**3GPP TSG-RAN WG2 Meeting #110-e *draft2\_R2-2005719***

**Online, 1– 12 June 2020**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.321** | **CR** | **0730** | **rev** | **1** | **Current version:** | **16.0.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | [Post109bis-e][958][V2X] Corrections to 5G V2X with NR Sidelink | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | LG Electronics Inc. | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5G\_V2X\_NRSL | | | | |  | ***Date:*** | | | 2020-05-11 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Some RAN1 agreements need to be captured in 38.321:  **RAN1#100e agreements**  **Mode 1 resource allocation:**   * Only one new TB can be transmitted in one period of the configured grant.   + FFS any issue with retransmission spanning multiple periods * The DCI scheduling the retransmissions uses the HARQ process ID corresponding to the first transmission of the TB, as agreed for Q2. * The specification supports having multiple HARQ ID processes for a given SL configured grant. * The HARQ process ID for each transmission in a resource corresponding to a SL configured grant is determined based on the formula used for UL configured grants.   + The mapping with the values of HPN in SCI is fixed for a TB, and is up to UE implementation.   Note: This corresponds to the HARQ process ID for the interaction between gNB and UE, if any distinction is made.   * The mapping between the values of HPN signaled in DCI and HPN signaled in SCI is fixed for a TB, and is up to UE implementation. * For dynamic grant, the toggling of NDI in DCI is used as the toggling of NDI in SCI for the first SL transmission scheduled by the DCI. The SCI for the remaining transmissions scheduled by the DCI, if any, have the NDI untoggled with respect to the first SL transmission. * FFS NDI in SCI for PUCCH ACK-NACK error cases * The TX UE reports NACK to the gNB in the following cases:   + When it does not transmit the corresponding PSCCH/PSSCH due to intra-UE prioritization.   + When it does not receive the corresponding PSFCH due to intra-UE prioritization. * For groupcast option 2 in the case where there are multiple PSFCHs corresponding to multiple PSCCH/PSSCH transmissions of a single TB, the TX UE reports ACK to the gNB if it has received ACK at least once from each RX UE. Otherwise, it reports NACK to the gNB. * For groupcast option 2, the TX UE reports NACK to the gNB when it does not detect some expected PSFCH. * For configured grant, the TX UE reports ACK to the gNB in case no PSCCH/PSSCH is transmitted in a set of resources.   **Mode 2 resource allocation**   * For re-evaluation of a pre-selected resource contained in a slot ‘k’ to be first time signaled in a slot ‘m’, where k ≥ m,   + Step 1 of the resource (re-)selection procedure is performed at least at the moment ‘m-T3’, and if the pre-selected resource is not in the identified candidate resource set, Step 2 is triggered for reselection of the resource     - Re-evaluations before the moment ‘m-T3’ or after ‘m-T3’ but before ‘m’ are not precluded and are up to UE implementation * For pre-emption, both full and partial frequency domain overlap in the same slot are considered as the overlapping condition to trigger resource reselection, wherein the whole resource is reselected even if the partial overlap happened * (Re-)selection procedure for an already reserved but pre-empted resource to be used for transmission in a slot ‘m’ is not required to be triggered at moment > ‘m – T3’   + T3 here is identical to T3 introduced for the re-evaluation * In Step 2, a UE ensures a minimum time gap Z = a + b between any two selected resources of a TB where a HARQ feedback for the first of these resources is expected   + ‘a’ is a time gap between the end of the last symbol of the PSSCH transmission of the first resource and the start of the first symbol of the corresponding PSFCH reception determined by resource pool configuration and higher layer parameters of MinTimeGapPSFCH and periodPSFCHresource   + ‘b’ is a time required for PSFCH reception and processing plus sidelink retransmission preparation including multiplexing of necessary physical channels and any TX-RX/RX-TX switching time and is determined by UE implementation   **Physical layer procedures**   * RAN1 assumes that RAN2 will handle selection of appropriate groupcast HARQ feedback option. From RAN1 perspective, a TX UE can use GC HARQ feedback Option 2 only when the group size is not greater than the number of candidate PSFCH resources associated with the selected PSSCH resource.   + Send an LS to RAN2 * Zone length and zone width are always the same and configurable among {5m, 10m, 20m, 30m, 40m, 50m} per communication range requirement per resource pool. Zone ID bit field size is 12. * Communication range requirement bit field size is 4. * For TX-RX distance calculation, RX UE uses the distance between the center location of the indicated zone nearest to the RX UE and its own location. * RAN1 assumes that RAN2 will handle selection of appropriate groupcast HARQ feedback option. From RAN1 perspective, a TX UE can use distance HARQ feedback only when the TX UE’s location is available. * RAN1 assumes that RAN2 will handle the case the RX UE’s location is not available.   In addition, some texts should be revised to be aligned with RAN1 specificaions.  **RAN1#100B-e agreement:**   * It is up to UE implementation to reselect any pre-selected but not reserved resource which is still in the identified resource set after Step 1 in order to ensure the timing restrictions during reselection triggered by re-evaluation and/or pre-emption   + *The timing restrictions at least include the HARQ RTT related minimum gap Z agreed in RAN1#100e*   + *FFS how to handle the case that there is no resources satisfying the timing restrictions in the identified resource set after Step 1* * Finalize the RRC parameter for pre-emption activation per resource pool by * *Disabled* * *Enabled. Default is without a priority level (i.e., pre-emption is applicable to all levels).*    + *Can optionally configuring a priority level p\_preemption {1…8} (the value range is a working assumption), and (as a working assumption regarding “<”) if prioRX < p\_preemption, and prioTX > prioRX, then pre-emption can be triggered*      - *Note: In the inequalities it is assumed that the lowest priority value corresponds to the highest priority/importance traffic*     - *prioRX is the priority associated with the resource indicated in SCI, as per 8.1.4 in 38.214*     - *prioTX is L1 priority within a UE associated with the reserved resources, as per 8.1.4 in 38.214* * The procedure to check whether a reserved resource to be signaled in slot ‘m’ should be re-selected due to pre-emption: * *A regular Step 1 (as in 8.1.4 in 38.214) of the resource (re-)selection procedure is performed* * *If the reserved resource is still in the identified candidate resource set after the Step 1 execution, then Step 2 for reselection of the reserved resource(s) is not triggered* * *If the reserved resource is NOT in the identified candidate resource set after the Step 1 execution*   + *If the resource is excluded by comparison with the RSRP measurement for an SCI associated with a priority which can trigger pre-emption, then Step 2 for reselection of the reserved resource(s) is triggered*   + *If the resource is excluded by comparison with the RSRP measurement for an SCI associated with a priority which cannot trigger pre-emption, then Step 2 for reselection of the reserved resource(s) is not triggered* * Once pre-emption re-selection condition is met at the UE, re-selection is performed for all resources which satisfy the pre-emption re-selection condition * *A UE ensures the HARQ RTT related minimum time gap Z agreed in RAN1#100-e, between re-selected and non-preempted resources during the re-selection triggered by pre-emption* * *FFS cases when timing restriction could not be met* * *FFS whether/how to extend it to periodic reservations*   RAN2#109B-e Agreements:   * Sending HARQ ACK after checking the Layer-1 IDs in the SCI of the received MAC PDU, regardless of a result of checking the Layer-2 IDs in the MAC header, like sending HARQ NACK. * Working assumption for the CR: The V field is supported in a SL-SCH MAC subheader at least for future extensibility. * Working assumption for the CR: The structure of the SL-SCH MAC subheader V/R/R/R/R/SRC/DST in Figure 6.1.x-1. Size of V field needs to be further discussed. * HARQ feedback on PSFCH is not support for (re-)transmission of a MAC PDU only carrying CSI reporting MAC CE. i.e. TX UE disables HARQ feedback for transmission of a MAC PDU only carrying