3GPP TSG RAN WG1 Meeting #106-e R1-210xxxx

16th August – 27th August 2021

Agenda Item: 8.10

Source: Moderator (Qualcomm Incorporated)

Title: Summary of initial assessment on Rel-17 upper layer parameters to support eIAB physical layer operation [Post-106-e-Rel17-RRC-10]

Document for: Information

This document provides a summary of the following email discussion on upper layer parameters to support eIAB physical layer operation:

[Post-106-e-Rel17-RRC-10] eIAB – to be moderated by Luca (Qualcomm)

An initial assessment of the required upper layer parameters for Rel-17 eIAB has been made with input from the FLs of the applicable agenda items 8.10.1 and 8.10.2 and it is summarized in the following parameters table. A revised version of the parameters table has been made, based on the feedback received in the first round of discussion. Responses to companies’ comments have been provided. Track changes has been enabled to view the actual changes.

Companies are encouraged to provide additional feedback in the comments section at the end of the document.

| **Param. ID** | **Sub-feature group** | **New or existing parameter** | **Parameter name in specification** | **Description** | **Value range** | **Default value** | **IAB node specific/IAB nodes common** | **Specification** | **Signaling** | **Comment** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P01 | Resource multiplexing | New | Rel-17 frequency-domain IAB-DU-Resource-Configuration-H/S/NA-Config (final name in specification to be determined by RAN2/3) | Indicates H/S/NA attributes per RB set, per D/U/F resource type within a slot. | {Hard, Soft, Not Available} per RB set, per resource type in a slot [TBD relative to IAB-DU-Resource-Configuration-TDD-Config]  |  | IAB node specific |  | **F1AP** | **RAN1 #105-e**AgreementFor frequency domain multiplexing, H/S/NA configurations for an IAB-node are provided separately in addition to the Rel-16 H/S/NA**Agreement**If an IAB node is configured with a frequency-domain H/S/NA configuration down select between the following options:* Alt. 1 Either the Rel-16 H/S/NA configuration or frequency domain configuration is applied for a given resource
	+ FFS: Whether configurations are switched with per-slot, per-resource type within a slot, or per-symbol granularity
* Alt. 2 The Rel-16 H/S/NA configuration and frequency domain configuration are jointly applied

**RAN1 #106-e****Agreement**The semi-static configuration of H/S/NA resource type in frequency domain is provided per RB set, per D/U/F resource type within a slot. |
| P02 | Resource multiplexing | New | RB Set Configuration | Indicates the RB set size in number of PRBs used for frequency domain multiplexing between given IAB-DU and IAB-MT cells | * List of values {2, 4, 8, 16, 32, 64}
* N is at least the # PRBs corresponding to the MT’s #PRB of an RBG
* FFS: Value(s) in case of multiple configured BWPs at the IAB-MT
 |  | IAB node specific |  | **F1AP** | **RAN1 #105-e****Agreement**The minimum resource size for configuring the frequency domain granularity is a set of N RBs:• Candidate values for N: {4, 8, 16, other values TBD}• N is at least the # PRBs that are corresponding to the MT’s # PRBs of an RBG).FFS: Scaling or configuration of N based on system BW or size of IAB-MT BWP**RAN1 #106-e****Agreement**N is a configured number of PRBs, where the CU configures N* N = {2, 4, 8, 16, 32, 64}
* FFS: Value(s) of N in case of multiple configured BWPs at the IAB-MT
* This agreement does not revert any existing RAN1 agreement

