.822) as wide-area IAB-MTs.**

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| **Company** | **Which proposals do you support?** | **Comments** |
| **CATT** | **T1-P1** | **We are ok with T1-P1.**  **For T1-P2, we would like to clarify whether this means to confirm the mandatory features that R1 has agreed for wide area are also mandatory for local area. If this is the current understanding then we think it can be stated in a more explicit way, i.e.,**  *T1-P2: The mandatory features that R1 has agreed for wide area are also mandatory for local area.*  **Then we have some further question on 916-P2, as its proponent.**  **916-Proposal 2: A set of mandatory features are defined which are common for both IAB-MT classes.**  **We see there are some misunderstandings on this one. Huawei’s comment in the previous round actually is what in our mind with this proposal.**  **In short, we figure out the minimum set (e.g., what has been agreed so far as mandatory in R1/2/4) and that set is then mandatory for both IAB-MT types. Otherwise we need to then discuss which feature is mandatory for one type but not the other.** |
| **AT&T** | **T1-P1, T1-P2 (916-P2)** | **We have the same understanding as CATT about the intention of the proposal. We understand 916-P2 to be more general than T1-P2 (this was focused on resolving the issue in RAN1) so we would be open to it as well if there was consensus.** |
| **KDDI** | **T1-P1, T1-P2** | **We agree with two proposals. However for T1-P2, we prefer the CATT’s more explicit wording**  *T1-P2: The mandatory features that R1 has agreed for wide area are also mandatory for local area.* |
| **LG** | **T1-P1, T1-P2** | **Considering the intention of the T1-P2, we also prefer the CATT’s wording.**  *T1-P2: The mandatory features that R1 has agreed for wide area are also mandatory for local area.* |
| **Intel** | **T1-P1, T1-P2** |  |

**Final summary – Topic 1:**

**The following proposals are made as a result of the email discussion:**

**T1-P1: RAN1&4 take into account the signaling framework used by RAN2 and finalize the IAB-MT feature list.**

**T1-P2: Local-area IAB-MTs support the same mandatory UE features (as already agreed for wide-area IAB-MTs.**

**Topic 2:** **Mandatory support for topology adaptation**

Key RAN1 agreements:

**Agreement:**

* Wide-area IAB-MTs support the following Rel. 15 layer-1 mandatory UE features (as defined in TR 38.822)
  + Without capability (signaling)
    - 0-1, 0-3, 0-4, 1-1 (only 1 preamble for component 1, component 2, component 3 except paging), 2-1, 2-5, 2-6, 2-12, 2-16, 2-16a, 2-32 (only components 1-4 and 7), 2-50 (only components 1,2), 2-52 (only components 1, 2), 3-1 (only components 1,2,3,4,5), 4-1, 5-1 (only components 1/2/3/4/5/6/7/9/10/12), 6-1, 7-1, 8-3
  + With capability signaling which shall be set to '1'
    - 1-3, 2-22, 4-10
  + The rest of Rel-15 layer-1 UE features other than the ones as listed above are optional for wide-area IAB-MTs.
* Note: Mandatory MT capabilities are independent from DU capabilities and do not imply a corresponding mandatory DU capability.
* The UE feature list for local-area IAB-MTs is FFS

Key RAN2 agreements:

Chair Summary On topology adaptation, Operators and (some) Network Vendors have opposite opinions. Attempt to agree Mandatory, Mandatory only for Local area IAB MT, Mandatory with possibility for early deployment non-support were all blocked by objections.

Summary: While RAN1 agreed that SSB-based measurements are mandatory for IAB-MTs, there was no consensus on how to handle similar features related to topology adaptation in RAN2. In addition, there was no consensus on whether certain features related to topology adaptation in the RAN4 IAB-MT feature list should remain optional (as is the case for UEs) or become not-applicable for IAB-MTs.

Proposals from input contributions**:**

RAN1-related

**725-Proposal 1: Support for basic topology adaptation functionality (i.e. RRM measurements, reports, and handovers) is mandatory for both wide-area and local-area IAB-MTs.**

**725-Proposal 3: For FGs 20-2 and 20-3 in the Rel-16 NR UE Feature list, the following is agreed:**

**Optional with capability signalling. Devices supporting IAB backhaul must report this FG as supported.**

RAN2-related

**725-Proposal 4: The following Rel-15 Layer-2 and Layer-3 UE Features are mandatory with capability signaling for IAB-MTs:**

**4-1          Intra-NR measurements and reports**

**7-1          Handover:**

**1) Intra-frequency HO**

**2) Inter-frequency HO**

**OR**

**916-Proposal 3: The topology adaption related FG4-1/4-2/7-1 are not mandatory for IAB-MT in Rel-16.**

RAN4-related

**725-Proposal 6: RF/RRM Rel-15 UE Features related to topology adaptation (i.e. FG 3-1/3-2/3-3) should remain optional for IAB-MTs in Rel-16.**

Companies are asked to provide their views on the above proposals as well as any supporting comments or questions for clarification below:

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| **Company** | **Which proposals do you support?** | **Comments** |
| AT&T | 725-Proposal 1  725-Proposal 3  725-Proposal 4  725-Proposal 6 | As discussed in detail in 725, basic topology adaptation (i.e. RRM measurements, reports, and handovers) is a critical functionality for IAB nodes to ensure optimal routes for the backhaul links can be configured by the Donor CU. **This should not be left to OAM or implementation** as one of the key differentiators of IAB from other self-backhauling technologies is the ability to scale dense deployments of IAB nodes and manage the backhaul link operation and routing **within the RAN**.  Furthermore, given that RAN1 has agreed SSB-based RRM measurements are mandatory for at least wide-area IAB-MTs (i.e. FG 1-1 component 2), consistent agreements should be applied across WGs. In our view, making the relevant RAN1/RAN2 FGs in 725 Proposals 3 and 4 as mandatory for IAB-MTs with capability signaling is an acceptable compromise which still enables the potential for IAB nodes to be deployed without this functionality in limited small-scale or isolated early deployments if so desired by an operator. |
| LG | 725-Proposal 1  725-Proposal 3  725-Proposal 4  725-Proposal 6 | Basic topology adaptation functionalities are essential to support high density use case, e.g., Local area IAB-MT. Given that the IAB donor CU configures and manages all backhaul links and routes in IAB network, we think basic topology adaptation provides a way to handle a backhaul link failure to the IAB donor CU and is also important for Wide area IAB-MT. |
| KDDI | 725-Proposal 6 | We support 725-Proposal 6. We can accept 725-Proposal 1, 725-Proposal 3, 725-Proposal 4 as a compromise. Even though we are not sure whether topology adaptation functionalities should be mandatory for wide-area IAB-MTs in Rel-16 time frame. But, mandatory with capability signaling seems to be a good compromise to progress the discussion. |

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| Huawei | **916-Proposal 3** | As we clarified in Q1, RAN2 has already agreed the principle of minimum set selection for IAB:   * Minimum set of IAB-MT capabilities should contain:  1. **Features which are indispensable for IAB-MT to perform initial access and establish an RRC connection and OAM connection with the network.** 2. **Basic BAP procedures, i.e. routing, bearer mapping** 3. **IP signalling over RRC**   And RAN WGs have defined the minimum feature set, which can already meet the requirement. Features for the aka topology adaptation functionality are clearly dispensable for IAB-MT to perform initial access and OAM connection.  On the other hand, the scenario for the topology adaptation functionality as mentioned in this paper is “scale dense deployments of IAB nodes”, which is not the focus of the initial phase of IAB deployment. But supporting the features for the topology adaptation functionality would require a lot of implementation efforts for vendors (even if it is mandatory with capability), and as a consequence would delay the IAB commercialization.  Given that RAN1/2/4 have already agreed the basic feature set that IAB nodes have to support, we think other features can be optional and can also be supported based on the need and request of some specific operators. |
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| Huawei | **925-Proposal 6** | For the RAN4 RRM part (725-Proposal 6  3-1/3-2/3-3), keeping them optional is acceptable to us (as a compromise) |

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| Huawei | Object 725-Proposal 1 and 725-Proposal 3 | In general, our view is that topology adaption is not the basic operation for IAB-MT since it does not have any impact on initial access and connection setup. We can provide more details if needed…but probably not needed…. |
| Ericsson | **725-P1: Yes, for local-area IAB nodes.**  **725-P3**  **725-P4: But only for local-area IAB nodes.**  **725-P6** | 725-P1: We think that initial deployments of wide-area IAB nodes will be simple with one parent node and therefore deployment adaptations will not be needed. In later deployments (which may be more advanced and dense) this is an interesting feature to support. Therefore we think it is good to have this feature optional from the start. This gives freedom to the operator to request this feature from the vendor. For local-area IAB nodes deployed in a non-planned manner or not under operator control, we see this feature as necessary for system performance.  725-P3: We understand this is about removing the brackets and we are fine with that.  725-P4: We think this proposal is related to mobility which was ruled out in the work item description. We can accept to support it for local-area IAB nodes though as they are more similar to UEs.  725-P6: We are fine to support this proposal. |
| Nokia, NSB | **916-Proposal 3, 725-Proposal 6** | At least for wide-area IAB-MTs it is not necessary to support handovers as mandatory features, given that any changes to topology would be relatively rare. We can accept as a compromise to mandate support on 4-1 as RRM measurements are useful in general. |
| Futurewei | **916- Proposal 3,**  **725 – Proposal 6** | Given the limited time to complete Rel-16 and the likely deployment scenarios of Rel-16 IAB, topology adaption related features don’t need to be made mandatory. |
| Verizon | **725-Proposal 1**  **725-Proposal 3**  **725-Proposal 4**  **725-Proposal 6** | Basic topology adaptation features like RRM measurements/reports are essential functionality needed for a scalable IAB deployment that allow IAB donor CU to configure IAB backhaul routes. Leaving this to OAM creates an unnecessary deployment burden that makes IAB less desirable to other backhaul alternatives.  Recognising the challenge some vendors might face in implementing the features in Proposals ¾ in their early products, making the features in Proposals 3/4 mandatory with capability signalling is reasonable way forward that allows both small scale deployments without these features and also large scale deployment with these features enabled. |
| Intel | 725-Proposal 1  725-Proposal 3  725-Proposal 4  725-Proposal 6 | Based on operator views, topology adaptation is an important feature for IAB.  Update: note however, that in our view, avoiding different mandatory feature sets for local area and wide area IAB MTs is more important. Please see comments below. |

