**3GPP TSG RAN WG1 #106bis-e R1-21xxxxx e-Meeting, October 11th – 19th, 2021**

**Agenda Item:** **8.10.1**

**Source: Moderator (AT&T)**

**Title: Feature Lead Summary #2 of 8.10.1**

**Document for:** **Discussion/Approval**

# Introduction

This contribution provides a summary of the discussion in RAN1#106-e for the following email discussion:

[106bis-e-NR-eIAB-01] Email discussion on enhancements to resource multiplexing between child and parent links of an IAB node – Thomas (AT&T)

* 1st check point: October 14
* Final check point: October 19

# Simultaneous Operation of Access and Backhaul Links

**From the eIAB WID:**

* Specification of enhancements to the resource multiplexing between child and parent links of an IAB node, including:
	+ **Support of simultaneous operation (transmission and/or reception) of IAB-node’s child and parent links (i.e., MT Tx/DU Tx, MT Tx/DU Rx, MT Rx/DU Tx, MT Rx/DU Rx)**
	+ Support for dual-connectivity scenarios defined by RAN2/RAN3 in the context of topology redundancy for improved robustness and load balancing.

**Summary of input contributions:**

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| **Company** | **Proposals** |
| **Huawei, HiSilicon R1-2108765** | ***Proposal 1:*** *An IAB node shall report conditions for different multiplexing cases per {MT-CC, DU cell}-pair as follows:** *Multiplexing case A (Simultaneous MT-Tx/DU-Tx): Case #6 timing, additional uplink PC parameters, guard band, and recommended Tx beam*
* *Multiplexing case B (Simultaneous MT-Rx/DU-Rx): Additional downlink PC parameters, guard band, recommended Rx beam, and orthogonal DMRS ports*
* *Multiplexing case C (Simultaneous MT-Rx/DU-Tx): Additional downlink PC parameters, guard band, recommended Rx beam, and orthogonal DMRS ports*
* *Multiplexing case D (Simultaneous MT-Tx/DU-Rx): Additional uplink PC parameters, guard band, and recommended Tx beam*

***Proposal 2****: TCI state ID and SRS ID are adopted for the reporting of recommended DL beams and UL beams respectively based on MAC CE signaling.****Proposal 3:*** *To support the parent node indicating a set of restricted beams to IAB node, dedicated sounding reference signals (SRS) should be defined/configured.****Proposal 4:*** *To facilitate the co-existence of TDM and FDM slots and backward compatibility, a two-step H/S/NA configuration is supported in Rel-17** *Step 1: Configure time domain H/S/NA for each slot in one period by reusing Rel-16 mechanism*
* *Step 2: Configure frequency domain H/S/NA using SLIV-based indication for a subset of the slots within one period, which overrides the time domain H/S/NA configuration in the slots*

***Proposal 5:*** *To support soft resource availability in the frequency domain, 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.****Proposal 6:*** *For intra-CC FDM, the guard band should be placed in MT resources.****Proposal 7:*** *If an IAB-MT is additionally provided TDD-UL-DL-ConfigDedicated-IAB-MT, the parameter tdd-UL-DL-ConfigurationDedicated-IAB-MT overrides all symbols per slot over the number of slots as provided by tdd-UL-DL-ConfigurationCommon.****Proposal 8:*** *To increase the resources for simultaneous operation, the specification should allow the collision between tdd-UL-DL-ConfigurationDedicated-IAB-MT and cell-specific signals/channels. In the slots with the collision, the IAB node should ignore tdd-UL-DL-ConfigurationDedicated-IAB-MT. The list of cell-specific signals/channels includes:** *SS/PBCH block*
* *CORESET for Type0-PDCCH CSS set*
* *PRACH*

***Proposal 9:*** *Donor CU can provide two sets of resource configurations to each DU cell: a basic resource configuration for access UEs and one additional resource configuration for child IAB node MTs, and the DU cell should maintain two sets of DU resource configurations simultaneously.****Proposal 10:*** *Only Case #6 and Case#7 timing modes for IAB-MT should be taken into account for the enhancements of Desired/Provided Guard Symbols.* |
| **Nokia, Nokia Shanghai Bell R1-2108826** | ***Proposal 2.1: The minimum bandwidth resolution of an RB set is equal to the RBG size of the smallest BWP configured.******Proposal 2.2: The number of RB sets that can be configured within a carrier is limited to M.**** ***Appropriate values of M to be discussed***

***Proposal 2.3: Rules specifying the interaction of TDM, FDM, SDM config, and multiplexing capability indication should be discussed after further details related to the operation of TDM, FDM, and SDM are finalized.******Proposal 2.4: Support Alt. 1 by extending the number of availability combinations to support the number of RB sets configured within the available frequency resource (e.g. carrier, BWP).*** * ***FFS whether Rel-17 DCI format 2\_5 shall be enhanced to support additional availability combinations***

***Proposal 2.5: Indicate beam restrictions independently for nodes operating in case A and case B multiplexing modes.******Proposal 2.6: Support explicit indication of DU SSB during multiplexing operation by a parent node towards a child IAB node.******Proposal 2.7: Support indication of beam restriction via beam identifier on parent link (e.g. TCI state for DL, SRI for UL), such that the IAB DU determines corresponding beam restrictions via association.******Proposal 2.8: Specify new MAC-CE for beam preference indication from an IAB node towards its parent DU.******Proposal 2.9: Indication of preferred IAB MT beam (e.g., TCI state for DL, SRI for UL) is provided from an IAB node to a parent separately for case A and case B multiplexing mode.******Proposal 2.10: Beam preference indication for DL beams can be indicated via TCI or SSB index. Beam preference for UL beams can be provided via SRI.******Proposal 2.11: A beam indication should be assumed to be a request for a transmission either in UL or DL that will be fulfilled once a resource grant has been provided with the given beam configuration.******Observation 2.1: Unless additional agreement is made a node operating in either case#6 or case#7 timing mode and changing link direction would necessitate a change in timing mode as well.******Observation 2.2: For an IAB node switching from either Rel-17 enhanced multiplexing mode (e.g., case A or case B) requires only a single indication of required guard symbols when switching to Rel-16 TDM operation.*** ***Observation 2.3: When an IAB node switches between Rel-16 TDM multiplexing and Rel-17 case A multiplexing indication of desired guard symbols for changing operation within either the MT or DU is unnecessary.******Observation 2.4: Required guard symbols for switching operation between Rel-17 case A multiplexing mode and Rel-16 TDM mode can be determined by the parent node via Rel-16 guard symbol indication and timing control for case #1 and case #6 timing mode.*** ***Proposal 2.12: Enhance MAC-CE for guard symbol indication to indicate, in symbols, the slot boundary offset of the UL Tx for the child node switching between case#7 and case#1, with details related to range of symbols discussed later.*** |
| vivo**R1-2108995** | **Proposal 1: IAB MT reports to parent node the supported timing mode, guard symbol, interference information, DL/UL power control information and desired DL/UL beam to assist parent node to indicate the applicability of a given multiplexing case.** * The required guard symbol should be reported per timing mode.

**Proposal 2: Support both semi-static and dynamic adaptation of an IAB-node’s multiplexing operation on a given set of time/frequency resources.****Proposal 3: Support to indicate the allowance of a given multiplexing case on a given set of time/frequency resources by parent node/CU.****Proposal 4: Support IAB node to report the expected operation (e.g., simultaneous operation or TDM operation) on a given set of time/frequency resources to parent node/CU.** **Proposal 5: Rel-17 H/S/NA overides Rel-16 H/S, while Rel-16 NA should not be overridden.** **Proposal 6: For DCI format 2\_5, Alt 1 should be supported. i.e., A single DCI format 2\_5 can be received indicating availability for multiple RB sets.** **Proposal 7: The child node can dynamically report the recommended TCI(s)/SRI(s) to the parent node per multiplexing case.** **Proposal 8: MAC CE is used to report the recommended TCI(s)/SRI(s) to the parent node.****Proposal 9: When child node reports recommended TCI(s) to parent node, the associated per beam interference is included in the beam reporting.*** The associated interference includes MT-to-MT CLI in case of simultaneous to DU RX and MT TX at IAB node.
* The associated interference includes self-interference from IAB DU to IAB MT in case of simultaneous to DU TX and MT RX.

Proposal 10: Regarding applicability of the indicated restricted beams from parent node to child IAB-DU, the following should be supported.* The beam restriction is applied to the occasions of simultaneous DU TX and MT TX at child IAB node.
* The beam restriction is not applied cell-specific signaling transmission, e.g., SSB and periodic CSI-RS.

**Proposal 11: Parent node indicates a set of restricted beams in the form of CRI of child DU.****Proposal 12: Clarify the applicability of the beam restriction indications from different parent nodes in case of dual connectivity of the child IAB node.****Proposal 13: New types of guard symbols should be defined if Case 6 timing mode is supported for the following switching cases*** **Case 1 DU TX to Case 6 MT TX.**
* **Case 1 DU RX to Case 6 MT TX.**
* **Case 6 MT TX to Case 1 DU TX.**
* **Case 6 MT TX to Case 1 DU RX.**

**Proposal 14: New types of guard symbols should be defined if Case 7 timing mode is supported*** **Case 1 MT RX to Case 7 DU RX.**
* **Case 1 MT TX to Case 7 DU RX.**
* **Case 7 DU RX to Case 1 MT RX.**
* **Case 7 DU RX to Case 1 MT TX.**

