3GPP TSG-RAN WG2 #130 R2-2503360

**St Julian’s, Malta, 19-23 May 2025**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  | **38.321** | **CR** |  | **rev** |  | **Current version:** | **18.5.0** |  |
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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:***  | Introduction of XR enhancements |
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| ***Source to WG:*** | Qualcomm Incorporated |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_XR\_Ph3-Core |  | ***Date:*** | 2025-05-05 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-19 |
|  | *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 canbe 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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)Rel-20 (Release 20)* |
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| ***Reason for change:*** | New mechanisms have been agreed to enhance support for XR services in Rel-19. |
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| ***Summary of change:*** | 1. Enhancements to support dynamic logical channel priority based on delay status of buffered data;
2. Enhancements to improve granularity of reported delay information in DSR MAC CEs;
3. Enhancements to supported dynamically skipped measurement gaps;
4. Enhancements to support UL rate control for XR applications.
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| ***Consequences if not approved:*** | Enhancements for XR services would not be supported in Rel-19.  |
|  |  |
| ***Clauses affected:*** | 5.4.1, 5.4.2.2, 5.4.3.1.1, 5.4.3.1.3, 5.4.5, 5.4.9, 5.12, 5.14, 5.18.1, 5.18.x, 6.1.3.72, 61.3.x, 6.2.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.300 CR xxxxTS 38.306 CR xxxxTS 38.322 CR xxxxTS 38.321 CR xxxxTS 38.331 CR xxxx |
| ***affected:*** |  | **X** |  Test specifications |  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |

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| ***This CR's revision history:*** |  |

------------------------------------------- [Start of the 1st change] ----------------------------------------------

### 5.4.1 UL Grant reception

(*omitted text*)

For configured uplink grants that are not part of a multi-PUSCH configured grant and neither configured with *harq-ProcID-Offset2* nor with *cg-RetransmissionTimer*, the HARQ Process ID associated with the first symbol of a UL transmission is derived from the following equation:

 HARQ Process ID = [floor(CURRENT\_symbol/*periodicity*)] modulo *nrofHARQ-Processes*

For configured uplink grants that are not part of a multi-PUSCH configured grant and configured with *harq-ProcID-Offset2*, the HARQ Process ID associated with the first symbol of a UL transmission is derived from the following equation:

 HARQ Process ID = [floor(CURRENT\_symbol / *periodicity*)] modulo *nrofHARQ-Processes* + *harq-ProcID-Offset2*

For a multi-PUSCH configured grant (as specified in clause 5.8.2) configured with neither *harq-ProcID-Offset2* nor *cg-RetransmissionTimer*, the HARQ Process ID associated with the first symbol of a UL transmission is derived from the following equation:

HARQ Process ID = [*nrofSlotsInCG-Period*× floor (CURRENT\_symbol / *periodicity*) + ID\_OFFSET] modulo *nrofHARQ-Processes*

For a multi-PUSCH configured grant configured with *harq-ProcID-Offset2*, the HARQ Process ID associated with the first symbol of a UL transmission is derived from the following equation:

HARQ Process ID = [*nrofSlotsInCG-Period* × floor (CURRENT\_symbol / *periodicity*) + ID\_OFFSET] modulo *nrofHARQ-Processes* + *harq-ProcID-Offset2*

where, if *cg-SDT-PeriodicityExt* (as defined in TS 38.331 [5]) is not configured,

CURRENT\_symbol = (SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* + slot number in the frame × *numberOfSymbolsPerSlot* + symbol number in the slot)

alternatively, if *cg-SDT-PeriodicityExt* (as defined in TS 38.331 [5]) is configured, *periodicity* equals to *cg-SDT-PeriodicityExt*, and

CURRENT\_symbol = ((H-SFN × *numberOfSFNperH-SFN* + SFN) × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* + slot number in the frame × *numberOfSymbolsPerSlot* + symbol number in the slot).

*numberOfSFNperH-SFN*, *numberOfSlotsPerFrame* and *numberOfSymbolsPerSlot* above refer to the number of consecutive frames per H-SFN, the number of consecutive slots per frame and the number of consecutive symbols per slot, respectively as specified in TS 38.211 [8].

For a multi-PUSCH configured grant, ID\_OFFSET equals 0 for the first configured uplink grant within a *periodicity* of the configuration and K for the Kth (1 ≤ K < *nrofSlotsInCG-Period*) valid configured uplink grant after the first configured uplink grant within the same *periodicity*. A configured uplink grant in a multi-PUSCH configured grant is considered valid if it satisfies the conditions specified in clause 6.1 in TS 38.214 [7].

For configured uplink grants configured with *cg-RetransmissionTimer*, the UE implementation selects an HARQ Process ID among the HARQ process IDs available for the configured grant configuration. If the MAC entity is configured with *intraCG-Prioritization*, for HARQ Process ID selection, the UE shall prioritize the HARQ Process ID with the highest priority, where the priority of HARQ process is determined by the highest priority among priorities of the logical channels that are multiplexed (i.e. the MAC PDU to transmit is already stored in the HARQ buffer) or have data available that can be multiplexed (i.e. the MAC PDU to transmit is not stored in the HARQ buffer) in the MAC PDU, according to the mapping restrictions as described in clause 5.4.3.1.2. In this selection, the priority of a logical channel configured with *priorityAdjustmentThreshold* shall be the highest priority that can be applied or has been applied for it in the LCP procedure for the MAC PDU (see clause 5.4.3.1.3). If the MAC entity is configured with *intraCG-Prioritization*, for HARQ Process ID selection among initial transmission and retransmission with equal priority, the UE shall prioritize retransmissions before initial transmissions. The priority of a HARQ Process for which no data for logical channels is multiplexed or can be multiplexed in the MAC PDU is lower than the priority of a HARQ Process for which data for any logical channels is multiplexed or can be multiplexed in the MAC PDU. If the MAC entity is not configured with *intraCG-Prioritization*, for HARQ Process ID selection, the UE shall prioritize retransmissions before initial transmissions. The UE shall toggle the NDI in the CG-UCI for new transmissions and not toggle the NDI in the CG-UCI in retransmissions.

NOTE 1: If a configured uplink grant is associated with a multi-PUSCH configured grant, CURRENT\_symbol refers to the symbol index of the first transmission occasion in the first configured uplink grant within the same periodicity. Otherwise, CURRENT\_symbol refers to the symbol index of the first transmission occasion of a bundle of configured uplink grant.

NOTE 2: A HARQ process is configured for a configured uplink grant where neither *harq-ProcID-Offset* nor *harq-ProcID-Offset2* is configured, if the configured uplink grant is activated and the associated HARQ process ID is less than *nrofHARQ-Processes*. A HARQ process is configured for a configured uplink grant where *harq-ProcID-Offset2* is configured, if the configured uplink grant is activated and the associated HARQ process ID is greater than or equal to *harq-ProcID-Offset2* and less than sum of *harq-ProcID-Offset2* and *nrofHARQ-Processes* for the configured grant configuration.

NOTE 3: If the MAC entity receives a grant in a Random Access Response (i.e. MAC RAR or fallbackRAR), or addressed to Temporary C-RNTI or determines a grant as specified in clause 5.1.2a for MSGA payload and if the MAC entity also receives an overlapping grant for its C-RNTI or CS-RNTI, requiring concurrent transmissions on the SpCell, the MAC entity may choose to continue with either the grant for its RA-RNTI/Temporary C-RNTI/MSGB-RNTI/the MSGA payload transmission or the grant for its C-RNTI or CS-RNTI.

NOTE 4: In case of unaligned SFN across carriers in a cell group, the SFN of the concerned Serving Cell is used to calculate the HARQ Process ID used for configured uplink grants.

NOTE 5: If *cg-RetransmissionTimer* is not configured, a HARQ process is not shared between different configured grant configurations in the same BWP.

For the MAC entity configured with *lch-basedPrioritization*, priority of an uplink grant is determined by the highest priority among priorities of the logical channels that are multiplexed (i.e. the MAC PDU to transmit is already stored in the HARQ buffer) or have data available that can be multiplexed (i.e. the MAC PDU to transmit is not stored in the HARQ buffer) in the MAC PDU, according to the mapping restrictions as described in clause 5.4.3.1.2. In this determination, the priority of a logical channel configured with *priorityAdjustmentThreshold* shall be the highest priority that can be applied or has been applied for it in the LCP procedure for the MAC PDU (see clause 5.4.3.1.3). The priority of an uplink grant for which no data for logical channels is multiplexed or can be multiplexed in the MAC PDU is lower than either the priority of an uplink grant for which data for any logical channels is multiplexed or can be multiplexed in the MAC PDU or the priority of the logical channel triggering an SR.