**Requires intra/inter CU coordination:** No |
| P03 | Resource multiplexing | New | Frequency Domain H/S/NA Configuration Reference SCS | Indicates reference SCS to be applied to Rel-17 IAB-DU-Resource-Configuration-H/S/NA-Config at the IAB-DU | FR1: {15kHz, 30kHz, 60kHz}FR2: {60kHz, 120kHz} |  | IAB node specific |  | **F1AP** | **RAN1 #106-e****Agreement**A Reference SCS is configured for frequency domain H/S/NA configuration.**Requires intra/inter CU coordination:** No |
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| P05 | Resource multiplexing | New | Peer Parent Common Resource Configuration | Indicates the semi-static and/or cell-common higher layer configuration (e.g. SSB, CORESET 0, and RACH and configurations) from/for different parent nodes. | TBD (at least cell-common higher layer configuration (e.g. SSB, CORESET 0, and RACH and configurations) |  | IAB node specific |  | **F1AP and Xn** | **RAN1 #106-e****Agreement**For intra-donor and inter-donor DC scenarios, coordinating the semi-static and/or cell-common higher layer configuration (e.g. SSB, CORESET 0, and RACH and configurations) from/for different parent nodes. |
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| P10 | Resource multiplexing | New | Rel-17 Desired Guard Symbols  | Number of symbols the IAB node would like the parent IAB node not to use at the edge (beginning or end) of a slot for Case #6 and Case #7 timing cases when there is a transition between the IAB node MT and DU per cell  | FFS |  | IAB node specific | Resource multiplexing | **MAC-CE** | **RAN1 #106-e****Agreement**MAC-CE signaling of Desired/Provided Guard Symbols is enhanced (e.g. using the same Rel-16 MAC-CE design) to support indication of guard symbols additionally required for Case #6 and Case #7 timing cases.* FFS: Number of guard symbols associated with Case #6 and Case #7 timing modes
* FFS: Need for explicit indication of guard symbols switching between timing cases
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| P11 | Resource multiplexing | New | Rel-17 Provided Guard Symbols  | Number of symbols the IAB node uses at the edge (beginning or end) of a slot for Case #6 and Case #7 timing cases when there is a transition between the IAB node MT and DU at the child node per cell | FFS |  | IAB node specific | Resource multiplexing | **MAC-CE** |
| P12 | FFS: Resource multiplexing or Interference management | New | Simultaneous Operation Beam Indication | Signaling from a parent node to a child node indicating beams of an IAB-DU in the direction of which simultaneous operation is restricted | FFS |  | IAB node specific | Resource multiplexing | **MAC-CE** | **RAN1 #106-e****Agreement**MAC-CE signaling from a parent node is supported for indication of beams of an IAB-DU in the direction of which simultaneous operation is restricted* FFS: Details of beam indication (e.g. TCI state ID, Spatial relation information ID, RS ID (including CSI-RS, SRS, SSB, etc.))
* FFS: Applicability to other beams

**Agreement****Spatial domain restrictions from a parent node or recommendations from a child node is limited to a subset of time resources in which simultaneous operation is applied.*** **FFS: Handling of frequency resources in case of FDM operation**
* **FFS: Support for implicit/explicit indication of the simultaneous operation mode**
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| P13 | Interference management | Existing parameter | *Intended TDD DL-UL Configuration* | Rel-16 *Intended TDD DL-UL Configuration* is extended to support IAB-specific UFD patterns. | Permutation: ENUMERATED (DFU, UFD, …) | DFU | IAB node specific |  | **F1AP and Xn** | **RAN1#105-e**AgreementRel-16 CLI coordination signalling (Intended TDD DL-UL Configuration) is extended to support IAB specific UFD patterns.FFS: Support the exchange of IAB-DU H/S/NA resource configuration information among neighbouring IAB-nodes/IAB-donors for CLI management purposes. |
| P14 | FFS: Resource multiplexing or Interference management | New | Peer DU Resource Configuration | Indicates the DU resource configuration (UL/DL/FL, H/S/NA) of the peer IAB-node or donor DU that can be used for resource coordination in case of DC, and/or for interference management | *(Rel-16) gNB-DU Cell Resource Configuration* (which includes SCS, DUF TX periodicity, DUF config, HSNA periodicity and HSNA config) *+ (Rel-17 frequency-domain) gNB-DU Cell Resource Configuration* (which includes “Rel-17 IAB-DU-Resource-Configuration-H/S/NA-Config”, “RB Set Configuration”, and “Frequency Domain H/S/NA Configuration Reference SCS”) |  | IAB node specific |  | **F1AP and Xn** | **RAN1#106-e****Agreement**Support the exchange of semi-static Rel-16 IAB-DU H/S/NA resource configuration information and Rel-17 frequency domain IAB-DU H/S/NA resource configuration information among neighbouring IAB-nodes/IAB-donorsAlso related to parameter “Peer Parent DU Resource Configuration” as common signaling may be desirable. |
| P15 | Timing control | New | Timing Case Indication | The parent-node indicates to an IAB-node when (over which time resources) a timing case is performed, including:* When Case 6 timing is performed at the IAB-node.
* When Case 7 timing is performed at the parent-node.
* [FFS] when Case 7 timing is performed at the IAB-node.
* [FFS] whether the indication should be associated with another dimensions, e.g. multiplexing cases
 | FFS |  | IAB node specific |  | **FFS** | **RAN1#104-e****Agreement**Switching between Case 1, Case 6, and Case 7 timing is supported.* FFS whether Case 6 and Case 7 timing shall be restricted to certain resources, e.g. excluding resources used for access or TDM backhaul
* FFS details on switching including the switching conditions
* FFS relationship between switching timing modes with the usage/indication of different resource multiplexing modes
* FFS whether Rel-16 OTA synchronization shall be enhanced to support switching timing modes