**Proposal 15: RAN1 further study how to derive the guard symbol for the switching between Case 6 and Case 7 timing mode.****Proposal 16: For a given IAB node operating in Case 6 or Case 7 timing mode, RAN 1 further study the impact on guard symbol of the parent node for switching between Case 6 DU RX and MT TX/RX, and guard symbol of the child node for switching between Case 7 MT TX and DU RX/TX.****Proposal 17: The indication of timing mode is associated with indication of multiplexing mode, i.e., Case 6 timing is associated to multiplexing case A and Case 7 timing is associated to multiplexing case B.** Proposal 18: IAB-node is also indicated by parent node, when Case 7 timing is performed at the IAB-node, e.g., via indication of the associated multiplexing case. |
| **Vivo****R1-2108997** | Observation 1: When PRACH resources configured by both rach-ConfigCommonIAB and rach-ConfigCommon are available, Rel-16 child IAB-node will prioritize the PRACH resource configured by rach-ConfigCommonIAB for radio access purpose.Observation 2: Always using the PRACH resources configured by rach-ConfigCommonIAB once rach-ConfigCommonIAB is configured may incur large random access latency for an IAB-node.Proposal 1: Support a PRACH occasion selection mechanism, which gives the child IAB-node sufficient flexibility to use PRACH resources configured by both RACH-ConfigCommonIAB and rach-ConfigCommon.Proposal 2: Specify a mechanism for an IAB node to select between the PRACH resources configured by rach-ConfigCommon and that configured by rach-ConfigCommonIAB. |
| **ZTE, Sanechips****R1-2109261** | [Observation 1: The benefit to specify the relationship between N and the RGB\_MT is not clear, but arising a lot of following issues and normative works.](#_Toc83923096)[Observation 2: In addition to a reference SCS, a reference carrier also needs to be defined for frequency domain H/S/NA configuration, e.g., at least the starting frequency location and bandwidth corresponding to the carrier including the RB sets need to be known first.](#_Toc83923097)[Observation 3: Dynamic H/S/NA configuration selection between Rel-17 frequency domain H/S/NA configuration and Rel-16 time domain H/S/NA configuration may lead to inconsistent understanding of H/S/NA frequency on an IAB-node DU.](#_Toc83923098)[Observation 4: Alt. 3 has less specification impact and is better compatible with Rel-16 availability indication of soft resources.](#_Toc83923099)[Observation 5: It is sufficient to indicate the preferred beams for IAB node MT to its parent node.](#_Toc83923100)[Observation 6: For a given time resource, actual multiplexing case adopted by an IAB-node can be determined according to timing mode indication, power control parameters provided by its parent node, beams used by IAB node DU and MT, resource type (i.e. DL, F, UL) of IAB node DU and MT etc.](#_Toc83923101)[Proposal 1: N is a number of PRBs configured per DU cell by the CU regardless single or multiple BWPs are configured at the IAB MT.](#_Toc83923102)[Proposal 2: For semi-static frequency domain H/S/NA configuration:](#_Toc83923103)[• The reference SCS defined in Rel-17 is used to determine the frequency domain granularity, i.e., per RB set, of the frequency domain H/S/NA configuration.](#_Toc83923104)[• The SCS defined in Rel-16 for the D/F/U configuration is reused to determine the time domain granularity, i.e., per D/U/F resource type within a slot, of the frequency domain H/S/NA configuration.](#_Toc83923105)[Proposal 3: The carrier corresponding to the reference SCS in the carrier list of the IAB-node DU cell is used as the reference carrier to determine RB sets for frequency domain H/S/NA configuration.](#_Toc83923106)[Proposal 4: A parent node should be made aware of the SCS-specific carriers and frequency domain H/S/NA configuration of its child node DU’s cell(s).](#_Toc83923107)[Proposal 5: Rel-17 frequency domain H/S/NA configuration, if provided, always overrides Rel-16 time domain H/S/NA configuration.](#_Toc83923108)[Proposal 6: Rel-16 DCI Format 2\_5 is full reused to indicate soft resource availability for TDM and FDM slots (i.e. Alt. 3):](#_Toc83923109)[• For TDM slot, availability indication is valid for all soft symbols in the slot](#_Toc83923110)[• For FDM slot, availability indication is valid for all soft RB sets in the slot.](#_Toc83923111)[Proposal 7: The IAB-node MT indicates recommended beams to its parent node by MAC CE signalling.](#_Toc83923112)[Proposal 8: For the child node indication of recommended beams, IAB-MT DL beams are defined by TCI state ID, IAB-MT UL beams are defined by SRI.](#_Toc83923113)[Proposal 9: Indication of IAB MT “not preferred” beams to its parent node is not supported.](#_Toc83923114)[Proposal 10: Restricted beams of its child IAB-node DU indicated by parent node are defined by RS ID (e.g., SSB index).](#_Toc83923115)[Proposal 11: For a given time resource, the applied timing mode can be explicitly indicated by the parent node, while the expected multiplexing case at the given time resource can be implicitly determined based on the timing mode indication.](#_Toc83923116) |
| **ZTE, Sanechips****R1-2109263** | [Observation 1: If more than one SCS-specific carrier for an IAB-node DU cell is reported to CU, IAB-node DU should know which carrier (e.g. either which one of the SCS-specific carriers or the carrier defined/determined by CU) is used by CU to define the RB sets for H/S/NA resource configuration in frequency domain.](#_Toc19578)[Proposal 1: A reference carrier should be defined to determine the RB sets for frequency domain H/S/NA configuration, e.g., the carrier corresponding to the reference SCS can be used as the reference carrier.](#_Toc3316)[Proposal 2: Parent nodes should be made aware of the carrier frequency information of an IAB DU cell (i.e., its child node).](#_Toc13561)[• FFS: how to indicates of the carrier frequency information to the parent node](#_Toc11450) |
| Samsung*R1-2109510* | *Proposal 1: FDM H/S/NA configuration includes time domain information.**Proposal 2: Either the Rel-16 H/S/NA configuration or frequency domain configuration is applied for a given resource.**Proposal 3: Guard band can be generated by each IAB node or parent IAB.**Proposal 4: The following H/S/NA resource types are supported for FDM**- H type for frequency resource: the IAB DU can assume it can use the frequency resource regardless of the MT’s configuration on the frequency resource**- S type for frequency resource: the IAB DU can assume it can use the frequency resource without an impact on the MT’s configuration on the frequency resource**- NA type for frequency resource: the IAB DU cannot assume it can use the frequency resource**Proposal 5: For the beam restriction, beam information including TCI states ID, reference signal ID for CSI-RS or SSB* *is reported to parent IAB.**Proposal 6: For the beam restriction, MAC-CE signaling from the parent DU includes which beam is restricted or not restricted in an order based on the reported TCI state ID.**Proposal 7: For the beam recommendation, MAC-CE signaling from the child IAB is reported to parent IAB.**Proposal 8: Both semi-static and dynamic adaptation for IAB node's multiplexing operations are supported.**Proposal 9: Only one set of signaling for Desired/Provided Guard Symbols considering maximum values of all possible timing switching can be supported.* |
| Intel Corporation**R1-2109629** | **Observation 1:** For the switching of Case#1🡪 Case#6 timing at an IAB-node, the guard symbols for the following two transitions defined in Rel-16 IAB can be removed as simultaneous DU TX/MT TX is allowed in Case#6 timing: * IAB-DU TX in slot n to IAB-MT TX in slot (n+1)
* IAB-MT TX in slot n to IAB-DU TX in slot (n+1)

**Observation 2:** For the switching of Case#6🡪 Case#1 timing at an IAB-node, new guard symbols are needed for IAB-MT Case#6 TX to IAB-MT Case#1 TX transition. **Observation 3:** For the switching of Case#1🡪 Case#7 timing, the guard symbols for the following two transitions defined in Rel-16 IAB can be removed as simultaneous DU RX/MT RX is allowed in Case#7 timing: * IAB-DU RX in slot n to IAB-MT RX in slot (n+1)
* IAB-MT RX in slot n to IAB-DU RX in slot (n+1)

**Observation 4:** For the switching of Case#7🡪 Case#1 timing at an IAB-node, guard symbols are needed for child-MT Case#7 TX to child-MT Case#1 TX transition. **Observation 5:** For the switching of Case#6🡪 Case#7 timing at an IAB-node, it is equivalent to the combination of Case#6🡪 Case#1 switching and Case#1🡪 Case#7 switching. New guard symbols are needed for IAB-MT Case#6 TX to IAB-MT Case#1 TX transition. **Observation 6:** For the switching of Case#7🡪 Case#6 timing at an IAB-node, it is equivalent to the combination of Case#7🡪 Case#1 switching and Case#1🡪 Case#6 switching. New guard symbols are needed for child-MT Case#7 TX to child-MT Case#1 TX transition. **Proposal 1:** Either the Rel-16 H/S/NA configuration or frequency domain configuration is applied for a given resource. **Proposal 2:** For frequency-domain soft resource availability indication, support a single DCI format 2\_5 to indicate availability for multiple RB sets which corresponding to the same time resources of the child IAB-DU cell. **Proposal 3:** Limit the maximum number of semi-static configured frequency-domain soft regions per resource type or per slot. **Proposal 4:** New guard symbols are needed for switching between Case#1/Case#6/Case#7 timing as in Table 1. **Proposal 5:** When simultaneous operation(s) are supported, the corresponding transition guard symbols defined in Rel-16 IAB are not needed as in Table 2.  |
| NTT DOCOMO, INC.**R1-2109697** | **Proposal 1: For a given RB set at a symbol, if both Rel-17 frequency domain H/S/NA and Rel-16 time domain H/S/NA are provided, whether frequency domain or time domain H/S/NA is applied can be determined at least based on following rules.** * **Time domain H/S/NA is applied, and DU can Tx/Rx on all the RBs at the symbol, if the following condition is met.**
	+ **If a given symbol is DU hard in time domain, and**
		- **MT does not Tx/Rx at the symbol,**
		- **Or the simultaneous MT/DU operation corresponding to the MT/DU DL/UL configuration at the symbol is not supported/indicated, e.g., the symbol is configured as MT DL and DU DL, but MT-Rx/DU-Tx is not supported.**
	+ **Or if a given symbol is DU soft in time domain, and**
		- **MT does not Tx/Rx at the symbol,**
		- **Or Soft-IA is indicated for at least one RB set, and the simultaneous MT/DU operation corresponding to the MT/DU DL/UL configuration at the symbol is not supported/indicated, e.g., the symbol is configured as MT DL and DU DL, but MT-Rx/DU-Tx is not supported**
* **Otherwise, frequency domain H/S/NA is applied, and DU can Tx/Rx on the RBs configured/indicated as hard/soft-IA at the symbol.**

**Proposal 2: Support Alt.1 for soft resource availability in the frequency domain, i.e.,*** **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.**

**Proposal 3: *AvailabiltyCombination* can be extended to include multiple *resourceAvailabilty*, where each *resourceAvailabilty* includes availability indication for one RB set.****Proposal 4: IAB-MT reports recommended beams per multiplexing case.** **Proposal 5: Legacy beam reporting framework can be reused for IAB-MT reporting of recommended beams.** **Proposal 6: A set of restricted DU beams are indicated per MT beam.****Proposal 7: With parent node’s indication of restricted beam, whether a beam is used by DU is up to DU implementation.****Proposal 8: Support simultaneous restricted DU beam indication across MT CCs. A list of MT CCs can be configured. If a set of restricted DU beams is indicated for one MT CC in the list, the indication applies to all the MT CCs in the list.****Proposal 9: Parent node indicates whether Case#6 or Case#7 timing is performed via UL scheduling DCI.****Proposal 10 : If case#6 timing mode is required for simultaneous MT-Tx/DU-Tx, simultaneous MT-Tx/DU-Tx can be performed only if case#6 UL Tx timing is indicated by parent node; otherwise, simultaneous Tx cannot be performed.****Proposal 11: On a DU flexible symbol, parent node can configure/indicate IAB node MT Tx/Rx, and IAB node DU will Tx/Rx on the symbol based on MT transmission/reception direction and its multiplexing capability.****Proposal 12: The indication of guard symbols can be extended as Table II to indicate guard symbols for transition between MT Tx with case#6/7 timing and DU Tx/Rx.****Proposal 13: Whether different value range of the number of guard symbols is needed for the new timing modes needs to be studied.****Proposal 14: Guard band can be handled by IAB node implementation.** |
| **Huawei, HiSilicon****R1-2109755** | ***Proposal 1:*** *Number of guard symbols for MT and DU flexible symbols = min(Number of guard symbols for MT and DU downlink switching, Number of guard symbols for MT and DU uplink switching)****Proposal 2****: Introduce negative value of Ng to support efficient resource utilization.* |
| ETRI**R1-2109816** | **Observation 1: No need to support an explicit parent acknowledgement for multiplexing capability adaptation.****Proposal 1: Introduce L2 (MAC CE) based report/indication on conditions/parameters to facilitate adaptation between multiplexing operation modes, where the report/indication includes the following contents, at least:*** **Supported multiplexing mode (FDM and/or SDM).**
* **Required timing mode.**
* **Required DL/UL power control support.**
* **Information on the “non-preferred” beam.**
* **Required number of guard symbols for switching of multiplexing mode.**
* **Required guard band for FDM**

**Proposal 2: Introduce higher-layer parameter(s) to configure the following information:*** **Periodicity or timing of report/indication on conditions/parameters to facilitate adaptation between multiplexing operation modes.**
* **Recommendations on the conditions/parameters from parent node perspectives.**

**Proposal 3: Support 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) for soft resource availability in the frequency domain.*** **FFS, whether to additionally support Alt. 2 or Alt. 3 on top of Alt. 1.**
* **Clarify whether the terminology “all the soft resources” in Alt. 3 includes “all the soft resources configured by Rel-16 and Rel-17 signalings at a given time” or not.**

**Proposal 4: Extend the mapping between values of *resourceAvailability* elements and types of soft symbols/resources for the time/frequency resources configured with both Rel-17 frequency domain H/S/NA configuration and the Rel-16 time domain H/S/NA configuration****Proposal 5: Consider specification supports on handling of cell-specific or semi-static signals/channels when the signals/channels are associated with the non-preferred DU beams.****Proposal 6: Consider specification supports to report non-preferred MT beams for simultaneous operations.****Proposal 7: Preferred(recommended)/non-preferred(restricted) beams can be reported/indicated by one or more among the following options:*** **Option 1: TCI state ID**
* **Option 2: Spatial relation information ID**
* **Option 3: RS ID (including CSI-RS, SRS, SSB, etc.)**