For the MAC entity configured with *lch-basedPrioritization*, if the corresponding PUSCH transmission of a configured uplink grant is cancelled by CI-RNTI as specified in clause 11.2A of TS 38.213 [6] or cancelled by a high PHY-priority PUCCH transmission as specified in clause 9 of TS 38.213 [6], this configured uplink grant is considered as a de-prioritized uplink grant. If this de-prioritized uplink grant is configured with *autonomousTx*, the *configuredGrantTimer* for the corresponding HARQ process of this de-prioritized uplink grant shall be stopped if it is running. If this de-prioritized uplink grant is configured with *autonomousTx*, the *cg-RetransmissionTimer* for the corresponding HARQ process of this de-prioritized uplink grant shall be stopped if it is running.

Editor’s note: FFS if the MAC entity is configured with *lch-basedPrioritization*, whether the priority of a triggered SR can be adjusted if the LCH that triggered the SR satisfies the priority adjustment criteria. The current agreement is that it can be supported if companies think its impact is simple enough (e.g. Huawei’s TP can be used as a reference). Companies are invited to share their view in the comments.

When the MAC entity is configured with *lch-basedPrioritization*, for each uplink grant delivered to the HARQ entity and whose associated PUSCH can be transmitted by lower layers, the MAC entity shall:

1> if this uplink grant is received in a Random Access Response (i.e. in a MAC RAR or fallback RAR), or addressed to Temporary C-RNTI, or is determined as specified in clause 5.1.2a for the transmission of the MSGA payload:

2> consider this uplink grant as a prioritized uplink grant.

1> else if this uplink grant is addressed to CS-RNTI with NDI = 1 or C-RNTI:

2> if there is no overlapping PUSCH duration of a configured uplink grant which was not already de-prioritized, in the same BWP, whose priority is higher than the priority of the uplink grant; and

2> if there is no overlapping PUCCH resource with an SR transmission which was not already de-prioritized and the simultaneous transmission of the SR and the uplink grant is not allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*, and the priority of the logical channel that triggered the SR is higher than the priority of the uplink grant:

3> consider this uplink grant as a prioritized uplink grant;

3> consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s);

3> consider the other overlapping SR transmission(s), if any, as a de-prioritized SR transmission(s), except for the SR transmission(s) whose simultaneous transmission is allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*;

3> if the de-prioritized uplink grant(s) is a configured uplink grant configured with *autonomousTx* whose PUSCH has already started:

4> stop the *configuredGrantTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s);

4> stop the *cg-RetransmissionTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s).

1> else if this uplink grant is a configured uplink grant:

2> if there is no overlapping PUSCH duration of another configured uplink grant which was not already de-prioritized, in the same BWP, whose priority is higher than the priority of the uplink grant; and

2> if there is no overlapping PUSCH duration of an uplink grant addressed to CS-RNTI with NDI = 1 or C-RNTI which was not already de-prioritized, in the same BWP, whose priority is higher than or equal to the priority of the uplink grant; and

2> if there is no overlapping PUCCH resource with an SR transmission which was not already de-prioritized and the simultaneous transmission of the SR and the uplink grant is not allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*, and the priority of the logical channel that triggered the SR is higher than the priority of the uplink grant:

3> consider this uplink grant as a prioritized uplink grant;

3> consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s);

3> if the de-prioritized uplink grant(s) is a configured uplink grant configured with *autonomousTx* whose PUSCH has already started:

4> stop the *configuredGrantTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s);

4> stop the *cg-RetransmissionTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s).

3> consider the other overlapping SR transmission(s), if any, as a de-prioritized SR transmission(s), except for the SR transmission(s) whose simultaneous transmission is allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*.

NOTE 6: If the MAC entity is configured with *lch-basedPrioritization* and if there is overlapping PUSCH duration of at least two configured uplink grants whose priorities are equal, the prioritized uplink grant is determined by UE implementation.

NOTE 7: If the MAC entity is not configured with *lch-basedPrioritization* and if there is overlapping PUSCH duration of at least two configured uplink grants, it is up to UE implementation to choose one of the configured uplink grants.

NOTE 8: If the MAC entity is configured with *lch-basedPrioritization*, the MAC entity does not take UCI multiplexing according to the procedure specified in TS 38.213 [6] into account when determining whether the PUSCH duration of an uplink grant overlaps with the PUCCH resource for an SR transmission.

------------------------------------------- [End of the 1st change] ----------------------------------------------

------------------------------------------- [Start of the 2nd change] ---------------------------------------------

#### 5.4.2.2 HARQ process

Each HARQ process is associated with a HARQ buffer.

New transmissions are performed on the resource and with the MCS indicated on PDCCH or indicated in the Random Access Response (i.e. MAC RAR or fallbackRAR), or signalled in RRC or determined as specified in clause 5.1.2a for MSGA payload. Retransmissions are performed on the resource and, if provided, with the MCS indicated on PDCCH, or on the same resource and with the same MCS as was used for last made transmission attempt within a bundle, or on stored configured uplink grant resources and stored MCS when *cg-RetransmissionTimer* or *cg-SDT-RetransmissionTimer* or *cg-RRC-RetransmissionTimer* is configured. If *cg-RetransmissionTimer* is configured, retransmissions with the same HARQ process may be performed on any configured grant configuration if the configured grant configurations have the same TBS. If *cg-SDT-RetransmissionTimer* is configured, retransmission for the initial CG-SDT transmission with the same HARQ process may be performed on any configured grant configuration if the configured grant configurations have the same TBS.

When *cg-RetransmissionTimer* is configured and the HARQ entity obtains a MAC PDU to transmit and LBT failure indication is received from lower layer, the corresponding HARQ process is considered to be pending. For a configured uplink grant, configured with *cg-RetransmissionTimer*, each associated HARQ process is considered as not pending when:

- a transmission is performed on that HARQ process and LBT failure indication is not received from lower layers; or

- the configured uplink grant is initialised and this HARQ process is not associated with another active configured uplink grant; or

- the HARQ buffer for this HARQ process is flushed.

If the HARQ entity requests a new transmission for a TB, the HARQ process shall:

1> store the MAC PDU in the associated HARQ buffer;

1> store the uplink grant received from the HARQ entity;

1> generate a transmission as described below.

If the HARQ entity requests a retransmission for a TB, the HARQ process shall:

1> store the uplink grant received from the HARQ entity;

1> generate a transmission as described below.

To generate a transmission for a TB, the HARQ process shall:

1> if the MAC PDU was obtained from the Msg3 buffer; or

1> if the MAC PDU was obtained from the MSGA buffer; or

1> if there is no measurement gap or there is an overlapping measurement gap but it has been canceled (as specified in clause 10.6 in [6]) at the time of the transmission and, in case of retransmission, the retransmission does not collide with a transmission for a MAC PDU obtained from the Msg3 buffer or the MSGA buffer:

2> if there are neither NR sidelink transmission nor transmission of V2X sidelink communication at the time of the transmission; or

2> if the transmission of the MAC PDU is prioritized over sidelink transmission or can be simultaneously performed with sidelink transmission:

3> instruct the physical layer to generate a transmission according to the stored uplink grant.

If a HARQ process receives downlink feedback information, the HARQ process shall:

1> stop the *cg-RetransmissionTimer*, if running;

1> if acknowledgement is indicated:

2> stop the *configuredGrantTimer*, if running.

If the *configuredGrantTimer* expires for a HARQ process, the HARQ process shall:

1> stop the *cg-RetransmissionTimer*, if running;

1> stop the *cg-SDT-RetransmissionTimer*, if running.

1> stop the *cg-RRC-RetransmissionTimer*, if running;

1> if a PDCCH addressed to the MAC entity's C-RNTI has not been received after initial transmission for the CG-SDT with CCCH message to which the *configuredGrantTimer* corresponds:

2> indicate failure to perform SDT procedure to the upper layer.