CSI reporting MAC CE. * If a SL CSI Reporting MAC CE is multiplexed with data from logical channels, whether to enable or disable HARQ feedback for transmission of the MAC PDU depends on logical channel configuration about enabling or disabling HARQ feedback. * RAN2 confirms that UE is configured only with a single number of symbols in length for PSSCH transmissions and a single SCS value per SL BWP as in RAN1 agreements. * PSSCH duration based LCP restriction is not supported for NR SL in REL-16. * If the highest priority logical channel of the destination selected in SL LCP is configured with ‘HARQ enabled’, UE selects only logical channels with ‘HARQ enabled’ for the entire TB. * If the highest priority logical channel of the destination selected in SL LCP is configured with ‘HARQ disabled’, UE selects only logical channels with ‘HARQ disabled’ for the entire TB. * UE can be configured with either both LTE mode 3 and NR mode 2 or both LTE mode 4 and NR mode 1, i.e. mixed mode can be supported only for inter-RAT sidelink. * The PDB is determined for SL CSI report. * UE in SL mode 2 may trigger resource reselection due to latency of CSI report, depending on UE implementation. * A UE cancels a triggered SL CSI report if the latency bound associated to the triggered CSI report has been exceeded prior to transmission of the report. * UE does not expect collision between configured grant and dynamic grant. * RAN2 assumes that collision between SL configured grants can occur. How to handle collision across multiple SL configured grants was left to UE implementation. * PUCCH resource cannot be configured without PSFCH resource. * For mode 1, MAC select either LCHs with FB disabled or LCHs with FB enabled for a SL grant configured with both PSFCH and PUCCH in SL LCP. * For mode1, MAC select only LCHs with FB disabled for a SL grant configured with neither PSFCH nor PUCCH in SL LCP. * For mode1, if UE only has SL data on LCHs with FB enabled for a SL grant configured without PSFCH, the SL grant is skipped and so not used for transmission. * Groupcast HARQ option 2 can be selected only when the following conditions are met: * - The V2X layer passes the group size and the member ID to the AS layer; and * - The group size is not greater than the number of candidate PSFCH resources associated with the selected PSSCH resource. * Which HARQ option is used for groupcast is up to the MAC layer of TX UE (even though the V2X layer passes the group size and the member ID to the AS layer.) * If the V2X layer dose not pass the group size and the member ID to the AS layer, UE selects Option 1 for HARQ feedback if LCH is HARQ FB enabled. Whether we need additional condition for HARQ option1 is to be further discussed. * UE does not report the group size to NG-RAN. * A TX UE can use distance HARQ feedback only when the TX UE’s location is available (as agreed in RAN1). When the TX UE’s location is not available, TX UE enables HARQ feedback without the distance-based operation. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * In 5.8.3, a new parameter *nrofHARQ-Processes*: is added. * In 5.22.1.1, RAN1 agreements on configured sidelink grants are captured. * In 5.22.1.1, RAN1 agreements on the minimum time gap are captured. * In 5.22.1.2, re-evaluation for TX resource reselection is added. * In 5.22.1.3, RAN1 agreements on configured sidelink grants are captured. * In 5.22.1.3, RAN1 agreements on groupcast HARQ feedback are captured. * In 5.22.1.3, some HARQ precedural texts which have been missing in the middle of RAN2#109-e are recoved in 5.22.1.3.1 and 5.22.1.3.2. In addition, new clause 5.22.1.3.x is added. * In 5.22.1.3.2, RAN1 agreements on HARQ feedback report are added. * In 5.22.1.3.2, if TAT is running, SL HARQ feedback on PUCCH is sent as in 5.3.2 for DL HARQ feedback. * In 5.22.1.6, some indent are changed and two steps are re-ordered. * In 5.22.2.2.2, RAN1 agreements on groupcast HARQ feedback are captured. In addition, only destination is used for broadcast and groupcast in packet filtering. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | UE will not correctly perform NR sidelink transmission and reception. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.8.3, 5.22.1.1, 5.22.2.2, 5.22.1.3.1, 5.22.1.3.x, 5.22.1.3.2, 5.22.1.6, 5.22.2.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