**Intermediate summary – Topic 2:**

**The following proposals are considered:**

**T2-P1: For FGs 20-2 and 20-3 in the RAN1 Rel-16 NR UE Feature list, the following is agreed:**

**Optional with capability signalling. ~~Devices supporting IAB backhaul~~ local-area IAB-MTs must report this FG as supported.**

**T2-P2: The following Rel-15 Layer-2 and Layer-3 UE Features are mandatory with capability signaling for wide-area and local-area IAB-MTs:**

**4-1          Intra-NR measurements and reports**

**The following Rel-15 Layer-2 and Layer-3 UE Features are mandatory with capability signaling for local-area IAB-MTs:**

**7-1          Handover:**

**1) Intra-frequency HO**

**2) Inter-frequency HO**

**T2-P3: RF/RRM Rel-15 UE Features related to topology adaptation (i.e. FG 3-1/3-2/3-3) should remain optional for IAB-MTs in Rel-16.**

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| **Company** | **Which proposals do you support?** | **Comments** |
| **CATT** |  | As discussed in topic 1 currently we still want to check the possibility of a common set of mandatory features for both IAB types. We think Topic 2 can be discussed together with this issue.  As a compromise can we have all topology adaption related features as not mandatory (i.e., optional with singling) for both IAB-MT types, but clarify in spec that for local area cases it has to be reported as supported. I see T2-P1 is in that direction… |
| **AT&T** | **T2-P1, T2-P2, T2-P3** | As pointed out by Intel, Qualcomm, and Verizon, topology adaptation is a key functionality of IAB from the very beginning even before the concept of wide-area and local-area IAB classes was introduced (which was actually quite late in the WI). As a result we believe T2-P1, T2-P2 and represent a significant compromise for us. However as pointed about by Nokia, measurements (which are already mandatory from a Layer 1 perspective) and reports (and it is expected only minimal work to implement) are generally useful for all types of IAB deployments so we can accept that these are mandatory for both types while additional SMTCs/HO are only mandatory for local area IAB nodes. |
| **KDDI** | **T2-P1, T2-P2, T2-P3** | **Agree with AT&T** |
| **LG** | **T2-P1, T2-P2, T2-P3** | **Same view as AT&T.** |
| **Intel** |  | We still really do not see the need to differentiate mandatory features between local area and wide area IAB MTs. This can cause unnecessary fragmentation, and its not clear how we will distinguish between wide area and local area MTs in practice (we think this itself will need significant further discussion – for example, node association to a parent node may depend on whether the parent node has a wide area or local area MT).  Looking at the comments thus far (and observing that topology adaptation seems to be the sticking point) I think we seem to be choosing between two options broadly:   1. Somehow distinguish between wide area IAB MTs and local area IAB MTs and making topology adaptation mandatory for local area IAB MTs. 2. Leaving topology adaptation optional and not explicitly distinguishing between local area and wide area MTs.   Topology adaptation is clearly important for IAB and has always been planned. However, making it optional does not mean that it will not be implemented. We think the issues resulting from distinguishing between local area and wide area IAB MTs could be more significant. For this reason we would prefer to go with the 2nd option (i.e., similar to CATT’s thinking). |

**Final summary – Topic 2:**

**The following proposals are made as a result of the email discussion:**

**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**

**The following Rel-15 Layer-2 and Layer-3 UE Features are optional with capability signaling for wide-area and local-area IAB-MTs:**

**7-1          Handover:**

**1) Intra-frequency HO**

**2) Inter-frequency HO**

**T2-P3: RF/RRM Rel-15 UE Features related to topology adaptation (i.e. FG 3-1/3-2/3-3) should remain optional for IAB-MTs in Rel-16.**

# Conclusions

**The following proposals are made as a result of the email discussion:**

**T1-P1: RAN1&4 take into account the signaling framework used by RAN2 and finalize the IAB-MT feature list.**

**T1-P2: Local-area IAB-MTs support the same mandatory UE features (as already agreed) for wide-area IAB-MTs.**

**T2-P2’’: The following 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**

**The following Rel-15 Layer-2 and Layer-3 UE Feature is optional with capability signaling for wide-area and local-area IAB-MTs:**

**7-1          Handover:**

**1) Intra-frequency HO**

**2) Inter-frequency HO**

**T2-P3: RF/RRM Rel-15 UE Features related to topology adaptation (i.e. FG 3-1/3-2/3-3) should remain optional for IAB-MTs in Rel-16.**