The transmission of the MAC PDU is prioritized over sidelink transmission or can be performed simultaneously with sidelink transmission if one of the following conditions is met:

- if there are both a sidelink grant for NR sidelink transmissionand configured grant(s) for transmission of V2X sidelink communication on SL-SCH as determined in clause 5.14.1.2.2 of TS 36.321 [22] at the time of the transmission, and neither the NR sidelink transmission is prioritized as determined in clause 5.22.1.3.1a nor the transmission(s) of V2X sidelink communication is prioritized as determined in clause 5.14.1.2.2 of TS 36.321 [22]; or

- if there are both a sidelink grant NR sidelink transmission and configured grant(s) for transmission of V2X sidelink communication on SL-SCH as determined in clause 5.14.1.2.2 of TS 36.321 [22] at the time of the transmission, and the MAC entity is able to perform this UL transmission simultaneously with the NR sidelink transmission and/or the transmission(s) of V2X sidelink communication; or

- if there is only configured grant(s) for transmission of V2X sidelink communication on SL-SCH as determined in clause 5.14.1.2.2 of TS 36.321 [22] at the time of the transmission, and either none of the transmission(s) of V2X sidelink communication is prioritized as determined in clause 5.14.1.2.2 of TS 36.321 [22] or the MAC entity is able to perform this UL transmission simultaneously with the transmission(s) of V2X sidelink communication; or

- if there is only a sidelink grant for NR sidelink transmission at the time of the transmission, and if the NR sidelink transmission is not prioritized as determined in clause 5.22.1.3.1a, or there is a sidelink grant for NR sidelink transmission at the time of the transmission and the MAC entity is able to perform this UL transmission simultaneously with the NR sidelink transmission; or

- if there are both a sidelink grant for NR sidelink transmission and configured grant(s) for transmission of V2X sidelink communication on SL-SCH as determined in clause 5.14.1.2.2 of TS 36.321 [22] at the time of the transmission, and either only the of NR sidelink transmission is prioritized as determined in clause 5.22.1.3.1a or only the transmission(s) of V2X sidelink communication is prioritized as determined in clause 5.14.1.2.2 of TS 36.321 [22] and the MAC entity is able to perform this UL transmission simultaneously with the prioritized NR sidelink transmission or the transmission of V2X sidelink communication:

NOTE 1: Among the UL transmissions where the MAC entity is able to perform the transmission of NR sidelink communication prioritized simultaneously, if there are more than one UL transmission which the MAC entity is not able to perform simultaneously, it is up to UE implementation whether this UL transmission is performed.

NOTE 2: Among the UL transmissions that the MAC entity is able to perform simultaneously with all transmission(s) of V2X sidelink communication prioritized, if there are more than one UL transmission which the MAC entity is not able to perform simultaneously, it is up to UE implementation whether this UL transmission is performed.

NOTE 3: Among the UL transmissions where the MAC entity is able to perform the NR sidelink transmission prioritized simultaneously with all transmission(s) of V2X sidelink communication prioritized, if there are more than one UL transmission which the MAC entity is not able to perform simultaneously, it is up to UE implementation whether this UL transmission is performed.

NOTE 4: If there is configured grant(s) for transmission of V2X sidelink communication on SL-SCH as determined in clause 5.14.1.2.2 of TS 36.321 [22] at the time of the transmission, and the MAC entity is not able to perform this UL transmission simultaneously with the transmission(s) of V2X sidelink communication, and prioritization-related information is not available prior to the time of the transmission due to processing time restriction, it is up to UE implementation whether this UL transmission is performed.

------------------------------------------- [End of the 2nd change] ----------------------------------------------

------------------------------------------- [Start of the 3rd change] ---------------------------------------------

#### 5.4.3.1 Logical Channel Prioritization

##### 5.4.3.1.1 General

The Logical Channel Prioritization (LCP) procedure is applied whenever a new transmission is performed.

RRC controls the scheduling of uplink data by signalling for each logical channel per MAC entity:

- *priority* where an increasing priority value indicates a lower priority level. It is the default priority used for a logical channel in the LCP procedure, unless specified otherwise;

- *additionalPriority* which is applied instead of *priority* for the LCP procedure when the conditions specified in clause 5.4.3.1.3 are met;

- *priorityAdjustmentThreshold* which is used to determine whether *additionalPriority* or *priority* is used for the LCP procedure;

- *prioritisedBitRate* which sets the Prioritized Bit Rate (PBR);

- *bucketSizeDuration* which sets the Bucket Size Duration (BSD).

RRC additionally controls the LCP procedure by configuring mapping restrictions for each logical channel:

- *allowedSCS-List* which sets the allowed Subcarrier Spacing(s) for transmission;

- *maxPUSCH-Duration* which sets the maximum PUSCH duration allowed for transmission;

- *configuredGrantType1Allowed* which sets whether a configured grant Type 1 can be used for transmission;

- *allowedServingCells* which sets the allowed cell(s) for transmission;

- *allowedCG-List* which sets the allowed configured grant(s) for transmission;

- *allowedPHY-PriorityIndex* which sets the allowed PHY priority index(es) of a dynamic grant for transmission;

- *allowedHARQ-mode* which sets the allowed UL HARQ mode for transmission.

The following UE variable is used for the Logical channel prioritization procedure:

- *Bj* which is maintained for each logical channel *j*.

The MAC entity shall initialize *Bj* of the logical channel to zero when the logical channel is established.

For each logical channel *j*, the MAC entity shall:

1> increment *Bj* by the product PBR × T before every instance of the LCP procedure, where T is the time elapsed since *Bj* was last incremented;

1> if the value of *Bj* is greater than the bucket size (i.e. PBR × BSD):

2> set *Bj* to the bucket size.

NOTE: The exact moment(s) when the UE updates *Bj* between LCP procedures is up to UE implementation, as long as *Bj* is up to date at the time when a grant is processed by LCP.

##### 5.4.3.1.3 Allocation of resources

Before the successful completion of the Random Access procedure initiated for DAPS handover, the target MAC entity shall not select the logical channel(s) corresponding to non-DAPS DRB(s) for the uplink grant received in a Random Access Response or the uplink grant for the transmission of the MSGA payload. The source MAC entity shall select only the logical channel(s) corresponding to DAPS DRB(s) during DAPS handover.

The MAC entity shall, when a new transmission is performed:

1> allocate resources to the logical channels as follows:

2> for a logical channel configured with *priorityAdjustmentThreshold*, if the smallest remaining value of the running PDCP *discardTimer*s among its data available for this transmission, evaluated at the time of the first symbol of this transmission, is below or at its *priorityAdjustmentThreshold*:

3> apply *additionalPriority* of this logical channel;

2> logical channels selected in clause 5.4.3.1.2 for the UL grant with *Bj* > 0 are allocated resources in a decreasing priority order. If the PBR of a logical channel is set to *infinity*, the MAC entity shall allocate resources for all the data that is available for transmission on the logical channel before meeting the PBR of the lower priority logical channel(s);

Editor’s note: The current working assumption is that a logical channel, even if it has priority-adjustable data, is not considered for LCP if its *Bj* is negative.

2> decrement *Bj* by the total size of MAC SDUs served to logical channel *j* above;

2> if any resources remain:

3> if a logical channel has applied *additionalPriority* above; and

3> if none of its remaining data available for this transmission has a running PDCP *discardTimer* whose remaining value, evaluated at the time of the first symbol of this transmission, is below or at its *priorityAdjustmentThreshold*:

4> apply *priority* of this logical channel;

3> all the logical channels selected in clause 5.4.3.1.2 are served in a strict decreasing priority order (regardless of the value of *Bj*) until either the data for that logical channel or the UL grant is exhausted, whichever comes first. For this allocation of resources, logical channels applied with equal priority should be served equally.

NOTE 1: The value of *Bj* can be negative.

If the MAC entity is requested to simultaneously transmit multiple MAC PDUs, or if the MAC entity receives the multiple UL grants within one or more coinciding PDCCH occasions (i.e. on different Serving Cells), it is up to UE implementation in which order the grants are processed.

The UE shall also follow the rules below during the scheduling procedures above:

- the UE should not segment an RLC SDU (or partially transmitted SDU or retransmitted RLC PDU) if the whole SDU (or partially transmitted SDU or retransmitted RLC PDU) fits into the remaining resources of the associated MAC entity;

- if the UE segments an RLC SDU from the logical channel, it shall maximize the size of the segment to fill the grant of the associated MAC entity as much as possible;

- the UE should maximise the transmission of data;

- if the MAC entity is given a UL grant size that is equal to or larger than 8 bytes (when eLCID is not used) or 10 bytes (when eLCID is used) while having data available and allowed (according to clause 5.4.3.1) for transmission, the MAC entity shall not transmit only padding BSR and/or padding.

The MAC entity shall:

1> if the MAC entity is configured with *enhancedSkipUplinkTxDynamic* with value *true* and the grant indicated to the HARQ entity was addressed to a C-RNTI, or if the MAC entity is configured with *enhancedSkipUplinkTxConfigured* with value *true* and the grant indicated to the HARQ entity is a configured uplink grant:

2> if there is no UCI to be multiplexed on this PUSCH transmission as specified in TS 38.213 [6]; and

2> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and

2> if the MAC PDU includes zero MAC SDUs; and

2> if the MAC PDU includes only the periodic BSR and there is no data available for any LCG, or the MAC PDU includes only the padding BSR:

3> not generate a MAC PDU for the HARQ entity.