**Proposal 8: Support X>1, where X is the maximum numbers of the preferred(recommended)/non-preferred(restricted) beams for simultaneous operations.*** **Consider X=4, at least.**

**Proposal 9: Support explicit indication/association of the simultaneous operation mode for the preferred(recommended)/non-preferred(restricted) beam report and/or indication.****Proposal 10: RAN1 to strive concurrent support of “Rel-16 simultaneous TCI/spatial relation update” and “Rel-17 simultaneous DU/MT operations”.** |
| CEWiT, IIT-M, IIT-B and Saankhya LabsR1-2109839 | **Proposal 1: Mechanism to inform multiplexing capability of parent nodes to IAB node is supported****Proposal 2: Signalling of multiplexing capability and supported modes from IAB node to CU and parent-DU is supported** **Proposal 3: Following alternatives are proposed for configuring active mode of operation at an IAB node*** **Alt1: Donor configuring the active mode of operation of IAB node**
* **Alt2: Parent node configuring the active mode of operation of IAB node**

**Proposal 4: Dynamic switching between multiplexing modes of IAB node is supported under the control of parent node** **Proposal 5: Mechanism to fall back to TDM mode from simultaneous mode at IAB node is supported** **Observation 1: Frequent switching between multiplexing modes leads to signaling storm** **Proposal 6: Define minimum duration for active mode of operation****Observation 2: For an IAB node*** **The TA associated with UL-Tx at IAB-MT and guard required for switching to/from UL-Tx changes based on active mode of operation of IAB node and its parent node**
* **The timing of UL-Rx at IAB-DU and guard required for switching to/from UL-Rx changes based on active mode of operation of IAB node and its child node**

**Proposal 7: Parent node update TA and guard symbols required for switching to/from UL-Tx before mode switching at IAB node or its parent node****Proposal 8: IAB node inserts additional guard symbols for switching to/from UL-Rx at IAB-DU before mode switching at IAB node or its child node****Proposal 9: An IAB node apply either the time domain H/S/NA configuration or frequency domain H/S/NA configuration for a given resource based on the active mode of operation****Proposal 10: The switching between time domain H/S/NA configuration and frequency domain H/S/NA configuration occur based on the granularity of active mode of operation****Proposal 11: 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****Proposal 12: In case of IAB-MT, the resource configuration given by *tdd-UL-DL-ConfigurationDedicated-IAB-MT* override the configuration of cell specific signal/channel** |
| AT&TR1-2109920 | **Proposal 1: To support dynamic adaptation of multiplexing capability for DU flexible resources configured as soft, a DCI Format 2\_5 indication from the parent node can be used to jointly indicate a desired transmission direction (D or U) at the child along with an indication of whether the given soft time or frequency resource is indicated as available.** **Proposal 2: The Rel-17 frequency-domain H/S/NA configuration is only provided for RB sets in a given slot which have a different H/S/NA resource type from the corresponding Rel-16 H/S/NA configuration.****Proposal 3: MAC-CE signaling from the parent node to the child node can indicate a set of restricted IAB-specific SSB beams at the IAB-DU of the child node.****Proposal 4: The child node can dynamically report to the parent node both IAB-MT DL and IAB-MT UL beams based on SSB and CSI-RS using the existing beam-management framework (e.g. on the basis of different TCI states configured at the IAB-MT).****Proposal 5: An IAB-node is explicitly indicated when Case 6 and Case 7 timing is performed at the IAB-node via MAC-CE signaling based on whether desired/provided guard symbols for Case 6 and/or Case 7 timing are provided.** |
| Lenovo, Motorola MobilityR1-2109936 | Observation 1: Separate application of time- and frequency-domain H/S/NA may result in resources wasted when FDM cannot be realized at a moment.Observation 2: Separate application of time- and frequency-domain H/S/NA is a special case of joint application.Observation 3: The best-effort approach is insufficient for non-TDM operation in the presence of varying beam, power, interference, and timing alignment constraints.Observation 4: When non-TDM multiplexing between upstream and downstream links are intended, sending availability indication for IAB-DU resources solely based on IAB node’s non-TDM capability may result in shortage of resources for IAB-MT due to beamforming, power, interference, or timing alignment constraints at a moment.Proposal 1: Support joint application of time- and frequency-domain H/S/NA configurations.Proposal 2: Specify rules for determining H/S/NA resource types for time-frequency resources based on separate configurations in time and frequency domains.Proposal 3: Support conditional availability indication as a balance between existing best-effort non-TDM and TDM-only availability indication.Proposal 4: Extend DCI 2-5 for frequency-domain availability indication by allowing a unit of N PRBs in addition to the unit of 1 slot. Alt. 2 is preferable for the sake of flexibility.Proposal 5: No need to introduce scaling of N based on system BW or IAB-MT BWP.Proposal 6: Support per-panel granularity by allowing dynamic indication of restricting/using beams and their associated antenna panels for specific time-frequency resources.Proposal 7: Support early beam/panel indications for the upstream link in addition to downstream beam indications.Proposal 8: Support applicability of beam/panel indications to specific time-frequency resources. No need to specify indication of simultaneous operation mode in the standard.Proposal 9: Support signaling IAB node capabilities for timing alignment and multi-panel and baseband characteristics.Proposal 10: Support dynamic signalling for communicating operation constraints such as beam, power, interference, and timing alignment constraints along with information of time, frequency, and spatial resources.Proposal 11: Support indication of recommended beams to the parent node as part of dynamic signaling of “conditions/parameter” agreed in RAN#105-e.Proposal 12: Support MAC CE signaling for activation/deactivation of Case 6 timing.Proposal 13: Support MAC CE signaling for activation/deactivation of Case 7 timing. The activation MAC CE message can carry an additional TA value as offset to the legacy TA value.Proposal 14: Support RRC configuration for Case-6 and Case-7 timing alignment in addition to dynamic signaling.Proposal 15: Signalling for timing alignment indication is linked to multiplexing capability of the IAB node as well as whether the IAB node requires enhanced timing alignment.Proposal 16: Support a capability signalling, e.g., number of IFFT/FFT windows, to indicate whether the IAB node requires timing alignment between IAB-MT and IAB-DU operations. If negative, the IAB node can transmit unaligned OFDM symbols (Case A) and receive/process unaligned OFDM symbols (Case B), which simplifies signalling and configuration significantly. |
| Apple Inc.R1- 2110051 | **Proposal 2**: For simultaneous operation, either parent IAB-DU or IAB-DU, for example depending on data priority order of the link, can initiate and control the flow, and indicate the desired parameters to the other link.**Proposal 3**: For the case of parent IAB-DU indicating IAB node about the receiving beams/panels for Lp,DL and LA,UL / Lc,UL links, the indication can be dynamic and/or semi-static:* Dynamic e.g. through TCI index in DCI for scheduling PDSCH Lp,DL
* Semi-static, e.g. through MAC-CE/RRC to IAB-MT or through F1 interface to IAB-DU

**Proposal 4**: For the case of IAB indicating desired reception beams/panels on Lp,DL and LA,UL / Lc,UL links, the indication to parent IAB-DU can be dynamic and/or semi-static:* Dynamic e.g. through UCI transmission from IAB-MT to parent DU
* Semi-static, e.g. through MAC-CE from IAB-MT or through F1 interface from IAB-DU

**Proposal 5**: To achieve a simultaneous reception within an IAB node, i.e. DU-Rx & MT-Rx, a two-step indication is deployed* Step1: Parent IAB-DU indicates initial beam/panel, K0, SLIV, etc, and a grace time for IAB node in which IAB-MT can indicate its desired parameters like beam/panel, K0, SLIV, etc
* Step2: IAB indicates its desired parameters (beam/panel, K0, SLIV, Tx power, etc), for example, on PUCCH indicated by DL DCI from parent IAB-DU

**Proposal 6**: To utilize SDM resource multiplexing, support PDSCH allocation for IAB-MT with crossing the slot border.  |
| LG ElectronicsR1-2110101 | **Simultaneous operation schemes between MT and DU*****Proposal 1: Discuss whether the minimum resource size N is configured independently for DL and UL.******Proposal 2: The composition of the minimum resource for configuring the frequency domain granularity is based on the location of the CRB #0 of the corresponding MT.******Proposal 3: A RB set for frequency domain H/S/NA configuration is composed by one or multiple consecutive RB groups where a RB group is composed by N PRBs.******Proposal 4: If both the Rel-16 time domain H/S/NA configuration and Rel-17 frequency domain H/S/NA configuration are provided for a given RB set at a symbol, an IAB node only applies one of them based on the applied multiplexing operation mode.******Proposal 5: A single DCI format 2\_5 can be received indicating availability for multiple RB sets which corresponds to the same time resources of the child IAB-DU cell.******Proposal 6: Discuss whether the soft resource availability for time domain and frequency domain are indicated using different fields or the same field.*** ***Proposal 7:*** ***In case the frequency-domain H/S/NA is configured, this information can be used for deciding SDM operation of the IAB node. In addition, this information can be used for determining whether beam restriction for SDM operation is applied or not.******Proposal 8: For IAB-nodes that require timing alignment for simultaneous operation,*** * ***If MT is configured Case#6 for MT UL Tx, MT and DU can perform simultaneous Tx/Tx when the MT has UL Tx direction and the DU has DL Tx direction within the time resource applying Case #6 timing.***
* ***If Case#7 is allowed for DU UL Rx,*** ***MT and DU can perform simultaneous Rx/Rx when the MT has DL Rx direction and the DU has UL Rx direction within the time resource applying Case #7 timing.***
* ***When the MT and DU of the IAB-node have a Tx/Rx resource direction combination that is not capable of simultaneous operation within the time resource applying Case #6 or Case #7 timing, the MT and DU can be operated in TDM-manner.***

***Proposal 9: Discuss whether/how to handle overlapping of time resource for Case #6 timing and Case #7 timing.******Proposal 10: For the case of an IAB-node that does not require any timing alignment for simultaneous operation, the IAB-node can perform simultaneously without restriction on time resource or within the explicitly allowed time resource if the combination of Tx/Rx direction between MT and DU is capable of.******Proposal 11: It is supported to report the applicability of the given multiplexing operation mode to the parent node.******Proposal 12: Guard band for FDM between MT and DU is determined by DU and allocated in DU frequency resource.******Proposal 13: Support separation of CDM group between DU and MT for SDM operation of IAB-node.******Proposal 14: The IAB-node and the parent node determine the number of guard symbols implicitly according to the timing case applied by the IAB-node in a specific time resource.******Proposal 15: To indicate the number of guard symbols required for Case #6 and Case #7 timing, the switching scenarios only when the number of guard symbols is different compared to Case #1 timing case are considered.*** |
| Qualcomm IncorporatedR1-2110206 | **Proposal 2.1:****Support Rel-17 frequency-domain H/S/NA configuration to provide time-varying frequency-domain H/S/NA pattern over a number of slots.****Proposal 2.2:****Support Rel-17 frequency-domain H/S/NA configuration by extending the gNB-DU cell resource configuration IE used by the Rel-16 time-domain configuration to the granularity of an RB set, where selected slots and RB sets can be optionally specified.****Proposal 2.3:****For the size of an RB set, support additional candidate values of {96,128,160} to the agreed list of {2,4,8,16,32,64} so that it can be sufficient to configure 2 or 3 RB sets for a max carrier bandwidth.****Observation 2.1****For supporting soft resource availability in frequency-domain,** * **Alt1 is more flexible than Alt3 in that it can dynamically indicate availability of all or a subset of RB sets to the child node based on applicability of simultaneous operation mode and FDM requirement.**
* **Alt1 has less over-the-air signaling overhead than Alt2.**

**Proposal 2.4:****Support Alt1 with a single DCI format 2\_5 to indicate availability for multiple RB sets corresponding to the same time resource of the child IAB-DU cell.****Proposal 2.5:****Update resourceAvailability mapping table defined in TS38.213 so that the indication of availability can be applied over soft resources in frequency-domain for DL or UL or Flexible symbols.** * **E.g. replacing “soft DL/UL/Flexible symbols” with “soft resources in DL/UL/Flexible symbols”**