**RAN1#105-e****Agreement**An IAB-node is indicated when Case 6 timing is performed at the IAB-node.* FFS details of the indication (e.g. semi-static and/or dynamic, implicit and/or explicit, linkage to multiplexing capability, etc.).

FFS whether an IAB-node is also indicated when Case 7 timing is performed at the IAB-node.**RAN1#106-e****Agreement**An IAB-node is explicitly indicated by the parent node when Case 6 timing is performed at the IAB-node at least for specific time resources.* FFS: whether the indication should be associated with another dimensions, e.g. multiplexing cases
* FFS whether an IAB-node is explicitly indicated by the parent node when Case 7 timing is performed at the IAB-node.

**RAN1#106-e****Agreement**An IAB-node is explicitly indicated by the parent node when Case 7 timing is performed at the parent node.FFS for signalling details |
| P16 | Timing control | New | Case7 Timing Offset | The parent-node indicates to an IAB-node an offset to be used by the IAB-MT to set its UL TX timing based on the legacy TA loop and the indicated offset. | FFS |  | IAB node specific |  | **FFS** | **RAN1#106-e****Agreement**For Case 7 timing at a parent node, the IAB-MT Tx timing of the node is obtained via the legacy TA loop plus an offset from the parent node.FFS range, granularity, and signaling details of the offset. |
| P17 | Power control | New | Desired DL TX Power Adjustment | The IAB-MT indicates to its parent-node, its desired DL TX power adjustment to assist with the parent-node’s DL TX power allocation. This indication is provided at least for specific time resources and can further be associated with spatial configuration. | FFS |  | IAB node specific |  | **FFS** | **RAN1#104-e****Agreement**Support an IAB-node indicating information to assist with the DL power control of its parent-node towards the IAB-node without mandating an expected behavior at the parent node.* Note: At least the assistance information is for supporting the simultaneous operation within the IAB-node to avoid power imbalance
* FFS: type of assistance information (e.g., desired received power, power adjustment, preferred CSI-RS resource)
* FFS: whether this information is provided to the parent-node, the CU, or both.
* FFS: applicability of the assistance information (e.g. relation to beams or multiplexing modes)

FFS: the channel carrying this assistance information**RAN1#105-e****Agreement**The information to assist DL power allocation of the parent-node is indicated by the IAB-MT to the parent node DU in terms of desired power adjustment.* FFS applicability of assistance information, e.g. per multiplexing scenario, per resource, etc.