1> else if the MAC entity is configured with *skipUplinkTxDynamic* with value *true* and the grant indicated to the HARQ entity was addressed to a C-RNTI, or the grant indicated to the HARQ entity is a configured uplink grant:

2> if there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and

2> if the MAC PDU includes zero MAC SDUs; and

2> if the MAC PDU includes only the periodic BSR and there is no data available for any LCG, or the MAC PDU includes only the padding BSR:

3> not generate a MAC PDU for the HARQ entity.

Logical channels shall be prioritised in accordance with the following order (highest priority listed first):

- MAC CE for C-RNTI, or data from UL-CCCH;

- MAC CE for (Enhanced) BFR, or MAC CE for Configured Grant Confirmation, or MAC CE for Multiple Entry Configured Grant Confirmation;

- MAC CE for Sidelink Configured Grant Confirmation;

- MAC CE for LBT failure;

- MAC CE for SL LBT failure according to clause 5.31.2;

- MAC CE for Timing Advance Report;

- MAC CE for Delay Status Report;

- MAC CE for SL-BSR prioritized according to clause 5.22.1.6;

- MAC CE for (Extended) BSR, with exception of BSR included for padding;

- MAC CE for (Enhanced) Single Entry PHR, or MAC CE for (Enhanced) Multiple Entry PHR or MAC CE for Single Entry PHR with assumed PUSCH, or MAC CE for Multiple Entry PHR with assumed PUSCH, or MAC CE for Enhanced Single Entry PHR for multiple TRP or MAC CE for Enhanced Multiple Entry PHR for multiple TRP, or MAC CE for Enhanced Single Entry PHR for multiple TRP STx2P or MAC CE for Enhanced Multiple Entry PHR for multiple TRP STx2P;

- MAC CE for Positioning Measurement Gap Activation/Deactivation Request;

- MAC CE for the number of Desired Guard Symbols;

- MAC CE for Case-6 Timing Request;

- MAC CE for (Extended) Pre-emptive BSR;

- MAC CE for SL-BSR, with exception of SL-BSR prioritized according to clause 5.22.1.6 and SL-BSR included for padding;

- MAC CE for IAB-MT Recommended Beam Indication, or MAC CE for Desired IAB-MT PSD range, or MAC CE for Desired DL Tx Power Adjustment;

- data from any Logical Channel, except data from UL-CCCH;

- MAC CE for Recommended bit rate query, or MAC CE for UL bit rate query;

- MAC CE for BSR included for padding;

- MAC CE for SL-BSR included for padding.

NOTE 2: Prioritization among MAC CEs of same priority is up to UE implementation.

The MAC entity shall prioritize any MAC CE listed in a higher order than 'data from any Logical Channel, except data from UL-CCCH' over NR sidelink transmission.

------------------------------------------ [End of the 3rd change] -------------------------------------------------

------------------------------------------ [Start of the 4th change] ------------------------------------------------

### 5.4.4 Scheduling Request

(*omitted text*)

As long as at least one SR is pending, the MAC entity shall for each pending SR:

1> if the MAC entity has no valid PUCCH resource configured for the pending SR; and

1> if there is no ongoing RACH-less LTM cell switch; and

1> if *rach-LessHO* is not configured:

2> initiate a Random Access procedure (see clause 5.1) on the SpCell and cancel the pending SR.

1> else, for the SR configuration corresponding to the pending SR:

2> when the MAC entity has an SR transmission occasion on the valid PUCCH resource for SR configured; and

2> if *sr-ProhibitTimer* is not running at the time of the SR transmission occasion; and

2> if the PUCCH resource for the SR transmission occasion does not overlap with a measurement gap or it overlaps with a measurement gap that has been canceled (as specified in clause 10.6 in [6]):

3> if the PUCCH resource for the SR transmission occasion does not overlap with any of a UL-SCH resource whose simultaneous transmission with the SR is not allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*, an SL-SCH resource, or an SL-PRS resource; or

3> if the MAC entity is able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource; or

3> if the MAC entity is configured with *lch-basedPrioritization*, and the PUCCH resource for the SR transmission occasion does not overlap with the PUSCH duration of an uplink grant received in a Random Access Response or with the PUSCH duration of an uplink grant addressed to Temporary C-RNTI or with the PUSCH duration of a MSGA payload, and the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.4.5 overlaps with any other UL-SCH resource(s), and the physical layer can signal the SR on one valid PUCCH resource for SR, and the priority of the logical channel that triggered SR is higher than the priority of the uplink grant(s) for any UL-SCH resource(s) where the uplink grant was not already de-prioritized and its simultaneous transmission with the SR is not allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCHgroups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*, and the priority of the uplink grant is determined as specified in clause 5.4.1; or

3> if both *sl-PrioritizationThres* and *ul-PrioritizationThres* are configured and the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.22.1.5 overlaps with any UL-SCH resource(s) carrying a MAC PDU, and the value of the priority of the triggered SR determined as specified in clause 5.22.1.5 is lower than *sl-PrioritizationThres* and the value of the highest priority of the logical channel(s) in the MAC PDU is higher than or equal to *ul-PrioritizationThres* and any MAC CE prioritized as described in clause 5.4.3.1.3 is not included in the MAC PDU and the MAC PDU is not prioritized by upper layer according to TS 23.287 [19]; or

3> if an SL-SCH resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.4.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource, and either transmission on the SL-SCH resource is not prioritized as described in clause 5.22.1.3.1a or the priority value of the logical channel that triggered SR is lower than *ul-PrioritizationThres*, if configured; or

3> if an SL-SCH resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.22.1.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource, and the priority of the triggered SR determined as specified in clause 5.22.1.5 is higher than the priority of the MAC PDU determined as specified in clause 5.22.1.3.1a for the SL-SCH resource; or

3> if an SL-PRS resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.4.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-PRS resource, and either transmission on the SL-PRS resource is not prioritized as described in clause 5.22.1.3.1a or in the clause 5.22.1.3.5, or the priority value of the logical channel that triggered SR is lower than *ul-PrioritizationThres*, if configured; or

3> if an SL-PRS resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.22.1.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-PRS resource, and the priority of the triggered SR determined as specified in clause 5.22.1.5 is higher than the priority of the MAC PDU and SL-PRS, if available, determined as specified in clause 5.22.1.3.1a or the SL-PRS resource in clause 5.22.1.3.5:

4> consider the SR transmission as a prioritized SR transmission.

4> consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s), except for the overlapping uplink grant(s) whose simultaneous transmission is allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* or *simultaneousPUCCH-PUSCH-SamePriority* or *simultaneousPUCCH-PUSCH-SamePriority-SecondaryPUCCHgroup*;

4> if the de-prioritized uplink grant(s) is a configured uplink grant configured with *autonomousTx* whose PUSCH has already started:

5> stop the *configuredGrantTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s);

5> stop the *cg-RetransmissionTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s).

4> if *SR\_COUNTER* < *sr-TransMax*:

5> instruct the physical layer to signal the SR on one valid PUCCH resource for SR;

5> if LBT failure indication is not received from lower layers:

6> increment *SR\_COUNTER* by 1;

6> start the *sr-ProhibitTimer*.

5> else if *lbt-FailureRecoveryConfig* is not configured:

6> increment *SR\_COUNTER* by 1.

4> else:

5> notify RRC to release PUCCH for all Serving Cells;

5> notify RRC to release SRS for all Serving Cells;

5> clear any configured downlink assignments and uplink grants;

5> clear any PUSCH resources for semi-persistent CSI reporting;

5> if *rach-LessHO* is not configured and if there is no ongoing RACH-less LTM cell switch:

6> initiate a Random Access procedure (see clause 5.1) on the SpCell and cancel all pending SRs.

3> else:

4> consider the SR transmission as a de-prioritized SR transmission.

(*omitted text*)

------------------------------------------- [End of the 4th change] ---------------------------------------------

------------------------------------------- [Start of the 5th change] ----------------------------------------------

5.4.9 Delay status reporting

The Delay Status Report (DSR) is used to provide the serving gNB with delay status of LCGs. RRC controls the DSR procedure by configuring the following parameters per LCG:

- *remainingTimeThreshold*: the threshold on remaining time for triggering a DSR for a logical channel within an LCG. It is also used for reporting the amount of UL data buffered in an LCG in the Single Entry DSR MAC CE;

- *dsr-ReportingThresList*: the list of thresholds on remaining time for reporting the amount of UL data buffered in an LCG in the Multiple Entry DSR MAC CE. Delay status for an LCG is evaluated and reported based on remaining time, which is the remaining value of the running PDCP *discardTimer* of an PDCP SDU as specified in clause 7.3 in TS 38.323 [4]. The delay status for an LCG also includes the amount of delay-critical UL data or delay-reporting UL data for the LCG, depending on whether the LCG is configured with *dsr-ReportingThresList* (see clause 6.1.3.72). The reported amount of data is calculated according to the data volume calculation procedure specified in clause 5.5 in TS 38.322 [3] and clause 5.15 in TS 38.323 [4] for the associated RLC and PDCP entities, respectively.