**Observation 3.1:****For a supported simultaneous operation mode at an IAB-node, the assistant information on whether FDM is required or not can be beneficial** * **for the donor-DU to determine more efficient H/S/NA resource pattern,**
* **for the parent node to make more optimized decision on coordinating soft resources with its child node.**

**Proposal 3.1:** **Support indication of whether FDM is required or not for a simultaneous operation mode to donor-CU and/or parent node.****Proposal 3.2:** **Support dynamic indication by the IAB-node to its parent-node to indicate applicability of simultaneous operation modes.*** **FFS: indicated in the same signaling for required conditions.**
* **FFS: support of dynamic overriding Rel-16 time-domain configuration by Rel-17 frequency-domain configuration based on indication of applicability of simultaneous operation modes.**

**Observation 3.2:****Rel-17 supports quite a few new types of switching across combinations of MT/DU timing cases, and MT/DU multiplexing modes.****Each switch type may require a different number of guard symbols. However, supporting an indication of desired/provided guard symbols for all switch types will lead to a large signaling overhead.****Observation 3.3:****To support extension of Desired/Provided Guard Symbols to a new UL RX timing at a DU (based on Case 7) will further require providing the parent-node if/when the IAB-DU adopts Case 7 UL RX timing. This is not justified, due to its large signaling overhead, and questionable benefit.****Proposal 3.3:****MAC-CE signaling of Desired/Provided Guard Symbols is extended to support the following switch types:*** **MT TX based on Case 7 UL timing to/from DU RX, and MT TX based on Case 7 UL timing to/from DU TX**
* **MT TX based on Case 6 UL timing to/from DU RX, and MT TX based on Case 6 UL timing to/from DU TX**

**Proposal 3.4:** **An IAB-DU decides about its UL RX timing reference (e.g., whether to adopt Case 1, or Case 7) without any indication from its parent-node.****Observation 3.4:** **An IAB-MT’s Case 6 UL TX timing is to facilitate enhanced duplexing at the IAB-node, while IAB-MT’s Case 7 UL TX timing is to facilitate enhanced duplexing at the parent-node.** **An IAB-node cannot map Case 7 UL TX timing (of IAB-MT) to any subset of its time resources, without explicit indication from the parent-node.****It is desired to have a unified design for indication of different UL TX timing cases.****Proposal 3.5:** **An IAB-MT is provided with Timing Case Indication that explicitly indicates a list of slots and their associated UL TX timing cases (i.e., one of {Case 1, Case 6, Case 7} for each slot).** **Timing Case Indication is provided via MAC-CE.****Proposal 3.6:****Timing Case Indication received from a serving cell is applicable to all other cells in the same timing advance group (TAG).****Observation 3.5:** **An IAB-MT’s need for Case 6 UL TX timing may depend on:*** **MT CC, and/or (MT CC, DU cell) pair**
* **IAB-node’s multiplexing mode: (MT TX, DU TX) and/or (MT TX, DU RX)**
* **MT’s TX beam**
* **Whether MT’s TX is FDMed with DU’s communications or overlaps in the frequency domain.**

**Proposal 3.7:****IAB-MT indicates, to its parent-node, whether it desires Case 6 UL TX timing, for a given MT CC, to facilitate simultaneous IAB-MT’s TX and IAB-DU’s TX and/or RX.** * **FFS: whether this indication can further be beam specific.**
* **FFS: whether this indication can further depend on whether IAB-MT’s TX is FDMed with IAB-DU’s communications or not.**

**Observation 4.1:****Indication of “not-preferred” IAB-MT’s beam(s) (in addition or instead of recommended beam(s)) may provide more efficient and flexible assistance information. It can also effectively be used to indicate required fallback to TDMing, when an enhanced multiplexing mode of operation is not supported.****Proposal 4.1:****Further support indication of not-preferred IAB-MT’s beam(s) (for both TX and RX) to the parent-node.****Observation 4.2:****The parent-node should further be provided with information about the resources for which indicated recommended/not-preferred beam(s) are applicable.****Proposal 4.2:****The recommended and/or not-preferred IAB-MT’s beam(s), indicated by the IAB-MT to its parent-node, can be provided for:*** **A specific multiplexing mode – i.e., (MT RX, DU RX), (MT TX, DU TX), (MT RX, DU TX), (MT TX, DU RX)**
* **A given (MT CC, DU cell) pair**
* **The cases where concurrent MT’s and DU’s communications are FDMed or overlap in the frequency domain.**
* **The indication is provided via MAC-CE.**

**Proposal 4.3:****The recommended and/or not-preferred IAB-MT’s beam(s) are indicated based on IAB-MT’s TCI state IDs (for DL RX beam(s)), and SRI IDs (for UL TX beam(s)).****Proposal 4.4:****The indication of the restricted IAB-DU’s beam(s), provided by the parent-node to the IAB-MT, is only applicable to the IAB-DU’s DL TX beams.****Observation 4.1:****The parent-node may know about the IAB-DU’s STC and CSI-RS configurations and use them a reference to indicate IAB-DU’s beam(s).****Different IAB-DU’s STCs may be associated with different beamforming configurations.** **Proposal 4.5:****The indication of the restricted IAB-DU’s beam(s), provided by the parent-node to the IAB-MT, is via referring to any of the following*** **IAB-DU’s CSI-RS resource indices**
* **IAB-DU’s SSB and STC indices**

**Proposal 4.6:****The restricted IAB-DU’s beam(s), indicated by the parent-node to the IAB-MT, can be provided for:*** **A specific multiplexing mode – i.e., (MT TX, DU TX), (MT RX, DU TX)**
* **A given MT’s TX/RX beam**
* **A given (MT CC, DU cell) pair**
* **The cases where concurrent MT’s and DU’s communications are FDMed or overlap in the frequency domain.**

**Proposal 4.7:****The indication of the restricted IAB-DU’s beam(s), provided by the parent-node, is considered as a recommendation, without any mandated behavior at the IAB-DU, at least for the IAB-DU’s HARD resources.*** **FFS: expected behaviour of the IAB-DU regarding the indication of restricted beams within its SOFT resources.**
 |
| EricssonR1-2110331 | [Proposal 1 The frequency domain granularity, i.e., the N RBs in an RB set is related to MT’s BWP and number of PRBs in an RBG, NRB(RBG), as given in Table 1.](#_Toc84018858)[Proposal 2 In case that an IAB-MT cell is configured with multiple BWPs, support per-BWP frequency domain H/S/NA configuration, including a specific N value.](#_Toc84018859)[Proposal 3 In case that an IAB-DU cell is overlapping with multiple IAB-MT cells, the IAB-DU cell is configured with one N value which is derived based on the largest RBG size of all IAB-MT cells and is common to all the MT-BWPs.](#_Toc84018860)[Proposal 4 If a resource is configured as Hard, or explicitly indicated as Soft-IA the IAB-DU can transmit, receive, or either transmit or receive according to its configuration only if it does not impact the IAB-MT’s actual ability to operate in any other resource, including the same RB-Set and other RB-Sets.](#_Toc84018861)[Proposal 5 If a resource is configured as Soft, the IAB-DU can transmit, receive, or either transmit or receive only if it does not impact the IAB-MT’s actual ability to operate in any resource, including the same RB-Set and other RB-Sets. This applies to implicitly Indicated Available IAB-DU Soft resource.](#_Toc84018862)[Proposal 6 For one IAB-DU cell, support operation in either TDM or FDM modes on a per-slot basis.](#_Toc84018863)[Proposal 7 Support indicating both time-domain and frequency-domain H/S/NA in the same gNB-DU Cell Resource Configuration (9.3.1.107 in TS 38.473 [8]), where the frequency-domain H/S/NA is provided in terms of RB sets, or groups of RB sets.](#_Toc84018864)[Proposal 8 To reduce signaling overhead, the IAB-DU may be provided with frequency domain H/S/NA configurations only to the RB sets whose configuration is different from the time domain H/S/NA.](#_Toc84018865)[Proposal 9 For explicit availability indication of frequency-domain Soft resources over time, support to re-use the structure of the Rel-16 *availabilityCombinations* with enhancements.](#_Toc84018866)[Proposal 10 For explicit availability indication of frequency-domain Soft resources, each *availabilityCombination* of *availabilityCombinations* can indicate availability for single or multiple RB sets.](#_Toc84018867)[Proposal 11 Support multiple frequency domain DCI format 2\_5 associated to the same time slot.](#_Toc84018868)[Proposal 12 Rel-17 enhancement on DCI format 2\_5 should at least consider extension of the maximum payload size of DCI format 2\_5 to increase the number of IAB-DU cells that can be provided with availability information for Soft resources. FFS: Further enhancement to further increase the number of IAB-DU cells that can be indicated AI.](#_Toc84018869)[Proposal 13 One *resourceAvailability* element of the *availabilityCombinations* table is reserved to signal to the IAB-DU that “No new Availability Indication is provided” in DCI format 2\_5 for slots which receive multiple Availability Indicators.](#_Toc84018870)[Proposal 14 Explicit availability indication overrides SDM beam restrictions in Soft resources.](#_Toc84018871)[Proposal 15 RS ID (e.g., SSB index) is used by a parent node to indicate beams of an IAB-DU in the direction of which simultaneous operation is restricted.](#_Toc84018872)[Proposal 16 RS ID is used by a child node to indicate a set of preferred beams to the parent node.](#_Toc84018873)[Proposal 17 Interference measurement report, even if specified, is not included in the beam report.](#_Toc84018874)[Proposal 18 Interference measurement discussions are limited to Agenda Item 8.10.2.](#_Toc84018875)[Proposal 19 The IAB-node may report to the parent node a set of multiplexing conditions on the required timing mode, power control, beam indication.](#_Toc84018876)[ For simultaneous MT-TX/DU-TX, the multiplexing conditions include whether the IAB-node requires:](#_Toc84018877)[o Case-6 timing](#_Toc84018878)[o Parent node indication of restricted IAB-DU beams](#_Toc84018879)[o IAB-node indication to its parent node on its MT’s UL TX power control](#_Toc84018880)[ For simultaneous MT RX/DU RX, the multiplexing conditions include whether the IAB-node:](#_Toc84018881)[o Supports Case-7 timing](#_Toc84018882)[o Requires IAB-node indication of recommended IAB-MT beams](#_Toc84018883)[o Requires IAB-node indication to support parent node DL power control](#_Toc84018884)[Proposal 20 Whether or not to switch to FDM/SDM should be based on an ACK/NACK response from the parent IAB-node.](#_Toc84018885)[Proposal 21 Fallback to TDM does not need an ACK response from the parent IAB-node.](#_Toc84018886)[Proposal 22 Desired/Provided Guard Symbols are signaled in multiple groups that covers all relevant switching combinations among Case #1, Case #6 and Case #7 timing alignments.](#_Toc84018887) |

**ISSUE 2.1: FREQUENCY DOMAIN MULTIPLEXING**

**Proposal 2.1.1a: Rel-17 frequency domain H/S/NA configuration includes time domain information with the same granularity as the Rel-16 H/S/NA configuration.**

