**3GPP TSG-RAN WG2 Meeting #118-e *R2-22xxxxx***

**E-meeting, 09 – 20 May 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.321** | **CR** | **1300** | **rev** | **1** | **Current version:** | **17.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Miscellaneous corrections to 38.321 on Integrated Access and Backhaul for NR Rel-17 | | | | | | | | | |
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| ***Source to WG:*** | Samsung | | | | | | | | | |
| ***Source to TSG:*** | RAN2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IAB\_enh-Core | | | | |  | ***Date:*** | | | 2022-05-23 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | Make various miscellaneous changes, based on submissions to RAN2#118-e, the discussion in [AT118-e][065][eIAB] MAC (Samsung), and relevant agreements made at RAN2#118-e. | | | | | | | | |
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| ***Summary of change:*** | | (Rev 0)  - Change logicalChannelGroup-IABExt to logicalChannelGroup-IAB**-**Ext (clause 5.4.5), to align with RRC spec  - Insert “IAB-MT may report Extended Pre-emptive BSR of Pre-emptive BSR (as defined in clause 6.1.3.1) based on whether the MAC entity of the IAB-MT is configured with logicalChannelGroup-IAB-Ext by upper layers.” into clause 5.4.7.  - Remove ‘Pre-emptive’ to align with description of legacy procedure where we do not list all BSR MAC CE format names (clause 5.4.7).  - Change (3072, -3071, …, 1023) to (**-**3072, -3071, …, 1023), to correct the error made when previous CR was implemented (clause 6.1.3.38)  - Correct the statement that the function of Timing Delta MAC CE for Case-6 timing is only for the IAB-DU Tx, by explaining it also applies to the IAB-MT Tx (clause 6.1.3.38).  - Add missing description of the MAC CE in clause 6.1.3.39.  (Rev 1)  - Change made to clause 5.4.5 to implement the following RAN2#118-e agreement:   * RRC: logicalChannelGroup-IAB-Ext-r17: 0 to 255, to support MAC: ext short BSR also for LCG 0..7   Once the above change is implemented in RRC, the current MAC spec will allow (without change) for Extended Short BSR to be sent when logicalChannelGroup-IAB-Ext-r17 is configured, even when highest LCD ID configured is 7 or lower. However, in that scenario, according to the current spec, Extended Long BSR would be sent and this is not possible, so a change is made to allow sending legacy Long BSR in that scenario.  - Change made to 5.4.7 to list both Extended Pre-emptive BSR MAC CE and Pre-emptive BSR MAC CE, reverting related change from Rev 0. | | | | | | | | |
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| ***Consequences if not approved:*** | | Misalignment with RRC spec. Misalignment with RAN1 specs. Pre-emptive BSR section unclear/incomplete. Latest RAN2 agreements not implemented. | | | | | | | | |
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| ***Clauses affected:*** | | 5.4.5 Buffer Status Reporting  5.4.7 Pre-emptive Buffer Status Reporting  5.18.18 Timing offset adjustments for IAB  6.1.3.38 Case-7 Timing advance offset MAC CE  6.1.3.39 Case-6 Timing Request MAC CE | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | See Summary of change. | | | | | | | | |

FIRST CHANGE

### 

### 5.4.5 Buffer Status Reporting

The Buffer Status reporting (BSR) procedure is used to provide the serving gNB with information about UL data volume in the MAC entity.

RRC configures the following parameters to control the BSR:

- *periodicBSR-Timer*;

- *retxBSR-Timer*;

- *logicalChannelSR-DelayTimerApplied*;

- *logicalChannelSR-DelayTimer*;

- *logicalChannelSR-Mask*;

- *logicalChannelGroup*.

Each logical channel may be allocated to an LCG using the *logicalChannelGroup*. The maximum number of LCGs is eight except for IAB-MTs configured with *logicalChannelGroup-IAB-Ext*, for which the maximum number of LCGs is 256.

The MAC entity determines the amount of UL data available for a logical channel according to the data volume calculation procedure in TSs 38.322 [3] and 38.323 [4].

A BSR shall be triggered if any of the following events occur for activated cell group:

- UL data, for a logical channel which belongs to an LCG, becomes available to the MAC entity; and either

- this UL data belongs to a logical channel with higher priority than the priority of any logical channel containing available UL data which belong to any LCG; or

- none of the logical channels which belong to an LCG contains any available UL data.

in which case the BSR is referred below to as 'Regular BSR';

- UL resources are allocated and number of padding bits is equal to or larger than the size of the Buffer Status Report MAC CE plus its subheader, in which case the BSR is referred below to as 'Padding BSR';

- *retxBSR-Timer* expires, and at least one of the logical channels which belong to an LCG contains UL data, in which case the BSR is referred below to as 'Regular BSR';

- *periodicBSR-Timer* expires, in which case the BSR is referred below to as 'Periodic BSR'.

NOTE 1: When Regular BSR triggering events occur for multiple logical channels simultaneously, each logical channel triggers one separate Regular BSR.