If an LCG is configured for delay status reporting, the MAC entity shall for each logical channel within the LCG:

1> if the smallest remaining value of the running PDCP *discardTimer*s among all the PDCP SDUs buffered for the logical channel that have not been transmitted in any MAC PDU and have not been reported as data volume in a DSR MAC CE becomes below *remainingTimeThreshold* of the LCG; and

1> if there is no DSR pending for the logical channel:

2> trigger a DSR for the logical channel.

If there is at least one DSR pending, the MAC entity shall:

1> if UL-SCH resources are available for a new transmission:

2> if at least one LCG is configured with *dsr-ReportingThresList* and the UL-SCH resources can accommodate the Multiple Entry DSR MAC CE as specified in clause 6.1.3.72 plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the Multiple Entry DSR MAC CE;

2> else if none of the LCG(s) is configured with *dsr-ReportingThresList* and the UL-SCH resources can accommodate the Single Entry DSR MAC CE as specified in clause 6.1.3.72 plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the Single Entry DSR MAC CE as specified in clause 6.1.3.72;

2> else if there is no pending SR already triggered by the DSR procedure for the same logical channel as of this DSR:

3> trigger a Scheduling Request;

1> else if there is no pending SR already triggered by the DSR procedure for the same logical channel as of this DSR:

2> trigger a Scheduling Request.

NOTE 1: The availability of UL-SCH resources for the transmission of a DSR MAC CE follows the same critieria specified in clause 5.4.5.

A PDCP SDU is considered to be associated with a DSR if it has not been transmitted in any MAC PDU and is a delay-critical PDCP SDU (as defined in TS 38.323 [4]) associated with the logical channel which triggered the DSR.

A MAC PDU shall contain at most one DSR MAC CE. A MAC PDU shall not contain any DSR MAC CE if it includes all PDCP SDUs associated with all the pending DSRs.

After a DSR is triggered, it is considered as pending until it is cancelled. The MAC entity shall cancel a pending DSR, when all the PDCP SDUs associated with the DSR have been discarded, or when a MAC PDU is transmitted and this MAC PDU includes a DSR MAC CE that contains the delay information of all the PDCP SDUs associated with the DSR (as described in the clause 6.1.3.72), or when a MAC PDU is transmitted and this MAC PDU includes all the PDCP SDUs associated with the DSR.

Editor’s note: FFS whether the above paragraph needs to be updated for the DC case.

NOTE 2: It is up to UE implementation whether the MAC entity includes a DSR MAC CE in a MAC PDU if the MAC PDU can accommodate all PDCP SDUs associated with all the pending DSRs but is not sufficient to additionally accommodate this DSR MAC CE plus its subheader.------------------------------------------ [End of the 5th change] ---------------------------------------------

------------------------------------------ [Start of the 6th change] ----------------------------------------------

5.12 MAC Reset

If a reset of the MAC entity is requested by upper layers upon receiving *RRCResume* or *RRCSetup*, the MAC entity shall:

1> stop the MBS multicast DRX timers;

1> flush the soft buffers for all DL HARQ processes used for MBS multicast;

1> for each DL HARQ process used for MBS multicast, consider the next received transmission for a TB as the very first transmission.

Otherwise, if a reset of the MAC entity is requested by upper layers or the reset of the MAC entity is triggered due to SCG deactivation as defined in clause 5.29, the MAC entity shall:

1> if the MAC reset is not due to SCG deactivation:

2> initialize *Bj* for each logical channel to zero;

1> initialize *SBj* for each logical channel to zero if Sidelink resource allocation mode 1 is configured by RRC;

1> if upper layers indicate SCG deactivation and *bfd-and-RLM* with value *true* is configured for the deactivated SCG:

2> stop (if running) all timers except *beamFailureDetectionTimer* associated with PSCell and *timeAlignmentTimer*s.

1> else:

2> stop (if running) all timers, except MBS broadcast DRX timers;

2> consider all *timeAlignmentTimer*s, *inactivePosSRS-TimeAlignmentTimer*, and *cg-SDT-TimeAlignmentTimer*, if configured, as expired and perform the corresponding actions in clause 5.2;

1> set the NDIs for all uplink HARQ processes to the value 0;

1> sets the NDIs for all HARQ process IDs to the value 0 for monitoring PDCCH in Sidelink resource allocation mode 1;

1> stop, if any, ongoing Random Access procedure;

1> discard explicitly signalled contention-free Random Access Resources for 4-step RA type and 2-step RA type, if any;

1> flush Msg3 buffer;

1> flush MSGA buffer;

1> cancel, if any, triggered Scheduling Request procedure;

1> cancel, if any, triggered Buffer Status Reporting procedure;

1> cancel, if any, triggered Delay Status Reporting procedure;

1> cancel, if any, triggered Power Headroom Reporting procedure;

1> cancel, if any, triggered consistent LBT failure;

1> cancel, if any, triggered Sidelink consistent LBT failure;

1> cancel, if any, triggered BFR;

1> cancel, if any, triggered Sidelink Buffer Status Reporting procedure;

1> cancel, if any, triggered Pre-emptive Buffer Status Reporting procedure;

1> cancel, if any, triggered Timing Advance Reporting procedure;

1> cancel, if any, triggered Recommended bit rate query procedure;

1> cancel, if any, triggered UL Rate Control procedure;

1> cancel, if any, triggered Configured uplink grant confirmation;

1> cancel, if any, triggered configured sidelink grant confirmation;

1> clear, if any, configured sidelink grants;

1> cancel, if any, triggered Desired Guard Symbol query;

1> cancel, if any, triggered Positioning Measurement Gap Activation/Deactivation Request procedure;

1> cancel, if any, triggered SDT procedure;

1> cancel, if any, triggered IAB-MT Recommended Beam Indication query;

1> cancel, if any, triggered Desired DL TX Power Adjustment query;

1> cancel, if any, triggered Desired IAB-MT PSD range query;

1> cancel, if any, triggered Case-6 Timing Request query;

1> cancel, if any, triggered SL-PRS resource request;

1> flush the soft buffers for all DL HARQ processes, except for the DL HARQ process being used for MBS broadcast;

1> for each DL HARQ process, except for the DL HARQ process being used for MBS broadcast, consider the next received transmission for a TB as the very first transmission;

1> release, if any, Temporary C-RNTI;

1> clear, if any, Differential Koffset;

1> if upper layers indicate SCG deactivation and *bfd-and-RLM* with value *true* is not configured; or

1> if the MAC reset is not due to SCG deactivation:

2> reset all *BFI\_COUNTER*s;

1> reset all *LBT\_COUNTERs*.

If a Sidelink specific reset of the MAC entity is requested for a PC5-RRC connection by upper layers, the MAC entity shall:

1> flush the soft buffers for all Sidelink processes for all TB(s) associated to the PC5-RRC connection;

1> consider all Sidelink processes for all TB(s) associated to the PC5-RRC connection as unoccupied;

1> cancel, if any, triggered Scheduling Request procedure only associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink Buffer Status Reporting procedure only associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink CSI Reporting procedure associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink DRX Command MAC CE associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink IUC-Request transmission procedure associated to the PC5-RRC connection;

1> cancel, if any, triggered Sidelink IUC-Information Reporting procedure associated to the PC5-RRC connection;

1> stop (if running) all timers associated to the PC5-RRC connection;

1> reset the *numConsecutiveDTX* associated to the PC5-RRC connection;

1> initialize *SBj* for each logical channel associated to the PC5-RRC connection to zero.

----------------------------------------- [End of the 6th change] ---------------------------------------------

----------------------------------------- [Start of the 7th change] ---------------------------------------------

## 5.14 Handling of measurement gaps

During an activated measurement gap that has not been cancelled (as specified in clause 10.6 in [6]), the MAC entity shall, on the Serving Cell(s) in the corresponding frequency range of the measurement gap configured by *measGapConfig* as specified in TS 38.331 [5]:

1> not perform the transmission of HARQ feedback, SR, and CSI;

1> not report SRS;

1> not transmit on UL-SCH except for Msg3 or the MSGA payload as specified in clause 5.4.2.2;

1> if the *ra-ResponseWindow* or the *ra-ContentionResolutionTimer* or the *msgB-ResponseWindow* is running, or if there is an ongoing RACH-less LTM cell switch, or if there is an ongoing RACH-less handover:

2> monitor the PDCCH as specified in clauses 5.1.4, 5.1.5, and 5.7.