**Discussion: Views on proposal 2.1.1a?**

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| **Company**  | **Comments**  |
| **NTT Docomo** | **Do not support. By saying “frequency H/S/NA includes time domain information”, it may cause some confusion. To us, it is not quite clear how it includes time domain information. In our understanding, we only need to agree on how to apply frequency H/S/NA or time H/S/NA at a given time as in proposal 2.1.3.** |
| **LG** | In our view, it is necessary that H/S/NA resource type is configured differently for each slot for the same RB set.In the last meeting, it was agreed that 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. Thus it is our understanding that different resource types can be configured for each slot. |
| **Ericsson** | Our understanding of this proposal is that TD H/S/NA configuration can be recycled in coinciding FD resources where it matches the desired FD H/S/NA configuration. If this is the correct interpretation, then we **support** it. However, it may be useful if it is clarified if the proposal concerns signaling or the interpretation of the signaled configuration or both. This could be clarified by also agreeing to our proposal**Support indicating both time-domain and frequency-domain H/S/NA in the same gNB-DU Cell Resource Configuration (9.3.1.107 in TS 38.473 [8]), where the frequency-domain H/S/NA is provided in terms of RB sets, or groups of RB sets.** |
| **Intel** | We understand the motivation of this proposal to make time/frequency-domain H/S/NA aligned in time-domain. We are okay with this proposal, just not sure whether previous agreement of per D/U/F resource type granularity for frequency-domain H/S/NA already fulfilled this purpose.  |
| **Qualcomm** | We think we understand the intent and the motivation of the proposal, however some clarifications are needed to confirm the intent and to avoid potential confusion. Our understanding is that the intent is to say the frequency domain H/S/NA configuration can be provided for multiple slots (as the Rel-16 H/S/NA configuration) with different values for each slot. |
| **ZTE, Sanechips** | From our understanding, the motivation of the proposal is to clarify the time domain granularity of frequency domain H/S/NA configuration,i.e., ‘per D/U/F resource type within a slot’ as previous agreement.***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.*Here, the definition of ‘per D/U/F resource type within a slot’ for frequency domain H/S/NA configuration is the same as the Rel-16 H/S/NA configuration. |
| **Samsung** | In our understanding, this proposal is to clarify Rel-17 FDM H/S/NA configuration can be configured for a subset of slots with the same granularity as the Rel-16 H/S/NA configuration which is configured over all slots. With this understanding, we can accept the proposal. |
| **Lenovo, Motorola Mobility** | We agree with other companies that the intent is fine, but the wording is not clear. Adding an “e.g.” phrase could be helpful. |
| **Huawei, HiSilicon** | We understand the intention of this proposal and agree with DCM that this may cause some confusion. Given that the signaling design are described in 2.1.2a and 2.1.3a, we suggest the leave the proposal for now and focus on the other two proposals first. |
| **ETRI** | OK in principle.We think the following suggestion from QC covers both proposal 2.1.1a and 2.2.2a?(Or should we need to mention the time domain granularity as well?)**The frequency domain H/S/NA per slot configuration can be provided for a subset of slots only.*** **Additional signaling details (e.g. bitmap, slot pattern, etc.) can be left up to RAN3**
 |
| **Vivo** | In our understanding, the proposal is used to decide the granularity of slot based on a given reference SCS. We are fine with such proposal. |
| **CEWiT** | Our understanding is similar to QC. With that understanding we can support the proposal. |
| **Nokia** | Our understanding is that this proposal is consistent with current agreements regarding configuration of H/S/NA per RB set per D/U/F time resource within a slot. |

**Proposal 2.1.2a: Different frequency domain H/S/NA resource types can be indicated individually for each RB set over a subset of slots where the frequency domain H/S/NA configuration is different from the time domain H/S/NA configuration.**

* **Additional signaling details (e.g. bitmap, slot pattern, etc.) can be left up to RAN3**

**Discussion: Views on proposal 2.1.2a?**

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| **Company**  | **Comments**  |
| **NTT Docomo** | **Support**  |
| **LG** | For FDM operation between DU and MT, of course, H/S/NA resource type should be individually indicated for each RB set. Furthermore, different RB sets can be configured the same H/S/NA resource type. For example, both of two RB sets are configured as Soft, but only one RB set is indicated as available by DCI format 2\_5, so that DU and MT can operate using different RB sets.In the last meeting, it was agreed that 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. Thus, in our understanding, different resource types can be configured for different RB sets. |
| **Ericsson** | **Support.** We would also like to have an agreement that within a slot, either TDM or FDM configuration is applied. |
| **Intel** | We are okay with this proposal. But we think it is better to first define “RB set”, whether it means exactly N PRBs (which results in equal sized RB sets in freq-domain), or a group of N PRBs (which results in unequal sized RB sets in freq-domain).  |
| **Qualcomm** | We can support the proposal, although, if we understand the intent correctly, i.e. to provide guidance on some signaling design/optimization, we would recommend a simpler version:**The frequency domain H/S/NA per slot configuration can be provided for a subset of slots only.*** **Additional signaling details (e.g. bitmap, slot pattern, etc.) can be left up to RAN3**
 |
| **ZTE, Sanechips** | Qualcomm’s simper version is fine to us |
| **Samsung** | We slightly prefer QC’s updated proposal. |
| **Lenovo, Motorola Mobility** | We are fine with the intent of the part that is about frequency-domain configuration for a subset of slots and not necessarily all the slots.But the sentence “where the frequency domain H/S/NA configuration is different from the time domain H/S/NA configuration” is unclear. Does it intend to say: where time-domain and frequency-domain H/S/NA attributes for a resource are different? |
| **Huawei, HiSilicon** | We are fine to only indicate FDM H/S/NA resource type only for a subset of slots but not sure whether there is a need to indicate each RB set individually, it would be okay to indicate a number of consecutive RB sets. We suggest the following change **Proposal 2.1.2a: Different frequency domain H/S/NA resource types can be indicated ~~individually~~ for a number of ~~each~~ RB set(s) over a subset of slots where the frequency domain H/S/NA configuration is different from the time domain H/S/NA configuration.*** **Additional signaling details (e.g. bitmap, slot pattern, etc.) can be left up to RAN3**

We are also fine with QC’s modification. |
| **ETRI** | Fine with the QC’s version.In addition, we may need to capture the previous GTW discussions as follows:**The frequency domain H/S/NA per slot configuration can be provided for a subset of slots only.*** **Additional signaling details (e.g. bitmap, slot pattern, etc.) can be left up to RAN3**
* **FFS: The number of different frequency domain configurations at a given time**
 |
| **vivo** | Qualcomm’s simper version is fine to us.  |
| **CEWiT** | Support |
| **Nokia** | We may prefer Qualcomm’s proposal, but in general are ok with proposal. |

**Proposal 2.1.3a: If both the Rel-16 time domain H/S/NA configuration and Rel-17 frequency domain H/S/NA configuration are provided for a given RB set within a slot, an IAB node applies the frequency domain H/S/NA only if simultaneous operation is currently applied for the indicated resources.**

**Discussion: Views on proposal 2.1.3a?**

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| **Company**  | **Comments**  |
| **NTT Docomo** | **Support**  |
| **LG** | We support the FL Proposal.It is considered that applying the frequency domain H/S/NA configuration to the case where the FDM operation is not performed is to limit the operating frequency resource of the MT/DU unnecessarily. |
| **Ericsson** | **Support.** Same thing as for Proposal 2.1.2a that within a slot, either TDM or FDM configuration is applied. |
| **Intel** | We are okay with the proposal.  |
| **Qualcomm** | We **do not support** this proposal.It is not clear how exactly one can check whether “simultaneous operation is currently applied”, or not. It is not clear whether simultaneous operation refers to. Furthermore, the information about time-domain and frequency-domain resource configurations can be (semi-statically) shared among different IAB-nodes/donors for CLI and/or dual-connectivity management purposes. And having a dynamic rule to switch between the two configurations will complicate the related procedures.Hence, we propose to have a simple and sensible rule such as:**If both the Rel-16 time domain H/S/NA configuration and Rel-17 frequency domain H/S/NA configuration are provided for a given RB set within a slot, an IAB node applies the frequency domain H/S/NA.** |
| **ZTE, Sanechips** | As pointed by our contribution and Qualcomm, supporting dynamic H/S/NA configuration selection would cause a lot of issues, the proposal from Qualcomm is our preference. |
| **Samsung** | Support and also share a view with Ericsson. |
| **Lenovo, Motorola Mobility** | **Do not support**. We do not have an agreement on indication of “simultaneous operation.” |
| **Huawei, HiSilicon** | As discussion in the GTW, more clarification is needed on “only if simultaneous operation is currently applied for the indicated resources.” The parent node and IAB node should have same understanding on the semi-static H/S/NA resource configuration for the IAB-DU; however, whether simultaneous operation is currently applied or not depends on scheduling decisions at both parent node and an IAB node. Hence a dyamic switching between semi-static configurations does not work. We suggest the following**Proposal 2.1.3a: If both the Rel-16 time domain H/S/NA configuration and Rel-17 frequency domain H/S/NA configuration are provided for a given RB set within a slot, an IAB node applies the frequency domain H/S/NA ~~only if simultaneous operation is currently applied for the indicated resources~~.** |
| **ETRI** | It was already agreed to support dynamic indication of IAB node’s capability on simultaneous operation, while the configuration itself (from both Rel-16 and Rel-17 perspectives) will be semi-static.**Therefore, we feel that the FL proposal makes sense.** For instance, “only if simultaneous operation is currently applied” may refer “the dynamic indication of IAB node’s capability on simultaneous operation”. |
| **vivo** | it needs to be clarified how dynamic the switching would be. The switching from Rel-17 H/S/NA and Rel-16 H/S/NA can be determined based on enabling/disableing of the simultaneous operation, or based on whether there is MT scheduling or not.  |
| **CEWiT** | Support |
| **Nokia** | Prefer Huawei’s version of the proposal, as simultaneous operation in the current proposal is not fully understood. |

**Proposal 2.1.4a: Support additional candidate values of {96,128,160} for the size of an RB set, N.**

**Discussion: Views on proposal 2.1.4a?**

|  |  |
| --- | --- |
| **Company**  | **Comments**  |
| **LG** | We are ok with the proposal. |
| **Ericsson** | Do **not support** at this point but we could potentially come back to this when FD H/S/NA configuration is specified. Presently, we don’t see the need for introducing such large resource values of an RB set when, as described in our contribution, already the existing larger values are ill suited for some RB set sizes. |
| **Intel** | Similar to comments to Proposal 2.1.2a. We think it is better to first define “RB set”, whether it means exactly N PRBs (which results in equal sized RB sets in freq-domain), or a group of N PRBs (which results in unequal sized RB sets in freq-domain). If a RB set can include a group of N PRBs, we don’t need to further expand the value of N. |
| **Qualcomm** | We support this proposal. |
| **ZTE, Sanechips** | We have similar concern as Intel, the definition of ‘RB set’ should be clarified firstly.* Any RB set should be defined on a reference carrier(SCS, starting frequency, bandwidth), In NR, multiple SCS-specific carriers can be configured for one DU cell, as discussed in our contribution, so how to define the reference carrier should be discussed in order to define the RB sets on an IAB-DU cell.
* The relationship b/w the size of an RB set and N, they are the same or not as pointed by Intel.
 |
| **Lenovo, Motorola Mobility** | Fine with the proposal.We understand the term “RB set” is refers to “set of N RBs” in the following agreement (RAN1#105-e):AgreementThe 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
 |
| **Huawei, HiSilicon** | Given that we already agree that N can be up to 64, the additional overhead saving is not much to our understanding. As an example, considering 273 PRBs in total, assuming SLIV based signaling, the required number of bits is log2(5\*6/2) = 4 bits for N=64 while the required number of bits is log2(2\*3/2) = 2 bits for N=160. So the bit saving is 2 bits. |
| **Nokia** | In general the need for these values is unclear but we can be prepared to agree if there is strong support. |

**Proposal 2.1.5a: In case that an IAB-MT cell is configured with multiple BWPs, one of the following** **alternatives is supported:**

* **Per-BWP frequency domain H/S/NA configuration (including the value of N) is provided.**
* **A single value of N is common across all MT BWPs overlapping the IAB-DU cell**