START OF THE CHANGE

### 5.8.3 Sidelink

There are two types of transmission without dynamic grant:

- configured grant Type 1 where an sidelink grant is provided by RRC, and stored as configured sidelink grant;

- configured grant Type 2 where an sidelink grant is provided by PDCCH, and stored or cleared as configured sidelink grant based on L1 signalling indicating configured sidelink grant activation or deactivation.

Type 1 and/or Type 2 are configured with a single BWP. Multiple configurations of up to [8] configured grants (including both Type 1 and Type 2, if configured) can be active simultaneously on the BWP.

RRC configures the following parameters when the configured grant Type 1 is configured, as specified in TS 38.331 [5] or TS 36.331 [21]:

- *sl-ConfigIndexCG*: the identifier of a configured grant for sidelink;

- *sl-CS-RNTI*: SLCS-RNTI for retransmission;

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant;

- *sl-periodCG*: periodicity of the configured grant Type 1;

- *sl-TimeOffsetCGType1*: Offset of a resource with respect to [SFN = 0] in time domain;

- *sl-TimeResourceCGType1*: time resource location of the configured grant Type 1;

- *sl-CG-MaxTransNumList*: the maximum number of times that a TB can be transmitted using the configured grant.

RRC configures the following parameters when the configured grant Type 2 is configured, as specified in TS 38.331 [5]:

- *sl-ConfigIndexCG*: the identifier of a configured grant for sidelink;

- *sl-CS-RNTI*: SLCS-RNTI for activation, deactivation, and retransmission;

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant;

- *sl-periodCG*: periodicity of the configured grant Type 2;

- *sl-CG-MaxTransNumList*: the maximum number of times that a TB can be transmitted using the configured grant.

Upon configuration of a configured grant Type 1, the MAC entity shall for each configured sidelink grant:

1> store the sidelink grant provided by upper layers as a configured sidelink grant;

1> initialise or re-initialise the configured sidelink grant to determine PSCCH duration(s) and PSSCH duration(s) according to *sl-TimeOffsetCGType1* and *sl-TimeResourceCGType1*, and to reoccur with *sl-periodCG* for transmissions of multiple MAC PDUs according to clause 8.1.2 of TS 38.214 [7].

NOTE 1: If the MAC entity is configured with multiple configured sidelink grants, collision among the configured sidelink grants may occur. How to handle the collision is left to UE implementation.

When a configured sidelink grant is released by upper layers, all the corresponding configurations shall be released and all corresponding sidelink grants shall be cleared.

The MAC entity shall:

1> if the configured sidelink grant confirmation has been triggered and not cancelled; and

1> if the MAC entity has UL resources allocated for new transmission:

2> instruct the Multiplexing and Assembly procedure to generate a Sidelink Configured Grant Confirmation MAC CE as defined in clause 6.1.3.34;

2> cancel the triggered configured sidelink grant confirmation.

For a configured grant Type 2, the MAC entity shall clear the corresponding configured sidelink grant immediately after first transmission of Configured Grant Confirmation triggered by the configured sidelink grant deactivation.

NEXT CHANGE

## 5.22 SL-SCH Data transfer

### 5.22.1 SL-SCH Data transmission

#### 5.22.1.1 SL Grant reception and SCI transmission

Sidelink grant is received dynamically on the PDCCH, configured semi-persistently by RRC or autonomously selected by the MAC entity. The MAC entity shall have a sidelink grant on an active SL BWP to determine a set of PSCCH duration(s) in which transmission of SCI occurs and a set of PSSCH duration(s) in which transmission of SL-SCH associated with the SCI occurs.

If the MAC entity has been configured by RRC to transmit using a SL-RNTI or SLCS-RNTI as indicated in TS 38.331 [5] or TS 36.331 [21], the MAC entity shall for each PDCCH occasion and for each grant received for this PDCCH occasion:

1> if a sidelink grant has been received on the PDCCH for the MAC entity's SL-RNTI:

2> if the NDI received on the PDCCH has been not toggled compared to the value in the previously received HARQ information for the HARQ Process ID:

3> use the received sidelink grant to determine PSCCH duration(s) and PSSCH duration(s) for one or more retransmissions of a single MAC PDU for the corresponding Sidelink process according to clause 8.1.2 of TS 38.214 [7].

2> else:

3> use the received sidelink grant to determine PSCCH duration(s) and PSSCH duration(s) for initial transmission and, if available, retransmission(s) of a single MAC PDU according to clause 8.1.2 of TS 38.214 [7].

2> consider the received sidelink grant to be a configured sidelink grant;

2> if a configured sidelink grant is available for retransmission(s) of a MAC PDU which has been positively acknowledged as specified in clause 5.22.1.3.3:

3> clear the PSCCH duration(s) and PSSCH duration(s) corresponding to retransmission(s) of the MAC PDU from the configured sidelink grant.