**RAN1#106-e****Agreement**The desired DL TX power adjustment, indicated by the IAB-MT to its parent-node to assist with the parent-node’s DL TX power allocation, is provided at least for specific time resources. The desired DL TX power adjustment can further be associated with spatial configuration. (e.g., MT’s DL RX beams).* FFS: signalling details, e.g. indication via MAC-CE, PUCCH, or legacy CSI framework.
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| P18 | Power control | New | DL TX Power Adjustment | The parent-node indicates to the IAB-node an adjustment to the parent-node’s DL TX power (e.g., in response to receiving Desired DL TX Power Adjustment from the IAB-node). This indication is provided at least for specific time resources and can further be associated with spatial configuration. | FFS |  | IAB node specific |  | **FFS** | **RAN1#106-e****Agreement**Support an IAB-node indicating adjustment to its DL TX power to a child node (e.g., in response to receiving the DL TX power assistance information from the child node) at least for specific time resources.The DL TX power adjustment indication can further be associated with spatial configuration. (e.g., MT’s DL RX beams).FFS: signalling details. |
| P19 | Power control | New | Desired IAB-MT PSD range | The IAB-node indicates to its parent-node, its desired PSD range to help with its MT’s UL TX power control.  | FFS |  | IAB node specific |  | **FFS** | **RAN1#106-e****Agreement** Support an IAB-node indicating its desired IAB-MT PSD range to help with its MT’s UL TX power control. This information is provided to the parent node.FFS: applicability of assistance information, e.g., per multiplexing scenario, per resource, etc.FFS: signaling details, including the possibility to extend PHR. |
| P20 | Dual Connectivity | New | Simultaneous Rx Tx Intra-Band | The IAB-node indicates to Donor CU on IAB-MT’s capability regarding simultaneous TX and RX within the same band.  | FFS |  | IAB node specific |  | **F1-AP** | **RAN1#106-e****Agreement****The IAB-donor-CU can be made aware of the IAB-MT’s capability regarding simultaneous transmission and reception on multiple serving cells in a frequency band, configured by the two parent nodes in intra-donor DC scenarios.** |

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| Company | Comments |
| vivo | Regarding P15 - timing case indication. The details are still FFS including implicit and/or explicit, linkage to multiplexing capability.In our understanding, multiplexing case indication is more straightforward (which means timing case indication may be implicit), which should be discussed in future meeting.**Moderator’s response:**It should be noted that in RAN1#106-e it was already agreed that this indication is “**explicit**”, with FFS on the details of explicit indication , i.e. “**FFS: whether the indication should be associated with another dimensions, e.g. multiplexing cases.”** In the revised parameters table, the aforementioned FFS point was added in the “description column” of P15.  |
| ZTE, Sanechips | It seems P06~P09 are the same as P01~P04.For P04 and P14,We agree that P04 should be limited to DC scenarios, but for P14 which is related to CLI, coordination among neighbour nodes other than the parent nodes of DC cases should be also supported, and we propose to remove the restriction ‘in case of DC’ from the description part of P14And for the value range of P04 and P14, in addition to ‘IAB-DU-Resource-Configuration-TDD-Config + Frequency Domain H/S/NA Configuration Reference SCS’, we think the Rel-16 H/S/NA configuration, RB set configuration and Rel-17 frequency domain H/S/NA configuration should be also included.**Moderator’s response:**The duplication issue with P06-P09 has been addressed in the revised table.The P14 description has updated as “**can be used for resource coordination in case of DC, and/or for interference management”**, in conjunction with the removal of P04 to address comments from other companies.The P14 value range has been updated to include the full list of configuration parameters as suggested. |
| Huawei, HiSilicon | 1. There seems to be some duplication between P01~P04 and P06~P09.
2. P01/P06: The parameter name “Rel-17 IAB-DU-Resource-Configuration-H/S/NA-Config (final name in specification to be determined by RAN2/3)” seems to imply this parameter is to configure the Rel-17 H/S/NA for a DU cell. However, in the “value range” column, “{Hard, Soft, Not Available} per RB set, per resource type in a slot [TBD relative to IAB-DU-Resource-Configuration-TDD-Config]” seems to imply this is the H/S/NA configuration for a **given RB set, a given resource type, within a given slot**. Therefore, there are still some missing pieces that should be considered in order to have a full picture of Rel-17 H/S/NA resource configuration for **a given DU cell**. Based on the discussion in RAN1#106-e, there is a need to have more discussion on the time domain and frequency domain, e.g. whether there will be frequency domain resource H/S/NA in each slot and whether there is a need to configure frequency domain H/S/NA for each PRB set. We suggest to grey this parameter for now and wait for further agreements.
3. The following agreement is not included in current upper layer parameter table:

**Agreement**The IAB-donor-CU can be made aware of the IAB-MT’s capability regarding simultaneous transmission and reception on multiple serving cells in a frequency band, configured by the two parent nodes in intra-donor DC scenarios.Even though, this seems more like an IAB-MT capability parameter. We suggest to include a higher layer parameter to reflect this agreement, something like “***simultaneousRxTxIntraBand***”.1. On P04/P09 and P14, we are wondering there a need to define separate parameters even though they are addressing different use cases. One possible way to keep P14 and remove the condition for coordination.
2. P15: According to the agreement, it is still FFS on whether such kind of indication is “semi-static and/or dynamic, implicit and/or explicit, linkage to multiplexing capability and/or explicit, linkage to multiplexing capability, etc.” If only implicit/dynamic indication is supported, then there is no need to define the timing case indicator. We suggest add some notes.

**Moderator’s response:**1. The duplication issue with P06-P09 has been addressed in the revised table.2. In the revised parameter table, the P01 parameter name has been updated as “Rel-17 frequency-domain IAB-DU-resource-configuration H/S/NA-config (final name in specification to be determined by RAN2/3”. To address the concern on details of signaling for frequency-domain H/S/NA configuration still being subject to RAN1 discussion, the parameter description has been updated as “Indicates H/S/NA attributes per RB set, per D/U/F resource type within a slot”.3. In the revised parameters table, a new parameter P20 **Simultaneous RX TX Intra-Band** was added as suggested. 4. P04 was removed and consolidated into P14.5. For P15 please refer to the response to Vivo’s similar comment. |
| Ericsson | 1. P6-P9 are identical to P1-P4
2. We miss the following agreement in P02:

**RAN1 #105-e****Agreement**The minimum resource size for configuring the frequency domain granularity is a set of N RBs:* Candidate values for N: {4, 8, 16, other values TBD}
* N is at least the # PRBs that are corresponding to the MT’s # PRBs of an RBG).

FFS: Scaling or configuration of N based on system BW or size of IAB-MT BWP1. We miss the following agreement:

**RAN1 #106****Agreement**The IAB-donor-CU can be made aware of the IAB-MT’s capability regarding simultaneous transmission and reception on multiple serving cells in a frequency band, configured by the two parent nodes in intra-donor DC scenarios.1. P14 should not be limited to DC. Should RAN1 not agree first on how HSNA configuration is provided? We propose to agree on signalling when RAN1 has finished finalizing frequency domain H/S/NA configuration.
2. P14 should be in the sub-feature group of Interference Management (as P13).
3. For companies to consider: The relation between P13 and P14.
4. The following agreement is missing, that we think this agreement has impact on the RRC signalling of the Availability Combinations table:**RAN1#104-bis****Agreement**

Soft resource availability indications for frequency-domain resources are supported* FFS enhancements to DCI Format 2\_5
* FFS: Separate or joint TDM and FDM indications