**Discussion: Views on proposal 2.1.5a?**

|  |  |
| --- | --- |
| **Company**  | **Comments**  |
| **NTT Docomo** | **Prefer second alternative.** |
| **LG** | We are fine with the proposal, but we think the first alternative doesn’t make sense. Since the active BWP of the MT can be dynamically switched, in order to apply the first alternative, the frequency domain H/S/NA configuration applied by the DU should also be dynamically changed. This complicates the operation of DU resource scheduling and dynamic soft resource availability indication by DCI format 2\_5.So we want to leave only the second alternative. |
| **Ericsson** | We think that the above two alternatives that are not really mutually exclusive and says nothing about the FD H/S/NA configuration for the case where a single value of N is used. We would propose to reformulate the above according to:**In case that an IAB-MT cell is configured with multiple BWPs, Per-BWP frequency domain H/S/NA configuration is supported together with one of the following** **alternatives is supported:*** **N is provided per BWP.**
* **A single value of N is provided.**

where **Ericsson supports the first bullet.** |
| **Intel** | We support the second bullet to make it simple.  |
| **Qualcomm** | Our understanding is aligned with the second bullet, for which no specific agreement nor specification seems necessary. |
| **ZTE, Sanechips** | Disagree with the first alternatives, and the second alternative is preferred, and it is no different for single or multiple BWP case, propose to remove the first subbullet and change the second as :* **A single value of N is configured for an IAB-DU cell ~~c ommon across all MT BWPs overlapping the IAB-DU cell~~.**
 |
| **Samsung** | The second option as a simple approach is preferred. |
| **Lenovo, Motorola Mobility** | It may be better to agree on an alternative for the number of frequency-domain H/S/NA configurations:* per-BWP per-MT
* per-MT

N is a parameter in the configuration(s). |
| **Huawei, HiSilicon** | As discussed previously, we don’t see the need to couple the DU resource configuration with the size of IAB-MT BWP. The motivation has not been well explained. It was argued that this will help the resource alignment between the DU and the MT. However, the resource alignment can be achieved regardless of this. As a matter of fact, associating the size of RB set for DU and size of RBG for IAB-MT brings lots of issues:* Multiple BWP configurations
* Multiple MT CC overlapped with one DU cell
* Reconfiguration of BWP
* DL BWP and UL BWP

We don’t see the need to further discuss the issue. The system works perfectly fine without any agreement on this. |
| **ETRI** | Fine with ZTE’s suggestion. |
| **vivo** | How to configure N is up to implementation, single N is configured per DU cell. We don’t see the need to further discuss the issue. |
| **CEWiT** | Support the proposal. Prefer second bullet |
| **Nokia** | Support the proposal with a preference for the second alternative. |

**Proposal 2.1.6a: 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.**

* **FFS: Extension of *AvailabiltyCombination* to include multiple *resourceAvailabilty* per RB set**
* **FFS: Update resourceAvailability mapping table defined in TS38.213 so that the indication of availability can be applied over soft resources in frequency-domain for DL or UL or Flexible symbols.**
* **FFS: Extension of the maximum payload size of DCI format 2\_5 to increase the number of IAB-DU cells that can be provided with availability information for Soft resources.**

**Discussion: Views on proposal 2.1.6a?**

|  |  |
| --- | --- |
| **Company**  | **Comments**  |
| **NTT Docomo** | **Support**  |
| **LG** | We support the proposal.In this regard, another FFS point that requires another decision we consider is whether the frequency domain availability information will be indicated through the same DCI field as the existing time domain availability information or whether it will be indicated through the different DCI field.Therefore, we propose to add the following sub-bullet.**FFS: whether the availability information is transmitted in the same field as the information on the Rel-16 time domain availability or transmitted in a different field** |
| **Ericsson** | We **support the intention with the proposal**, but it is not clear to us if we agree on one or multiple indications are included in the single DCI format for the multiple RB sets. The below formulation will clarify that:**For a given time resource of the child IAB-DU cell, a single DCI format 2\_5 can be received indicating availability for the respective RB sets for that time resource.**Furthermore, the first FFS needs some clarification. Does it mean that an RB set could be included in multiple *AvailabilityCombinationId*:s (in which case we support it) or something else?Regarding the third FFS, we think that the current payload capacity will be too small to provide sufficient flexibility considering availability information for combinations of both time, frequency and/or DU cells. Hence, we can **agree to the third FFS** already now. |
| **Intel** | We support the proposal. |
| **Qualcomm** | We support the proposal. |
| **ZTE, Sanechips** | Alt 3 ,i.e., 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, is our preference which has less specification impact and Rel-16 availability indication of soft resources is reused, .As shown in the proposal, a lot of normative works would follow if this is supported, while the benefit is not clear(FDM can also be done with Alt 3) |
| **Samsung** | No urgent. We think this discussion is associated with how many RB sets at a time can be supported for soft resource which should be first discussed. We believe just one RB set is sufficient to configure one soft resource at a time and then resource availability of all RBs in the RB set can be indicated by the single DCI format. |
| **Lenovo, Motorola Mobility** | Support |
| **Huawei, HiSilicon** | We don’t see the necessity of enhancing DCI format 2\_5. With current DCI and proper frequency domain H/S/NA configuration, flexible FDM can be achieved.  |
| **ETRI** | Support the proposal. |
| **vivo** | Support |
| **CEWiT** | Support the proposal. |
| **Nokia** | Support the proposal. We also feel that a new table for resourceAvailability mapping would likely not be necessary, but could be done applying the current table on a per-RB set basis. |

**ISSUE 2.2: SPATIAL DOMAIN MULTIPLEXING**

Proposal 2.2.1a: RS ID is used for a parent node to indicate beams of an IAB-DU in the direction of which simultaneous operation is restricted

* **At least SSB ID is supported**
* **FFS: Informing the parent node of RS configuration for CSI-RS or SRS at the child IAB-DU**

**Discussion: Views on proposal 2.2.1a?**

|  |  |
| --- | --- |
| **Company**  | **Comments**  |
| **NTT Docomo** | **Support**  |
| **LG** | We are fine with the proposal. |
| **Ericsson** | **Support** |
| **Intel** | We need to further understand: 1. Are all the RS ID numbers related to an IAB-DU known by the parent-DU?
2. How can a parent-DU measure and provide RS ID related to an IAB-DU?
 |
| **Qualcomm** | We support the proposal with some clarifications. 1. We would like to note that an IAB-DU cell may send up to 5 different sets of SSBs (associated with up to 5 configured STCs). Hence, indication of an SSB ID alone may not be sufficient, and it should be accompanied by an STC index.
2. Also, it seems the parent-node can already be informed, via CU and through “GNB-DU RESOURCE CONFIGURATION”, about the IAB-DU’s CSI-RS configuration.
3. As we have applied to past agreements, it would be beneficial to align the terminologies and talk about either “parent-node and IAB-node” or “IAB-node and child-node”.

Hence, we suggest the following:RS ID is used for a parent node to indicate beams of an IAB-DU in the direction of which simultaneous operation is restricted* **At least SSB ID and STC index are supported**

**FFS: Informing the parent node of SRS at the IAB-DU** |
| **ZTE, Sanechips** | Agree in principle. |
| **Samsung** | Support |
| **Lenovo, Motorola Mobility** | Fine |
| **Huawei, HiSilicon** | We suggest to use SRS for the indication. If SRS is used, it can be obtained by parent node without the additional information |
| **ETRI** | Fine in principle.Several clarification questions:* Is this RS ID defined for the signaling from parent-node to IAB-node?
* Re the second point from QC (i.e. IAB-DU is configured with CSI-RS already), why should we focus on SSB only? Do you see any further specification efforts to include CSI-RS?
* Similar question for SRS.
 |
| **CEWiT** | Support the proposal. |
| **Nokia** | Support in principle. Propose to modify FFS to support indication of beam restriction via indication of parent beams (e.g. parent CRI/SRI) by which conflicted child link beams would be restricted. |

**Proposal 2.2.2a: The restricted beam indication from the parent node to the child IAB-DU may be provided per:**

* **Multiplexing mode**
* **MT TX/RX beam**
* **{MT CC, DU cell} pair**

**Discussion: Views on proposal 2.2.2a?**

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| --- | --- |
| **Company**  | **Comments**  |
| **NTT Docomo** | **Support in principle.****For the first bullet, we think it needs to be discussed and clarified that for which multiplexing mode(s), e.g., MT Tx/DU Tx, restricted DU beam indication is needed**  |
| **LG** | We are fine with the proposal. |
| **Ericsson** | We think parent node beam restriction is only relevant for parent node reception, corresponding to simultaneous transmission at the IAB node, either in a TD or FD Soft resource. For simultaneous reception at the IAB-node, it can be left to the IAB-node to schedule nodes such that interference from the parent node is avoided and, consequently, no signaling is needed. For Case-C DL full duplex, we doubt the feasibility about combining this mode of operation with SDM. Furthermore, since the restriction applies to SDM simultaneous operation, in our view, there is no need to introduce {MT CC, DU cell} pairs since it is already known. Hence, we **propose the following proposal:****Parent node beam restriction indication applies to simultaneous Tx at the IAB node.** |
| **Intel** | We are fine with the proposal. |
| **Qualcomm** | We support the proposal with some clarifications. 1. It would be good to clarify that the multiplexing mode here refers to IAB-node’s multiplexing mode.
2. We also think it would be better to clarify the relevant multiplexing modes, which, in our view, are (MT TX, DU TX) and (MT RX, DU TX).
3. It is important to keep {MT CC, DU cell} pair. Otherwise, the IAB-node may unnecessarily apply the restriction when there is no simultaneous communication on the problematic pairs.
4. A given {MT CC, DU cell} pair may have FDM’ed or overlapping communications (in the frequency-domain) during different time resources, and the restriction may be applicable to either or both cases. Hence, it would be better to further capture this aspect too.
5. As we have applied to past agreements, it would be beneficial to align the terminologies and talk about either “parent-node and IAB-node” or “IAB-node and child-node”.

Our suggestion for the modified proposal:**The restricted IAB-DU’s beam indication, from the parent-node to the IAB-node, may be provided per:*** **IAB-node’s multiplexing mode: (MT TX, DU TX) and (MT RX, DU TX)**
* **MT TX/RX beam**
* **{MT CC, DU cell} pair**
* **Frequency domain multiplexing of MT and DU**
 |
| **ZTE, Sanechips** | Does it mean all the listed alternatives should be supported? Or further down selection is needed. |
| **Samsung** | We’d like to clarify Multiplexing mode is at least for MT TX and DU TX. |
| **Lenovo, Motorola Mobility** | **Do not support.**We do not have an agreement on “multiplexing mode.”Also, MT RX beam is not clear.Side note: Use of the word “child IAB-DU” is not consistent with Proposal 2.2.1a. |
| **Huawei, HiSilicon** | We think some further discussion is required on whether Rx beams of DU should be restricted. Our understanding is that the main intention to introduce the restriction is to avoid interference for MT Tx/DU Tx. In this case, the multiplexing mode and MT Rx beam are unnecessary. In addition, it may become extremely complicated to indicate the beam restriction for each MT Tx beam since the parent node need to perform measurement for each single MT Tx beam.**Proposal 2.2.2a: The restricted beam indication from the parent node to the child IAB-DU may be provided per:*** **Multiplexing mode**
* **~~MT TX/RX beam~~**

**{MT CC, DU cell} pair** |
| **ETRI** | Support the proposal.@Lenovo, since the legacy beam report does not cover different characteristics due to the simultaneous operations, the motivation of this proposal seems valid.@Ericsson, Samsung, we think the Rel-17 IAB node shall not be forced to implement Rel-17 MIMO. Therefore, although we’re OK to add Rel-17 unified TCI here, we still believe that SRI should be captured as well.  |
| **vivo** | Support  |
| **CEWiT** | Share similar view with Ericsson. |
| **Nokia** | Support the proposal. |

**Proposal 2.2.3a: The recommended beam indication from the child IAB-MT to the parent node are provided via MAC-CE using the IAB-MT’s TCI state IDs (for DL RX beam(s)), and SRI IDs (for UL TX beam(s)).**

**Discussion: Views on proposal 2.2.3a?**

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| --- | --- |
| **Company**  | **Comments**  |
| **NTT Docomo** | **Do not support.****Our preference is to reuse legacy beam reporting framework. We can also accept MAC CE if it is majority view.****But how to indicate MT beams (e.g., via TCI state ID/SRI ID/SSB ID/CSI-RS ID) needs to be further discussed, especially the SRI ID part. First, we have some clarification questions.*** **Does SRI ID refer to SRS resource ID or codepoint of SRI field in DCI?**
* **What kind of SRS e.g., CB/NCB/BM SRS is considered here?**