1> else:

2> not monitor the PDCCH;

2> not receive on DL-SCH.------------------------------------------- [End of the 7th change] ----------------------------------------------

------------------------------------------- [Start of the 8th change] ----------------------------------------------

5.18.1 General

This clause specifies the requirements upon reception or transmission of the following MAC CEs:

- SP CSI-RS/CSI-IM Resource Set Activation/Deactivation MAC CE;

- Aperiodic CSI Trigger State Subselection MAC CE;

- TCI States Activation/Deactivation for UE-specific PDSCH MAC CE;

- TCI State Indication for UE-specific PDCCH MAC CE;

- SP CSI reporting on PUCCH Activation/Deactivation MAC CE;

- Enhanced SP CSI reporting on PUCCH Activation/Deactivation MAC CE;

- SP SRS Activation/Deactivation MAC CE;

- PUCCH spatial relation Activation/Deactivation MAC CE;

- Enhanced PUCCH spatial relation Activation/Deactivation MAC CE;

- SP ZP CSI-RS Resource Set Activation/Deactivation MAC CE;

- Recommended Bit Rate MAC CE;

- Enhanced SP/AP SRS Spatial Relation Indication MAC CE;

- SRS Pathloss Reference RS Update MAC CE;

- PUSCH Pathloss Reference RS Update MAC CE;

- Serving Cell set based SRS Spatial Relation Indication MAC CE;

- SP Positioning SRS Activation/Deactivation MAC CE;

- Timing Delta MAC CE;

- Guard Symbols MAC CEs;

- Positioning Measurement Gap Activation/Deactivation Command MAC CE;

- PPW Activation/Deactivation Command MAC CE;

- PUCCH spatial relation Activation/Deactivation for multiple TRP PUCCH repetition MAC CE;

- PUCCH Power Control Set Update for multiple TRP PUCCH repetition MAC CE;

- Unified TCI States Activation/Deactivation MAC CE;

- Differential Koffset MAC CE;

- Case-7 Timing advance offset MAC CE;

- DL TX Power Adjustment MAC CEs;

- Child IAB-DU Restricted Beam Indication MAC CE;

- Timing Case Indication MAC CE;

- PSI-Based SDU Discard Activation/Deactivation MAC CE;

- BFD-RS Indication MAC CE;

- IAB-MT Recommended Beam Indication MAC CE;

- UL PSD range adjustment for IAB MAC CE;

- Case-6 Timing Request MAC CE;

- NCR Backhaul Link Beam Indication MAC CEs;

- NCR Access Link Beam Indication MAC CE;

- Enhanced Unified TCI States Activation/Deactivation MAC CE;

- LTM Cell Switch Command MAC CE;

- Candidate Cell TCI States Activation/Deactivation MAC CE;

- Aggregated SP Positioning SRS Activation/Deactivation MAC CE;

- UL Rate Control MAC CE.

------------------------------------------- [End of the 8th change] ----------------------------------------------

------------------------------------------- [Start of the 9th change] ----------------------------------------------

### 5.18.x UL Rate Control

The UL Rate Control procedure provides the MAC entity with information on UL physical-layer bit rate available to a QoS flow.

Editor’s note: Bit rate recommendation for DL data transmission may be added later, if agreed.

The gNB may transmit a UL Rate Control MAC CE to the MAC entity to recommend an UL bit rate for a QoS flow. Upon reception of a UL Rate Control MAC CE, the MAC entity shall indicate the bit rate to upper layers.

The MAC entity may transmit a UL Rate Control MAC CE to the serving gNB to query available bit rate or request a desired bit rate for a QoS flow. If the MAC entity is requested by upper layers to do so, it shall:

1> if a bit rate query for this QoS flow has not been triggered:

2> trigger a bit rate query for this QoS flow.

Editor’s note: FFS granularity and management of the prohibit timer (It is being discussed in the RRC running CR review).

Editor’s note: The handling of triggered UL rate query (e.g. multiplexing, transmission, cancelation etc) will be added after more agreements become available.

------------------------------------------- [End of the 9th change] -----------------------------------------------

------------------------------------------- [Start of the 10th change] ---------------------------------------------

#### 6.1.3.72 Delay Status Report MAC CE

Delay Status Report (DSR) MAC CE consists of either the Single Entry DSR MAC CE or the Multiple Entry DSR MAC CE. These two formats are identified by MAC subheader with an eLCID as specified in Table 6.2.1-2b.

The fields in the DSR MAC CE are defined as follows:

- LCGi: This field indicates the presence of delay information (i.e. the Remaining Time and Buffer Size fields) for the LCG i. The LCGi field set to 1 indicates that the delay information for the LCG i is reported. The LCGi field set to 0 indicates that the delay information for the LCG i is not reported;

- Remaining Time: In the Single Entry DSR MAC CE, this field indicates the shortest remaining value of running PDCP *discardTimer* (described in clause 7.3 in TS 38.323 [4]) among all PDCP SDUs that are buffered for an LCG but have not been transmitted in any MAC PDU, at the time of the first symbol of the first PUSCH transmission that includes this Single Entry DSR MAC CE. In the Multiple Entry DSR MAC CE, the field Remaining Time i,j indicates the shortest remaining time among the PDCP SDUs associated with the reporting threshold j of LCG i, as specified in clause 5.15 in TS 38.323 [4], at the time of the first symbol of the first PUSCH transmission that includes this Multiple Entry DSR MAC CE. The length of this field is 6 bits. This field is present only if the buffer size indicated by the corresponding Buffer Size field is not zero; otherwise, this field is reserved and set to 0. If present, the value *r* in this field indicates a remaining time within the range of (*r*, *r* + 1] msec;

- BT: This field is present only if the corresponding LCG is configured with *additionalBS-TableAllowed* and the buffer size indicated by the corresponding Buffer Size field is not zero;otherwise, this field is reserved and set to 0. If present, the BT field set to 1 indicates that the buffer sizes specified in Table 6.1.3.1-3 are used to set the value of the Buffer Size field, while the BT field set to 0 indicates that the buffer sizes specified in Table 6.1.3.1-2 are used instead;

- Buffer Size: In the Single Entry DSR MAC CE, the Buffer Size field indicates the total amount of delay-critical UL data for an LCG according to the data volume calculation procedure specified in clause 5.5 in TS 38.322 [3] and clause 5.15 in TS 38.323 [4] for the associated RLC and PDCP entities, respectively, after the MAC PDU has been built. In the Multiple Entry DSR MAC CE, the field Buffer Size i,j indicates the total amount of delay-reporting data associated with the reporting threshold j of LCG i, according to the data volume calculation procedure specified in clause 5.5 in TS 38.322 [4] and clause 5.15 in TS 38.323 [4] for the associated RLC and PDCP entities, respectively, after the MAC PDU has been built. If the corresponding LCG is configured with *additionalBS-TableAllowed* and the amount of data to be reported by this field is within the buffer sizes specified in Table 6.1.3.1-3, the MAC entity shall use the buffer sizes specified in Table 6.1.3.1-3 to set the value of this field; otherwise, the MAC entity shall use Table 6.1.3.1-2 instead. This field is indicated in number of bytes. The length of this field is 8 bits.

- EXT i,j: This field is present only in the Multiple Entry DSR MAC CE. When set to 1, it indicates that an additional pair of Remaining Time field and Buffer Size field corresponding to the reporting threshold k (k>j) of LCG i is included immediately after the field Buffer Size i,j, as illustrated in Figure 6.1.3.72-2. When set to 0, it indicates that no additional field is present for LCG i after the field Buffer Size i,j.

A DSR MAC CE shall include delay status information of all LCGs which have pending DSRs when the MAC PDU containing this DSR MAC CE is to be built.

In the Single Entry DSR MAC CE, as illustrated in Figure 6.1.3.72-1, the Remaining Time, the BT, and the Buffer Size fields for an LCG shall be reported in two consecutive octets. These three fields for different LCGs shall be included in the Single Entry DSR MAC CE in ascending order based on the LCGi.