For Regular BSR, the MAC entity shall:

1> if the BSR is triggered for a logical channel for which *logicalChannelSR-DelayTimerApplied* with value *true* is configured by upper layers:

2> start or restart the *logicalChannelSR-DelayTimer*.

1> else:

2> if running, stop the *logicalChannelSR-DelayTimer*.

For Regular and Periodic BSR, the MAC entity for which *logicalChannelGroup-IAB-Ext* is not configured by upper layers shall:

1> if more than one LCG has data available for transmission when the MAC PDU containing the BSR is to be built:

2> report Long BSR for all LCGs which have data available for transmission.

1> else:

2> report Short BSR.

For Regular and Periodic BSR, the MAC entity for which *logicalChannelGroup-IAB-Ext* is configured by upper layers shall:

1> if more than one LCG has data available for transmission when the MAC PDU containing the BSR is to be built:

2> if the maximum LCG ID among the configured LCGs is 7 or lower:

3> report Long BSR for all LCGs which have data available for transmission.

2> else:

3> report Extended Long BSR for all LCGs which have data available for transmission.

1> else:

2> report Extended Short BSR.

For Padding BSR, the MAC entity for which *logicalChannelGroup-IAB-Ext* is not configured by upper layers shall:

1> if the number of padding bits is equal to or larger than the size of the Short BSR plus its subheader but smaller than the size of the Long BSR plus its subheader:

2> if more than one LCG has data available for transmission when the BSR is to be built:

3> if the number of padding bits is equal to the size of the Short BSR plus its subheader:

4> report Short Truncated BSR of the LCG with the highest priority logical channel with data available for transmission.

3> else:

4> report Long Truncated BSR of the LCG(s) with the logical channels having data available for transmission following a decreasing order of the highest priority logical channel (with or without data available for transmission) in each of these LCG(s), and in case of equal priority, in increasing order of LCGID.

2> else:

3> report Short BSR.

1> else if the number of padding bits is equal to or larger than the size of the Long BSR plus its subheader:

2> report Long BSR for all LCGs which have data available for transmission.

For Padding BSR, the MAC entity for which *logicalChannelGroup-IAB-Ext* is configured by upper layers shall:

1> if the number of padding bits is equal to or larger than the size of the Extended Short BSR plus its subheader but smaller than the size of the Extended Long BSR plus its subheader:

2> if more than one LCG has data available for transmission when the BSR is to be built:

3> if the number of padding bits is smaller than the size of the Extended Long Truncated BSR with zero Buffer Size field plus its subheader:

4> report Extended Short Truncated BSR of the LCG with the highest priority logical channel with data available for transmission.

3> else:

4> report Extended Long Truncated BSR of the LCG(s) with the logical channels having data available for transmission following a decreasing order of the highest priority logical channel (with or without data available for transmission) in each of these LCG(s), and in case of equal priority, in increasing order of LCGID.

2> else:

3> report Extended Short BSR.

1> else if the number of padding bits is equal to or larger than the size of the Extended Long BSR plus its subheader:

2> report Extended Long BSR for all LCGs which have data available for transmission.

For BSR triggered by *retxBSR-Timer* expiry, the MAC entity considers that the logical channel that triggered the BSR is the highest priority logical channel that has data available for transmission at the time the BSR is triggered.

The MAC entity shall:

1> if the Buffer Status reporting procedure determines that at least one BSR has been triggered and not cancelled:

2> if UL-SCH resources are available for a new transmission and the UL-SCH resources can accommodate the BSR MAC CE plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the BSR MAC CE(s) as defined in clause 6.1.3.1;

3> start or restart *periodicBSR-Timer* except when all the generated BSRs are long or short Truncated or Extended long or short Truncated BSRs;

3> start or restart *retxBSR-Timer*.

2> if a Regular BSR has been triggered and *logicalChannelSR-DelayTimer* is not running:

3> if there is no UL-SCH resource available for a new transmission; or

3> if the MAC entity is configured with configured uplink grant(s) and the Regular BSR was triggered for a logical channel for which *logicalChannelSR-Mask* is set to *false*; or

3> if the UL-SCH resources available for a new transmission do not meet the LCP mapping restrictions (see clause 5.4.3.1) configured for the logical channel that triggered the BSR:

4> trigger a Scheduling Request.

NOTE 2: UL-SCH resources are considered available if the MAC entity has been configured with, receives, or determines an uplink grant. If the MAC entity has determined at a given point in time that UL-SCH resources are available, this need not imply that UL-SCH resources are available for use at that point in time.

A MAC PDU shall contain at most one BSR MAC CE, even when multiple events have triggered a BSR. The Regular BSR and the Periodic BSR shall have precedence over the padding BSR.

The MAC entity shall restart *retxBSR-Timer* upon reception of a grant for transmission of new data on any UL-SCH.

All triggered BSRs may be cancelled when the UL grant(s) can accommodate all pending data available for transmission but is not sufficient to additionally accommodate the BSR MAC CE plus its subheader. All BSRs triggered prior to MAC PDU assembly shall be cancelled when a MAC PDU is transmitted and this PDU includes a Long, Extended Long, Short, or Extended Short BSR MAC CE which contains buffer status up to (and including) the last event that triggered a BSR prior to the MAC PDU assembly.