1> else if a sidelink grant has been received on the PDCCH for the MAC entity's SLCS-RNTI:

2> if PDCCH contents indicate retransmission(s) for the identifed HARQ process ID that has been configured for an activated configured sidelink grant:

3> use the received sidelink grant to determine PSCCH duration(s) and PSSCH duration(s) for one or more retransmissions of a single MAC PDU according to clause 8.1.2 of TS 38.214 [7].

2> else if PDCCH contents indicate configured grant Type 2 deactivation for a configured sidelink grant:

3> clear the configured sidelink grant, if available;

3> trigger configured sidelink grant confirmation for the configured sidelink grant.

2> else if PDCCH contents indicate configured grant Type 2 activation for a configured sidelink grant:

3> trigger configured sidelink grant confirmation for the configured sidelink grant;

3> store the configured sidelink grant;

3> initialise or re-initialise the configured sidelink grant to determine the set of PSCCH durations and the set of PSSCH durations for transmissions of multiple MAC PDUs according to clause 8.1.2 of TS 38.214 [7].

If the MAC entity has been configured by RRC to transmit using pool(s) of resources in a carrier as indicated in TS 38.331 [5] or TS 36.331 [21] based on sensing or random selection, the MAC entity shall for each Sidelink process:

NOTE 1: If the MAC entity has been configured by RRC to transmit using SL-RNTI or SLCS-RNTI but is configured by RRC to transmit using a pool of resources in a carrier as indicated in TS 38.331 [5], the MAC entity can create a configured sidelink grant on the pool of resources only after releasing other configured sidelink grant(s), if any.

1> if the MAC entity has selected to create a configured sidelink grant corresponding to transmissions of multiple MAC PDUs, and SL data is available in a logical channel:

2> perform the TX resource (re-)selection check as specified in clause 5.22.1.2;

NOTE 2: The MAC entity continuously performs the TX resource (re-)selection check until the corresponding pool of resources is released by RRC or the MAC entity decides to cancel creating a configured sidelink grant corresponding to transmissions of multiple MAC PDUs.

2> if the TX resource (re-)selection is triggered as the result of the TX resource (re-)selection check:

3> select one of the allowed values configured by RRC in *sl-ResourceReservePeriodList* and set the resource reservation interval with the selected value;

3> randomly select, with equal probability, an integer value in the interval [5, 15] for the resource reservation interval higher than or equal to 100ms and set SL\_RESOURCE\_RESELECTION\_COUNTER to the selected value;

3> select the number of HARQ retransmissions from the allowed numbers that are configured by RRC in *sl-MaxTxTransNumPSSCH* included in *sl-PSSCH-TxConfigList* and, if configured by upper layers, overlapped in *sl-MaxTxTransNumPSSCH* indicated in *sl-CBR-PSSCH-TxConfigList* for the highest priority of the logical channel(s) allowed on the carrier and the CBR measured by lower layers according to TS 38.2xx [xx] if CBR measurement results are available or the corresponding *sl-defaultTxConfigIndex* configured by RRC if CBR measurement results are not available;

3> select an amount of frequency resources within the range that is configured by RRC between *sl-MinSubChannelNumPSSCH* and *sl-MaxSubchannelNumPSSCH* included in *sl-PSSCH-TxConfigList* and, if configured by RRC, overlapped between *MinSubChannelNumPSSCH* and *MaxSubchannelNumPSSCH* indicated in *sl-CBR-PSSCH-TxConfigList* for the highest priority of the logical channel(s) allowed on the carrier and the CBR measured by lower layers according to TS 38.2xx [xx] if CBR measurement results are available or the corresponding *sl-defaultTxConfigIndex* configured by RRC if CBR measurement results are not available;

3> randomly select the time and frequency resources for one transmission opportunity from the resources indicated by the physical layer as specified in clause 8.1.4 of TS 38.214 [7], according to the amount of selected frequency resources and the remaining PDB of SL data available in the logical channel(s) allowed on the carrier.