In the Multiple Entry DSR MAC CE, as illustrated in Figure 6.1.3.72-2, the delay status information associated with a reporting threshold, which includes the BT, the EXT, the Remaining Time and the Buffer Size fields, shall be reported in two consecutive octets. If an LCG is configured with more than one reporting threshold, the delay status information associated with different reporting thresholds in the LCG should be reported consecutively in ascending order based on the values of the reporting thresholds. The delay status information associated with a reporting thresholdmay not be reported if the total amount of UL data associated with it is zero at the start of the MAC PDU assembly, according to the data volume calculation procedure specified in clause 5.5 in TS 38.322 [3] and clause 5.15 in TS 38.323 [4] for the associated RLC and PDCP entities, respectively. The delay status information for different LCGs should be included in the Multiple Entry DSR MAC CE in ascending order based on the field LCGi. ****

Figure 6.1.3.72-1: Single Entry DSR MAC CE



Figure 6.1.3.72-2: Multiple Entry DSR MAC CE------------------------------------------- [End of the 10th change] ----------------------------------------------

------------------------------------------- [Start of the 11th change] ----------------------------------------------

#### 6.1.3.x Uplink Rate Control MAC CE

The Uplink Rate Control MAC CE is identified by a MAC subheader with an eLCID as specified in Table 6.2.1-1 and Table 6.2.1-2 for available bit rate recommendation from the serving gNB and bit rate query from the UE, respectively.

* The fields in the Uplink Rate Control MAC CE are defined as follows: QoS flow ID: This field identifies the QoS flow for which the bit rate recommendation or bit rate query is applicable. The length of this field is X bits;

Editor’s note: FFS what identifier should be used for a QoS flow

* Bit rate: In bit rate recommendation from the serving gNB, this field indicates a recommended bit rate for the indicated QoS flow. In bit rate query from the UE, this field indicates a desired bit rate. This field is set to 0 in UE’s query for available bit rate. The MAC entity shall use the bit rates specified in Table 6.1.3.x-1 to set the value of this field. This field is indicated in kbits/s. The length of this field is 8 bits.

Editor’s note: FFS how to indicate a query is for available bit rate.

Editor’s note: The length of the Bit rate field may change, depending on the final format of the MAC CE.

Editor’s note: FFS whether any other fields need to be included

Figure 6.1.3.x-1: UL Rate Control MAC CE

Editor’s note: The format of the UL Rate Control MAC CE will be specified after all fields in the MAC CE are finalized.

Table 6.1.3.x-1: Values (kbit/s) for Bit Rate field

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Index** | **Bit Rate** | **Index** | **Bit Rate** | **Index** | **Bit Rate** | **Index** | **Bit Rate** |
| 0 | 0 | 64 | ≤ 455 | 128 | ≤ 2124 | 192 | ≤ 9907 |
| 1 | ≤ 100 | 65 | ≤ 466 | 129 | ≤ 2176 | 193 | ≤ 10149 |
| 2 | ≤ 102 | 66 | ≤ 478 | 130 | ≤ 2229 | 194 | ≤ 10396 |
| 3 | ≤ 105 | 67 | ≤ 489 | 131 | ≤ 2283 | 195 | ≤ 10649 |
| 4 | ≤ 107 | 68 | ≤ 501 | 132 | ≤ 2339 | 196 | ≤ 10908 |
| 5 | ≤ 110 | 69 | ≤ 514 | 133 | ≤ 2396 | 197 | ≤ 11174 |
| 6 | ≤ 113 | 70 | ≤ 526 | 134 | ≤ 2454 | 198 | ≤ 11446 |
| 7 | ≤ 116 | 71 | ≤ 539 | 135 | ≤ 2514 | 199 | ≤ 11725 |
| 8 | ≤ 118 | 72 | ≤ 552 | 136 | ≤ 2575 | 200 | ≤ 12010 |
| 9 | ≤ 121 | 73 | ≤ 565 | 137 | ≤ 2638 | 201 | ≤ 12303 |
| 10 | ≤ 124 | 74 | ≤ 579 | 138 | ≤ 2702 | 202 | ≤ 12603 |
| 11 | ≤ 127 | 75 | ≤ 593 | 139 | ≤ 2768 | 203 | ≤ 12909 |
| 12 | ≤ 130 | 76 | ≤ 608 | 140 | ≤ 2835 | 204 | ≤ 13224 |
| 13 | ≤ 133 | 77 | ≤ 623 | 141 | ≤ 2904 | 205 | ≤ 13546 |
| 14 | ≤ 137 | 78 | ≤ 638 | 142 | ≤ 2975 | 206 | ≤ 13876 |
| 15 | ≤ 140 | 79 | ≤ 653 | 143 | ≤ 3047 | 207 | ≤ 14214 |
| 16 | ≤ 143 | 80 | ≤ 669 | 144 | ≤ 3121 | 208 | ≤ 14560 |
| 17 | ≤ 147 | 81 | ≤ 685 | 145 | ≤ 3197 | 209 | ≤ 14914 |
| 18 | ≤ 151 | 82 | ≤ 702 | 146 | ≤ 3275 | 210 | ≤ 15278 |
| 19 | ≤ 154 | 83 | ≤ 719 | 147 | ≤ 3355 | 211 | ≤ 15650 |
| 20 | ≤ 158 | 84 | ≤ 737 | 148 | ≤ 3437 | 212 | ≤ 16031 |
| 21 | ≤ 162 | 85 | ≤ 755 | 149 | ≤ 3521 | 213 | ≤ 16421 |
| 22 | ≤ 166 | 86 | ≤ 773 | 150 | ≤ 3606 | 214 | ≤ 16821 |
| 23 | ≤ 170 | 87 | ≤ 792 | 151 | ≤ 3694 | 215 | ≤ 17231 |
| 24 | ≤ 174 | 88 | ≤ 811 | 152 | ≤ 3784 | 216 | ≤ 17651 |
| 25 | ≤ 178 | 89 | ≤ 831 | 153 | ≤ 3876 | 217 | ≤ 18080 |
| 26 | ≤ 182 | 90 | ≤ 851 | 154 | ≤ 3971 | 218 | ≤ 18521 |
| 27 | ≤ 187 | 91 | ≤ 872 | 155 | ≤ 4067 | 219 | ≤ 18972 |
| 28 | ≤ 191 | 92 | ≤ 893 | 156 | ≤ 4166 | 220 | ≤ 19434 |
| 29 | ≤ 196 | 93 | ≤ 915 | 157 | ≤ 4268 | 221 | ≤ 19907 |
| 30 | ≤ 201 | 94 | ≤ 937 | 158 | ≤ 4372 | 222 | ≤ 20392 |
| 31 | ≤ 206 | 95 | ≤ 960 | 159 | ≤ 4478 | 223 | ≤ 20889 |
| 32 | ≤ 211 | 96 | ≤ 983 | 160 | ≤ 4587 | 224 | ≤ 21397 |
| 33 | ≤ 216 | 97 | ≤ 1007 | 161 | ≤ 4699 | 225 | ≤ 21918 |
| 34 | ≤ 221 | 98 | ≤ 1032 | 162 | ≤ 4813 | 226 | ≤ 22452 |
| 35 | ≤ 227 | 99 | ≤ 1057 | 163 | ≤ 4931 | 227 | ≤ 22999 |
| 36 | ≤ 232 | 100 | ≤ 1083 | 164 | ≤ 5051 | 228 | ≤ 23559 |
| 37 | ≤ 238 | 101 | ≤ 1109 | 165 | ≤ 5174 | 229 | ≤ 24133 |
| 38 | ≤ 244 | 102 | ≤ 1136 | 166 | ≤ 5300 | 230 | ≤ 24721 |
| 39 | ≤ 250 | 103 | ≤ 1164 | 167 | ≤ 5429 | 231 | ≤ 25323 |
| 40 | ≤ 256 | 104 | ≤ 1192 | 168 | ≤ 5561 | 232 | ≤ 25939 |
| 41 | ≤ 262 | 105 | ≤ 1221 | 169 | ≤ 5696 | 233 | ≤ 26571 |
| 42 | ≤ 268 | 106 | ≤ 1251 | 170 | ≤ 5835 | 234 | ≤ 27218 |
| 43 | ≤ 275 | 107 | ≤ 1281 | 171 | ≤ 5977 | 235 | ≤ 27881 |
| 44 | ≤ 281 | 108 | ≤ 1313 | 172 | ≤ 6123 | 236 | ≤ 28560 |
| 45 | ≤ 288 | 109 | ≤ 1345 | 173 | ≤ 6272 | 237 | ≤ 29256 |
| 46 | ≤ 295 | 110 | ≤ 1377 | 174 | ≤ 6425 | 238 | ≤ 29968 |
| 47 | ≤ 302 | 111 | ≤ 1411 | 175 | ≤ 6581 | 239 | ≤ 30698 |
| 48 | ≤ 310 | 112 | ≤ 1445 | 176 | ≤ 6742 | 240 | ≤ 31446 |
| 49 | ≤ 317 | 113 | ≤ 1480 | 177 | ≤ 6906 | 241 | ≤ 32211 |
| 50 | ≤ 325 | 114 | ≤ 1517 | 178 | ≤ 7074 | 242 | ≤ 32996 |
| 51 | ≤ 333 | 115 | ≤ 1553 | 179 | ≤ 7246 | 243 | ≤ 33799 |
| 52 | ≤ 341 | 116 | ≤ 1591 | 180 | ≤ 7423 | 244 | ≤ 34623 |
| 53 | ≤ 349 | 117 | ≤ 1630 | 181 | ≤ 7603 | 245 | ≤ 35466 |
| 54 | ≤ 358 | 118 | ≤ 1670 | 182 | ≤ 7789 | 246 | ≤ 36330 |
| 55 | ≤ 367 | 119 | ≤ 1710 | 183 | ≤ 7978 | 247 | ≤ 37214 |
| 56 | ≤ 376 | 120 | ≤ 1752 | 184 | ≤ 8173 | 248 | ≤ 38121 |
| 57 | ≤ 385 | 121 | ≤ 1795 | 185 | ≤ 8372 | 249 | ≤ 39049 |
| 58 | ≤ 394 | 122 | ≤ 1838 | 186 | ≤ 8575 | 250 | ≤ 40000 |
| 59 | ≤ 404 | 123 | ≤ 1883 | 187 | ≤ 8784 | 251 | Reserved |
| 60 | ≤ 414 | 124 | ≤ 1929 | 188 | ≤ 8998 | 252 | Reserved |
| 61 | ≤ 424 | 125 | ≤ 1976 | 189 | ≤ 9217 | 253 | Reserved |
| 62 | ≤ 434 | 126 | ≤ 2024 | 190 | ≤ 9442 | 254 | Reserved |
| 63 | ≤ 445 | 127 | ≤ 2074 | 191 | ≤ 9672 | 255 | Reserved |
|  |