**And we also see some problems of using SRI ID*** **the number of candidate MT beams is limited. E.g., for CB, at most 2 SRS resources can be configured in R16, which means IAB node can only select between the 2 SRIs and report. And there is also cases that only one SRS resource may be configured.**
* **SRI only represent beam of PUSCH. Beam of PUCCH is configured as PUCCH spatial relation. If UL beam is reported via SRI ID, how to handle the UL Tx of PUCCH.**

**Thus, we suggest considering using SSB ID/CSI RS ID to indicate MT beam.** |
| **LG** | We are fine with the proposal. |
| **Ericsson** | We **support TCI** but do not see the need for SRI indication since in Rel-17 there has been specified a common TCI for both DL and UL. |
| **Intel** | We are fine with the proposal. |
| **Qualcomm** | We support the proposal. The word ‘child’ can be removed for consistent terminology.In the same context, and similar to proposal 2.2.2a, it seems ti should be further discussed/clarified how the beam recommendation indication is associated with different multiplexing modes, and other configurations. |
| **ZTE, Sanechips** | Agree in principle. |
| **Samsung** | Support TCI for DL RX beam. For UL TX beam, share a view with Ericsson. |
| **Lenovo, Motorola Mobility** | **Do not support.** It is not clear why the IAB-MT does not simply use the legacy beam report to inform the parent node of preferred beams.Side note: Similar to our comment on Proposal 2.2.2a, use of the word “child IAB-MT” is not consistent. |
| **Huawei, HiSilicon** | Support. On the UL Tx beams, we suggest to change “SRI ID” to “spatial relations” which is more generic and also consistent with the current specification.**Proposal 2.2.3a: The recommended beam indication from the child IAB-MT to the parent node are provided via MAC-CE using the IAB-MT’s TCI state IDs (for DL RX beam(s)), and ~~SRI IDs~~ IAB-MT’s spatial relations (for UL TX beam(s)).** |
| **vivo** | Support  |
| **CEWiT** | Support  |
| **Nokia** | Support the proposal. |

**ISSUE 2.3: MULTIPLEXING OPERATION ADAPTATION**

**Proposal 2.3.1a: In Rel-17, the semi-static indication of the multiplexing capability of an IAB node for the case of no-TDM between IAB MT and IAB DU is additionally provided with respect to each transmission-direction combination (per MT CC/DU cell pair):**

* **Support for FDM (FFS: desired guard band)**
* **Support for SDM (i.e. parent beam restrictions and/or child beam recommendations)**
* **Supported timing modes**
* **Support for DL Tx power adjustment**

**Discussion: Views on proposal 2.3.1a?**

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| --- | --- |
| **Company**  | **Comments**  |
| **NTT Docomo** | **Support**  |
| **LG** | We support the FL’s proposal. |
| **Ericsson** | **Support in general,** however, we don’t see the need for signaling of guard bands since this should be left to implementation and handled by the DU. Also, considering this is a IAB-node *capability*, we think it is static and not semi-static. Maybe a better formulation would be the following:**In Rel-17, ~~the semi-static indication of~~ the multiplexing capability of an IAB node…** |
| **Intel** | We want to further understand the proposal: is this multiplexing capability report to CU? If so, we are fine with the proposal.  |
| **Qualcomm** | Clarifications are needed.The following should be further clarified:1. Who are the transmitter and recipient of this information? IAB-MT to CU (via RRC)? IAB-DU to CU (via F1)? IAB-MT to parent-node (e.g., via MAC-CE)?
2. What does “support for FDM” mean? Does it mean, whether FDM is “required” by the IAB-node or not?
3. What does “support for SDM” mean? Does it mean IAB-node supports receiving/transmitting the associated beam restrictions/recommendations indications? Or does it mean further beam alignment between IAB-node and parent-node may be needed between?
4. What does “supported timing modes” mean? For example, does it mean IAB-node “requires” Case 6 timing for its simultaneous transmissions?

What does “support for DL TX power adjustment” mean? 8.10.2 already agreed an IAB-node may indicate desired parent-node’s DL TX power adjustment. What is the relation between 8.10.2 agreement and the bullet point here? |
| **ZTE, Sanechips** | Agree in principle. |
| **Samsung** | Support. We understand this information is sent from IAB to CU either via RRC or F1AP. |
| **Lenovo, Motorola Mobility** | We understand the word “semi-static” means the **recipient is IAB-CU**.We **support the intent of the proposal**, but more discussion seems needed on details.For example, what does “supported timing modes” means? Case 6 is only applicable to Tx/Tx and Case 7 is only applicable to Rx/Rx. Hence, the timing mode case can be inferred from “transmission-direction combination” (Tx/Tx, Rx/Rx) if enhanced timing alignment is required by the IAB node for that transmission direction combination.Instead, the IAB node should indicate whether it requires a Case 6 or Case 7 timing alignment. Depending on hardware capabilities of the IAB node (number of panels, baseband processing, etc.), enhanced timing alignment may or may not be required. |
| **Huawei, HiSilicon** | More discussion is needed.There is no need to define capabilities of FDM and SDM but the conditions/parameters should be define in order to operate FDM/SDM. This is more relevant to proposal 2.3.2a. The timing mode can be defined as separate capabilities and they should also be included as conditions/parameters in order to operate simultaneous Tx/Rx. |
| **ETRI** | Support the proposal. |
| **vivo** | If the report is to CU, we do not understand the motivation to report to CU, since TX/RX beam is local information at IAB node, even beam index is reported to CU, CU is not aware of the local beam direction. |
| **CEWiT** | Support  |
| **Nokia** | Support the proposal in principle. We are unclear on what specifically is indicated as capability regarding, “parent beam restrictions and/or child beam recommendations.” |

**Proposal 2.3.2a: MAC-CE signaling is used for the request/report of the following conditions/parameters to facilitate dynamic adaptation between multiplexing operation modes:**

**From the child to the parent:**

* **Desired DL TX power adjustment**
* **Desired IAB-MT PSD range for UL TX power control**

**From the parent to the child:**

* **Applied DL TX power adjustment**
* **Slots where Case 6 timing is applied at the child**
* **Slots where Case 7 timing is applied at the parent**

**FFS: Mapping of conditions/parameters to a set of time slots and MT Tx/Rx beams**

**FFS: Indication of additional dynamic “support” of a feature (e.g. timing mode, power control, beam restrictions/recommendations for simultaneous operation cases) on top of higher-layer signaling**

**Discussion: Views on proposal 2.3.2a?**

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| --- | --- |
| **Company**  | **Comments**  |
| **NTT Docomo** | **The power control related information is also discussed in 8.10.2. Maybe we can leave it to 8.10.2.****For the timing mode indication, we think whether the indication is per slot needs to be discussed first. If the timing mode varies per slot, what is the benefit of indicating the pattern via MAC CE than indicating timing mode in UL scheduling DCI?** |
| **LG** | We support the FL’s proposal. |
| **Ericsson** | **Support in general**, however, we would like a clarification about how this agreement relates to already made agreements in 8.10.2, or to agreements on individual topics that may belong in AI 8.10.2.  |
| **Moderator (AT&T)** | **Let’s table this discussion until details of the timing indication and DL/UL power control information are decided in 8.10.2** |

**Proposal 2.3.3a: An IAB node cannot operate under a given non-TDM multiplexing mode until all conditions and parameters required are explicitly acknowledged by the parent node.**

**Discussion: Views on proposal 2.3.3a?**

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| --- | --- |
| **Company**  | **Comments**  |
| **LG** | The meaning of the proposal seems unclear. Could you please clarify about the intention? |
| **Ericsson** | **Support** with slight modification. For Case-B sim RX, we think that also the child node must acknowledge that the IAB node may operate in Case-B. |
| **Intel** | If this means non-TDM multiplexing mode is controlled by parent node, we are fine with the proposal.  |
| **Qualcomm** | We do **not support** this proposal in the current form.The intention of this proposal is not clear to us. It also seems it would require some time to define ‘all conditions and parameters’ and how they get acknowledged by the parent node.As an example, why would FDM operation configured by the CU at a given IAB node be authorized by the parent node? Similarly, if an IAB-node is capable of SDM Rx, why should that be gated by the parent node? |
| **ZTE, Sanechips** | The motivation should be clarified, from our understanding, the parent node can indicated the potential/allowed multiplexing mode to IAB node. |
| **Samsung** | Support. We think non-TDM multiplexing mode may impact on operation between parent and IAB MT and then it should be controlled by parent. |
| **Lenovo, Motorola Mobility** | The proposal is not clear. Context and examples could be helpful. |
| **Huawei, HiSilicon** | Fine in principle. Our understanding of the proposal is non-TDM multiplexing mode is only operated when the conditions/parameters required to be fulfilled by the parent node are acknowledged from the parent node to the IAB node.  |
| **ETRI** | Support the proposal. |
| **vivo** | We can support the proposal, if it means “Enable or disable of the Rel-17 multiplexing mode is indicated by parent node”. Moreover, CU can also indicate whether Rel-17 multiplexing mode is enabled or not. |
| **CEWiT** | Support  |
| **Nokia** | The purpose of this proposal is unclear. Is this meant to imply that non-TDM multiplexing is only allowed when explicitly indicated by the parent node? |

**ISSUE 2.4: GUARD SYMBOL INDICATION ENHANCEMENTS**

**Proposal 2.4.1a:** **The MAC-CE signaling of Desired/Provided Guard Symbols is enhanced to optionally indicate the number of guard symbols required for switching between Case #1, Case #6, and/or Case #7 timing (e.g. only indicated when the number of guard symbols for switching is different compared to the individual timing cases themselves).**

**Discussion: Views on proposal 2.4.1a?**

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| --- | --- |
| **Company**  | **Comments**  |
| **NTT Docomo** | **We think the proposal needs some further clarification.****In R16, guard symbol was defined for the switching between MT Tx/Rx and DU Tx/Rx.****We have agreed to enhance guard symbol considering case6, case7 timing. In our understanding what is important for further discussion is to clarify enhancement is needed for which switching scenarios, e.g. in our view, guard symbol needs to be indicated additionally for the following switching scenarios besides R16.*** **Case#6 MT Tx and DU Tx/Rx**
* **Case#7 MT Tx (to support case#7 at parent node) and DU Tx/Rx**
 |
| **LG** | We are ok with the proposal.We have one clarification question. Case #7 timing in the proposal means Case #7 timing at the parent node or Case #7 timing at the IAB node? It may be MT Tx timing due to application of Case #7 timing at the parent node. |
| **Ericsson** | **Support,** however, should we also specify directivity for the switching (DL/DL, DL/UL,…)? |
| **Intel** | We are okay with the proposal and also fine with DCOM’s two listed additional switching scenarios.  |
| **Qualcomm** | We agree with NTT Docomo’s views. There are currently 8 multiplexing modes (4 enhanced multiplexing modes defined in Rel-17, and 4 TDM-based modes from Rel-16), and 4 timing cases (Case 1, Case 6 UL TX timing, Case 7 UL TX timing, Case 7 UL RX timing). Supporting all possible switches across different combinations is not justified. We should identify the minimal set of new switches to be supported, and for that we agree with Docomo to additional support the following cases:* **Case#6 MT Tx and DU Tx/Rx**
* **Case#7 MT Tx (to support case#7 at parent node) and DU Tx/Rx**
 |
| **Samsung** | We are fine with the FL proposal and also updated proposal from NTT DCM. |
| **Lenovo, Motorola Mobility** | Comments from NTT Docomo and Qualcomm are reasonable. |
| **Huawei, HiSilicon** | We share a similar concern with DCM and QC. The additional desired/provided guard symbol guard symbols indication only need to consider case 6/7 timing for MT. There is no need to consider Case 6/7 timing for the DU in the switching since the resource confliction can be handled internally by IAB node.  |
| **vivo** | Support the proposal. |
| **CEWiT** | Support the intention. Prefer Docomo’s version. |
| **Nokia** | Support proposal for switching between case #1 and case #7 timing, but it is not clear why guard symbol indication is necessary for switching between case #1 and case #6 timing. Only change between modes is MT UL timing reference, which is under control of parent node. Required symbols should be known by both parent and IAB node. |