NOTE 3: MAC PDU assembly can happen at any point in time between uplink grant reception and actual transmission of the corresponding MAC PDU. BSR and SR can be triggered after the assembly of a MAC PDU which contains a BSR MAC CE, but before the transmission of this MAC PDU. In addition, BSR and SR can be triggered during MAC PDU assembly.

NOTE 4: Void

NOTE 5: If a HARQ process is configured with *cg-RetransmissionTimer* and if the BSR is already included in a MAC PDU for transmission on configured grant by this HARQ process, but not yet transmitted by lower layers, it is up to UE implementation how to handle the BSR content.

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NEXT CHANGE

### 5.4.7 Pre-emptive Buffer Status Reporting

The Pre-emptive Buffer Status reporting (Pre-emptive BSR) procedure is used by an IAB-MT to provide its parent IAB-DU(s) or IAB-donor-DU(s) with the information about the amount of the data expected to arrive at the IAB-MT from its child node(s) and/or UE(s) connected to it.

If configured, Pre-emptive BSR may be triggered for the specific case of an IAB-MT if any of the following events occur:

- UL grant is provided to child IAB node or UE;

- BSR is received from child IAB node or UE.

IAB-MT may report Extended Pre-emptive BSR or Pre-emptive BSR (as defined in clause 6.1.3.1) based on whether the MAC entity of the IAB-MT is configured with *logicalChannelGroup-IAB-Ext* by upper layers.

The MAC entity shall:

1> if the Pre-emptive Buffer Status reporting procedure determines that at least one Pre-emptive BSR has been triggered and not cancelled:

2> if UL-SCH resources are available for a new transmission and the UL-SCH resources can accommodate the Extended Pre-emptive BSR or Pre-emptive BSR MAC CE plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the Extended Pre-emptive BSR or Pre-emptive BSR MAC CE as defined in clause 6.1.3.1.

2> else:

3> trigger a Scheduling Request.

A MAC PDU shall contain at most one Pre-emptive BSR MAC CE, even when multiple events have triggered a Pre-emptive BSR.

All triggered Pre-emptive BSR(s) shall be cancelled when a MAC PDU is transmitted and this PDU includes the corresponding Pre-emptive BSR MAC CE.

NOTE: Pre-emptive BSR may be used for the case of dual-connected IAB node. It is up to network implementation to work out the associated MAC entity or entities which report the Pre-emptive BSR, and the associated expected amount of data reported by any such entity or entities. For the case of dual-connected IAB node, if two ingress BH RLC channels belonging to the same ingress LCG are mapped to two different egress Cell Groups (corresponding to different parent nodes), there may be ambiguity in Pre-emptive BSR calculations and interpretation by the receiving parent node(s) and the IAB node reporting pre-emptive BSR.

NEXT CHANGE

### 5.18.18 Timing offset adjustments for IAB

For IAB operation, in order to achieve time-domain synchronization across multiple backhaul hops, a timing adjustment may be provided to an IAB node by its parent node. Two different values may be provided, related to Case-1/Case-6, and Case-7 timing modes respectively. These parameters are applicable only to IAB nodes. The Timing Delta MAC CE carries Tdelta which is used to determine the IAB-DU DL Tx timing adjustment for the Case-1 timing mode, and to determine the IAB-DU DL Tx and IAB-MT UL Tx timing adjustment for the Case-6 timing mode. The Case-7 Timing advance offset MAC CE carries Toffset,2 which is used to determine the IAB-MT UL Tx timing adjustment for the Case-7 timing mode.

Upon reception of a Timing Delta MAC CE the IAB node shall:

- apply the value of Tdelta as specified in TS 38.213 [6].

Upon reception of a Case-7 Timing advance offset MAC CE the IAB node shall:

- apply the value of Toffset,2 as specified in TS 38.213 [6].

NEXT CHANGE

#### 6.1.3.38 Case-7 Timing advance offset MAC CE

The Case-7 Timing advance offset MAC CE is identified by MAC subheader with eLCID as specified in Table 6.2.1-1b.

The Case-7 Timing advance offset MAC CE is related to the Case-7 timing mode, has a fixed size and consists of two octets defined as follows (Figure 6.1.3.21-2):

- R: Reserved bit, set to 0;

- Toffset,2: This field indicates the value (-3072, -3071, …, 1023) used to control the amount of timing adjustment that MAC entity indicates (as specified in TS 38.213 [6]). The length of the field is 12 bits.



Figure 6.1.3.38-1: Case-7 Timing advance offset MAC CE

NEXT CHANGE

#### 6.1.3.39 Case-6 Timing Request MAC CE

The Case-6 Timing Request MAC CE is identified by MAC subheader with eLCID as specified in Table 6.2.1-2b. This MAC CE is used by the IAB-MT node to inform its parent node whether Case-6 timing is required for simultaneous operation.

It has a fixed size of zero bits.

*End of Changes*