Editor’s note: FFS whether the index 0 has any special meaning.

------------------------------------------- [End of the 11th change] ----------------------------------------------

------------------------------------------- [Start of the 12th change] ---------------------------------------------

### 6.2.1 MAC subheader for DL-SCH and UL-SCH

(*omitted text*)

Table 6.2.1-1b: Values of one-octet eLCID for DL-SCH

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 0 to 21x | 64 to 27x | Reserved |
| xxx | xxx | UL Rate Control  |
| 216 | 280 | Aggregated SP Positioning SRS Activation/Deactivation |
| 217 | 281 | Enhanced SP CSI reporting on PUCCH Activation/Deactivation |
| 218 | 282 | Cross-RRH TCI State Indication for UE-specific PDCCH |
| 219 | 283 | LTM Cell Switch Command |
| 220 | 284 | Candidate Cell TCI States Activation/Deactivation |
| 221 | 285 | PSI-Based SDU Discard Activation/Deactivation |
| 222 | 286 | Enhanced Unified TCI states Activation/Deactivation MAC CE for Joint TCI States |
| 223 | 287 | Enhanced Unified TCI states Activation/Deactivation MAC CE for Separate TCI States |
| 224 | 288 | NCR Access Link Beam Indication |
| 225 | 289 | NCR Downlink Backhaul Link Beam Indication |
| 226 | 290 | NCR Uplink Backhaul Link Beam Indication |
| 227 | 291 | Serving Cell Set based SRS TCI State Indication |
| 228 | 292 | SP/AP SRS TCI State Indication |
| 229 | 293 | BFD-RS Indication |
| 230 | 294 | Differential Koffset |
| 231 | 295 | Enhanced SCell Activation/Deactivation (one octet Ci field) |
| 232 | 296 | Enhanced SCell Activation/Deactivation (four octet Ci field) |
| 233 | 297 | Unified TCI States Activation/Deactivation |
| 234 | 298 | PUCCH Power Control Set Update for multiple TRP PUCCH repetition |
| 235 | 299 | PUCCH spatial relation Activation/Deactivation for multiple TRP PUCCH repetition |
| 236 | 300 | Enhanced TCI States Indication for UE-specific PDCCH |
| 237 | 301 | Positioning Measurement Gap Activation/Deactivation Command |
| 238 | 302 | PPW Activation/Deactivation Command |
| 239 | 303 | DL Tx Power Adjustment |
| 240 | 304 | Timing Case Indication |
| 241 | 305 | Child IAB-DU Restricted Beam Indication |
| 242 | 306 | Case-7 Timing advance offset |
| 243 | 307 | Provided Guard Symbols for Case-6 timing |
| 244 | 308 | Provided Guard Symbols for Case-7 timing |
| 245 | 309 | Serving Cell Set based SRS Spatial Relation Indication |
| 246 | 310 | PUSCH Pathloss Reference RS Update |
| 247 | 311 | SRS Pathloss Reference RS Update |
| 248 | 312 | Enhanced SP/AP SRS Spatial Relation Indication |
| 249 | 313 | Enhanced PUCCH Spatial Relation Activation/Deactivation |
| 250 | 314 | Enhanced TCI States Activation/Deactivation for UE-specific PDSCH |
| 251 | 315 | Duplication RLC Activation/Deactivation |
| 252 | 316 | Absolute Timing Advance Command |
| 253 | 317 | SP Positioning SRS Activation/Deactivation |
| 254 | 318 | Provided Guard Symbols |
| 255 | 319 | Timing Delta |

(*omitted text*)

Table 6.2.1-2b: Values of one-octet eLCID for UL-SCH

|  |  |  |
| --- | --- | --- |
| Codepoint | Index | LCID values |
| 0 to 21x | 64 to 28x | Reserved |
| xxx | xxx | Multiple Entry Delay Status Report |
| xxx | xxx | UL Rate Control |
| 219 | 283 | Enhanced Multiple Entry PHR for multiple TRP STx2P (four octets Ci) |
| 220 | 284 | Enhanced Multiple Entry PHR for multiple TRP STx2P (one octets Ci) |
| 221 | 285 | Enhanced Single Entry PHR for multiple TRP STx2P |
| 222 | 286 | SL LBT Failure |
| 223 | 287 | Multiple Entry PHR with assumed PUSCH MAC CE (four octets Ci) |
| 224 | 288 | Multiple Entry PHR with assumed PUSCH MAC CE (one octets Ci) |
| 225 | 289 | Single Entry PHR with assumed PUSCH MAC CE |
| 226 | 290 | SL-PRS Resource Request |
| 227 | 291 | Refined Long BSR |
| 228 | 292 | Single Entry Delay Status Report |
| 229 | 293 | Enhanced Multiple Entry PHR for multiple TRP (four octets Ci) |
| 230 | 294 | Enhanced Multiple Entry PHR for multiple TRP (one octets Ci) |
| 231 | 295 | Enhanced Single Entry PHR for multiple TRP |
| 232 | 296 | Enhanced Multiple Entry PHR (four octets Ci) |
| 233 | 297 | Enhanced Multiple Entry PHR (one octets Ci) |
| 234 | 298 | Enhanced Single Entry PHR |
| 235 | 299 | Enhanced BFR (one octet Ci) |
| 236 | 300 | Enhanced BFR (four octet Ci) |
| 237 | 301 | Truncated Enhanced BFR (four octet Ci) |
| 238 | 302 | Positioning Measurement Gap Activation/Deactivation Request |
| 239 | 303 | IAB-MT Recommended Beam Indication |
| 240 | 304 | Desired IAB-MT PSD range |
| 241 | 305 | Desired DL Tx Power Adjustment |
| 242 | 306 | Case-6 Timing Request |
| 243 | 307 | Desired Guard Symbols for Case 6 timing |
| 244 | 308 | Desired Guard Symbols for Case 7 timing |
| 245 | 309 | Extended Short Truncated BSR |
| 246 | 310 | Extended Long Truncated BSR |
| 247 | 311 | Extended Short BSR |
| 248 | 312 | Extended Long BSR |
| 249 | 313 | Extended Pre-emptive BSR |
| 250 | 314 | BFR (four octets Ci) |
| 251 | 315 | Truncated BFR (four octets Ci) |
| 252 | 316 | Multiple Entry Configured Grant Confirmation |
| 253 | 317 | Sidelink Configured Grant Confirmation |
| 254 | 318 | Desired Guard Symbols |
| 255 | 319 | Pre-emptive BSR |
|  |  |  |

(*omitted text*)

------------------------------------------- [End of the 12th change] ----------------------------------------------