# Resource allocation for dual-connectivity scenarios (i.e. IAB-MT with concurrent BH links with two parent nodes)

**From the eIAB WID:**

* Specification of enhancements to the resource multiplexing between child and parent links of an IAB node, including:
	+ Support of simultaneous operation (transmission and/or reception) of IAB-node’s child and parent links (i.e., MT Tx/DU Tx, MT Tx/DU Rx, MT Rx/DU Tx, MT Rx/DU Rx)
	+ **Support for dual-connectivity scenarios defined by RAN2/RAN3 in the context of topology redundancy for improved robustness and load balancing.**

**Summary of input contributions:**

|  |  |
| --- | --- |
| **Huawei, HiSilicon R1-2108765** | ***Proposal 11:*** *To handle potential indication conflict of symbols configured as semi-static flexible by one parent node, but not the other in inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers,* *the IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents.****Proposal 12:*** *To handle potential indication conflict of symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers, the IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents.****Proposal 13:*** *To support the per-backhaul-link resource configuration, the donor CU can provide parent node-specific resource configurations to an IAB node and its parent nodes.* |
| **Nokia, Nokia Shanghai Bell R1-2108826** | ***Observation 3.1: RAN2 will need to determine the method of coordinating to avoid DCI format 2\_0 conflicts between parent DUs with a common donor CU and common child IAB MT.*** ***Observation 3.2: RAN2 will need to determine the method signaling resource configurations between parent DUs of a DC IAB node for both inter- and intra-donor scenarios.*** ***Observation 3.3: Selecting Alt. 1 for either scenario for resolving DCI format 2\_0 conflicts between parents of an inter-donor DC IAB should be expected to impact RAN2 and RAN3.*** ***Proposal 3.1: Select Alt.6 for inter-donor DC scenarios where a slot format conflict occurs, and one of the conflicted resources is semi-static flexible.******Proposal 3.2: Select Alt.5 for inter-donor DC scenarios where a slot format conflict occurs, and both conflicted resources are semi-static flexible.******Proposal 3.4: Support per-backhaul link per-DU resource configuration for DC IAB nodes.*** |
| vivo**R1-2108995** | **Observation 1: Current NR-DC requires two legs to use different carrier, which means NR-DC is not available when single carrier is deployed according the current spec, while intra-frequency DC can remove this barrier.** **Proposal 19: RAN1 supports both intra-carrier DC and inter-carrier DC.** Proposal 20: To handle potential indication conflict of symbols configured as semi-static flexible by one parent node, but not the other in inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers:* Alt. 1. The IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents.

Proposal 21: To handle potential indication conflict of symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers:* Alt. 1: The IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents.

Proposal 22: RAN1 specifies IAB DU behavior when IAB DU receives conflicted indications for Rel-17 features from two parent nodes, e.g., restricted beam indication, multiplexing case indication, etc. Proposal 23: Support child node to report soft resource availability from one parent node to the other parent node in DC scenario. |
| ZTE, Sanechips | [Proposal 12: To handle the potential indication conflict of symbols configured as semi-static flexible by one or both parent nodes in inter-donor DC scenarios：](#_Toc83923117)[• The IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents.](#_Toc83923118)[Proposal 13: When IAB MT detects more than one DCI format 2\_5, the IAB-MT expects that each of the more than one DCI formats 2\_5 from the same CG indicates a same value for the availability combination of the soft resources in the slot.](#_Toc83923119)[Proposal 14: For explicitly availability indication case, a per-cell IAB-DU soft resource is considered as available with respect to a IAB MT serving cell only if the IAB MT is explicitly indicated as IA by DCI 2\_5 from the CG that the serving cell belongs to.](#_Toc83923120) |
| Samsung | *Proposal 10: If a conflict occurs between different parents, the IAB MT is expected to perform as scheduled by MCG.**Proposal 11: If a collect occurs between different parents and there exist the essential channel and signal by SCG only, the IAB MT can prioritize scheduling by SCG.* |
| Intel | **Proposal 6:** For the semi-static DU resource configurations, additionally support per-backhaul link (e.g. per child IAB-MT link) configuration. **Proposal 7:** In inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers: * Support Alt. 6 (The IAB-MT is expected to operate according to the non-flexible configuration) to handle potential indication conflict of symbols configured as semi-static flexible by one parent node.
* Support Alt. 5 (If a conflict occurs, the IAB MT is expected to perform as scheduled by MCG) to handle potential indication conflict of symbols configured as semi-static flexible by both parents.
 |
| NTT DOCOMO | **Proposal 15: To handle potential indication conflict of symbols configured as semi-static flexible by one parent node, but not the other in inter-donor DC scenarios, support Alt.1, i.e.,*** **Alt. 1. The IAB MT does not expect to receive conflicting DCI formats including DCI 2\_0 and dynamic scheduling grants from different parents.**

**Proposal 16: To handle potential indication conflict of symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios, support Alt.1, i.e.,*** **Alt. 1. The IAB MT does not expect to receive conflicting DCI formats including DCI 2\_0 and dynamic scheduling grants from different parents.**
 |
| ETRI | **Proposal 11: Clarify that there is no impact on IAB-MT behavior due to conflicts between cell-specific signals/channels and other resource configurations of the IAB-MT, when the IAB node supports SDM between DU and MT resources at least.****Proposal 12: Support Alt. 1 for potential indication conflict handling.*** **Alt. 1. The IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents.**
 |
| CEWiT, IIT-M, IIT-B and Saankhya LabsR1-2109839 | **Proposal 13: In case symbols configured as semi-static flexible by one parent node, but not the other in inter-donor DC scenarios, the IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents****Proposal 14: In case symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios and if a conflict occurs, the IAB MT is expected to perform as scheduled by MCG** |
| AT&TR1-2109920 | **Proposal 6: Per-backhaul link NA resource configurations which can override the per-IAB-DU configuration are supported in Rel-17. Coordination signaling to exchange the per-link resource configurations between up to two parent IAB-nodes/donors should be additionally supported in Rel-17.** |
| Lenovo, Motorola MobilityR1-2109936 | Proposal 17: Support signaling from an IAB node in the DC mode to its parent node for informing the parent node of the status of availability of soft resources. Further discuss specification of mechanisms to handle availability indication collisions by two parent nodes in the DC mode.Proposal 18: To handle potential indication conflict of symbols configured as semi-static flexible by one parent node, but not the other in inter-donor DC scenarios, support Alt. 1. The matter can be left to implementation.Proposal 19: To handle potential indication conflict of symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios, support Alt. 1. The matter can be left to implementation.Proposal 20: Do not support per-backhaul-link resource configuration in Rel-17.Proposal 21: RAN1 to discuss resource conflicts in the DC mode due to conflicting Case-7 timing. |
| Apple | **Proposal 1**: For the case of inter-donor DC if IAB-MT incapable of simultaneous transmission and reception is indicated by conflicting allocations from multi-parents, IAB-MT is expected to operate as indicated by MCG. |
| LG ElectronicsR1-2110101 | **Dual-connectivity to support multiple parent DUs*****Proposal 16: In case of conflict of symbols configured as semi-static flexible by one parent node, but not by the other in inter-donor DC scenarios and if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers, the IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents.******Proposal 17: In case of conflict of symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios and if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers, the IAB MT is expected to perform as scheduled by MCG.******Proposal 18: Discuss how to handle the case where the MT cannot perform simultaneous Tx/Tx or simultaneous Rx/Rx for two serving cells due to timing misalignment in CA/DC environment.*** |
| Qualcomm IncorporatedR1-2110206 | **Proposal 5.1:****Support Alt5/6 for TDD confliction resolution, which may have slightly advantage and flexibility over Alt1.****Observation 5.1****Per-BH link resource config allows an IAB-node to override its Rel-16 DU-cell config for a specified child BH link without impacting to other child nodes, and it is more flexible than Rel-16 approach using per DU-cell config together with knowledge of child’s config.****Proposal 5.2****Support per-BH-link resource configuration.*** **Defer the discussion on whether the configuration shall be provided to the dual-connected child node after agreement of TDD prioritization rules.**
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| EricssonR1-2110331 | [Proposal 23 To handle potential indication conflict of symbols configured as semi-static flexible by one parent node, but not the other in inter-donor DC scenarios if the IAB-MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers, the dual-connected IAB-MT is expected to operate according to the non-flexible configuration.](#_Toc84018888)[Proposal 24 To handle potential indication conflict of symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios if the IAB-MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers, the dual-connected IAB-MT is expected to perform as scheduled by MCG, if a conflict occurs.](#_Toc84018889)[Proposal 25 In DC scenarios, support per-link-NA configuration in Rel-17 IAB.](#_Toc84018890) |

**ISSUE 3.1: FLEXIBLE SYMBOL CONFLICTS**

**Proposal 3.1.1a:**

Select the following alternative to handle potential indication conflict of symbols configured as semi-static flexible by one parent node, but not the other in inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers:

* **Alt. 1. The IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents. FFS: Explicitly captured in the specification or left as a network configuration error case without specification impact**
* ~~Alt. 6. The IAB-MT is expected to operate according to the non-flexible configuration.~~

Select the following alternative to handle potential indication conflict of symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers:

* ~~Alt. 1: The IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents. FFS: Explicitly captured in the specification or left as a network configuration error case without specification impact~~
* **Alt. 5: If a conflict occurs, the IAB MT is expected to perform as scheduled by MCG**

**Discussion: Views on proposal 3.1.1a?**

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| --- | --- |
| **Company**  | **Comments**  |
|  **NTT Docomo** | **support. we are also fine to support Alt.6 in the first case.** |
| **LG** | We support the proposal. |
| **Ericsson** | **Support** the bottom proposal.Do **not support** the top proposal. We would like to point out that Alt.1 is really not handling any conflict but merely leaving the problem to be taken care of by the network. This will lead to restrictions in NW configurability and flexibility which is unnecessary when a simple alternative exists. Furthermore, if the network is misconfigured, there may be undefined behavior, which is exactly what we should be addressing with this proposal but fail to do with Alt. 1.If companies think that it is too complicated with two different rules, we could agree to the following resolution rule also for the case with one flexible parent node:**If a conflict occurs, the IAB MT is expected to perform as scheduled by MCG.** |

**ISSUE 3.2: MULTI-PARENT RESOURCE COORDINATION**

**Proposal 3.2.1a: In DC scenarios, support per-child MT link-NA resource configuration.**

**Discussion: Views on proposal 3.2.1a?**

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| **Company**  | **Comments**  |
| **Ericsson** | **Support** |

# Summary

**Agreement**

**Select the following alternative to handle potential indication conflict of symbols configured as semi-static flexible by one parent node, but not the other in inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers:**

* **Alt. 1. The IAB MT does not expect to receive conflicting DCI formats including DCI2\_0 and dynamic scheduling grants from different parents. FFS: Explicitly captured in the specification or left as a network configuration error case without specification impact**

**Select the following alternative to handle potential indication conflict of symbols configured as semi-static flexible by both parent nodes in inter-donor DC scenarios if the IAB MT of the dual-connected IAB-node does not support simultaneous Tx and Rx on different carriers:**

* **Alt. 5: If a conflict occurs, the IAB MT is expected to perform as scheduled by MCG**

**Agreement:**

**In DC scenarios, support per-child MT link-NA resource configuration.**

* **This configuration can be made available to IAB node as well**

**Possible Agreement**

**Rel-17 frequency domain H/S/NA configuration includes time domain information with the same granularity as the Rel-16 H/S/NA configuration.**