**Moderator’s response:**1) The duplication issue with P06-P09 has been addressed in the revised table.2) In the revised parameters table the missed agreement for P02 was added as suggested. The condition “**N is at least the # PRBs that are corresponding to the MT’s #PRBs of an RBG**” was also added to the value range. 3) This has been addressed in P20.4) See comments to ZTE for P14. Though the details of frequency-domain H/S/NA configuration have not been finalized, the moderator thinks that it will be easier for tracking purposes to list all known upper layer parameters now based on the existing agreements and update it later based on more incoming agreements. 5) The sub-feature group for P14 has been updated to “**FFS: Resource multiplexing or Interference management”**.6) Noted.7) Noted. Based on the following RAN1#106e agreement, RAN1 will do down-selection among 3 alternatives in next meeting, wherein Alt3 will reuse existing DCI2\_5 framework without the need of changes on availability combination RRC table. So in this case it seems OK to determine whether a new parameter needed after the selection is done in the next meeting. **Agreement**To support soft resource availability in the frequency domain, the existing DCI 2\_5 format is reused according to one of the following alternatives:* Alt. 1: A single DCI format 2\_5 can be received indicating availability for multiple RB sets which correspond to the same time resources of the child IAB-DU cell.
* Alt. 2: Multiple DCI format 2\_5 can be received indicating availability with the granularity of one or more RB set(s) for different RB sets which correspond to the same time resources of the child IAB-DU cell.
* Alt. 3: A single DCI format 2\_5 can be received indicating availability of all the soft resources which correspond to the same time resources of the child IAB-DU cell.
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| Nokia | We agree that P06-P09 are redundant and could be removed.   It is not clear whether MAC-CE are requested, or the table should be limited specifically to RRC parameters. Additionally, we believe that parameters that have not been agreed should not be included unless/until further progress is made. Based on the understanding that the request is for RRC parameters only, we have the following comments:  Regarding P10, P11, and P12, it does not seem that MAC-CE parameters are necessary, and rather should be excluded. Regarding P15, P16, P17, P18, and P19, agreement has not been made regarding whether these are RRC parameters or not and so should likely be excluded until further progress has been made. **Moderator’s response:**The duplication issue with P06-P09 has been addressed in the revised table.As RAN1 has done in Rel-16 for IAB, the understanding is that the scope of this effort includes all RAN2/RAN3 upper layer parameters necessary to support eIAB operation defined in RAN1.  |
| Lenovo, Motorola Mobility | 1. Agree with ZTE’s comment that for P04/P09 and P14, timed-domain and frequency-domain H/S/NA seem to be additionally needed in the value range.
2. The sub-feature group for P12 should be interference management. Restricting IAB-DU beams of a child node by its parent node aims at managing interference caused by the IAB-DU of the child node, as was argued in the online meeting and email discussions in favor of the agreements. Resource multiplexing at the spatial domain can be enhanced by controlling IAB-MT beams directly.
3. It might be helpful to use more consistent terminology in future agreements and discussions.
	1. The use of parent node, child node, and IAB node is not fully consistent, which may result in confusion. In the example topology N1—N2—N3, for simultaneous operation at the middle node, N2 may be referred to as IAB node or subject node or something similar. N1 and N3 will then be its parent node and child node, respectively.
	2. Does “multiplexing scenario” always mean “multiplexing case?” If yes, the latter term might be preferable.
	3. Does intra-CU always mean intra-donor? If yes, the latter term might be preferable.

**Moderator’s response:**1) The duplication issue with P06-P09 has been addressed in the revised table.2) The sub-feature group for P12 has been updated to “**FFS: Resource multiplexing or Interference management”**.3) Noted. Yes, RAN1 should strive to use the consistent terminology in future agreements and discussions. |
| Samsung | 1) P06~P09 are duplicated and then can be removed.2) P02, P03: We understand RB set configuration and reference SCS are a sub-part of P01 for Rel-17 IAB DU resource configuration and then they can be included under P01.3) P14: We share a view with other companies that “in case of DC” can be removed because it was agreed mainly for CLI. As a same reason, sub-feature group can be updated from “Resource multiplexing” to “Interference management”.**Moderator’s response:**1) The duplication issue with P06-P09 has been addressed in the revised table.2) Since in Rel-16 IAB RAN1 used separate rows to capture sub-part of Rel-16 IAB DU resource configuration information, the same approach was followed in Rel-17 eIAB DU resource configuration information.3) P14 has been updated accordingly. |

NOTE: the Parameter ID field is an arbitrary field that was added to facilitate referencing a particular row in the parameters table when commenting.

Moderator responses to companies’ comments are included inline in the table above.

Companies are encouraged to provide additional feedback, if any, in the following table:

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| Company | Comments |
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