3> use the randomly selected resource to select a set of periodic resources spaced by the resource reservation interval for transmissions of PSCCH and PSSCH corresponding to the number of transmission opportunities of MAC PDUs determined in TS 38.214 [7];

3> if one or more HARQ retransmissions are selected:

4> if there are available resources left in the resources indicated by the physical layer according to clause 8.1.4 of TS 38.214 [7] for more transmission opportunities:

5> randomly select the time and frequency resources for one or more transmission opportunities from the available resources, according to the amount of selected frequency resources, the selected number of HARQ retransmissions and the remaining PDB of SL data available in the logical channel(s) allowed on the carrier by ensuring the minimum time gap between any two selected resources in case that PSFCH is configured for this pool of resources;

5> use the randomly selected resource to select a set of periodic resources spaced by the resource reservation interval for transmissions of PSCCH and PSSCH corresponding to the number of retransmission opportunities of the MAC PDUs determined in TS 38.214 [7];

5> consider the first set of transmission opportunities as the new transmission opportunities and the other set of transmission opportunities as the retransmission opportunities;

5> consider the set of new transmission opportunities and retransmission opportunities as the selected sidelink grant.

3> else:

4> consider the set as the selected sidelink grant.

3> use the selected sidelink grant to determine the set of PSCCH durations and the set of PSSCH durations according to TS 38.214 [7];

3> consider the selected sidelink grant to be a configured sidelink grant.

2> else if SL\_RESOURCE\_RESELECTION\_COUNTER = 0 and when SL\_RESOURCE\_RESELECTION\_COUNTER was equal to 1 the MAC entity randomly selected, with equal probability, a value in the interval [0, 1] which is less than or equal to the probability configured by upper layers in *sl-ProbResourceKeep*:

3> clear the configured sidelink grant, if available;

3> randomly select, with equal probability, an integer value in the interval [5, 15] for the resource reservation interval higher than or equal to 100ms and set SL\_RESOURCE\_RESELECTION\_COUNTER to the selected value;

3> use the previously selected sidelink grant for the number of transmissions of the MAC PDUs determined in TS 38.214 [7] with the resource reservation interval to determine the set of PSCCH durations and the set of PSSCH durations according to TS 38.214 [7];

3> consider the selected sidelink grant to be a configured sidelink grant.

1> if the MAC entity has selected to create a configured sidelink grant corresponding to transmission(s) of a single MAC PDU, and if SL data is available in a logical channel or a SL-CSI reporting is triggered:

2> perform the TX resource (re-)selection check as specified in clause 5.22.1.2;

2> if the TX resource (re-)selection is triggered as the result of the TX resource (re-)selection check:

3> select the number of HARQ retransmissions from the allowed numbers that are configured by RRC in *sl-MaxTxTransNumPSSCH* included in *sl-PSSCH-TxConfigList* and, if configured by RRC, overlapped in *sl-MaxTxTransNumPSSCH* indicated in *sl-CBR-PSSCH-TxConfigList* for the highest priority of the logical channel(s) allowed on the carrier and the CBR measured by lower layers according to TS 38.2xx [xx] if CBR measurement results are available or the corresponding *sl-defaultTxConfigIndex* configured by RRC if CBR measurement results are not available;

3> select an amount of frequency resources within the range that is configured by RRC between *sl-MinSubChannelNumPSSCH* and *sl-MaxSubChannelNumPSSCH* included in *sl-PSSCH-TxConfigList* and, if configured by RRC, overlapped between *sl-MinSubChannelNumPSSCH* and *sl-MaxSubChannelNumPSSCH* indicated in *sl-CBR-PSSCH-TxConfigList* for the highest priority of the logical channel(s) allowed on the carrier and the CBR measured by lower layers according to TS 38.2xx [xx] if CBR measurement results are available or the corresponding *sl-defaultTxConfigIndex* configured by RRC if CBR measurement results are not available;

3> randomly select the time and frequency resources for one transmission opportunity from the resources indicated by the physical layer as specified in clause 8.1.4 of TS 38.214 [7], according to the amount of selected frequency resources and the remaining PDB of SL data available in the logical channel(s) allowed on the carrier;

3> if one or more HARQ retransmissions are selected:

4> if there are available resources left in the resources indicated by the physical layer according to clause 8.1.4 of TS 38.214 [7] for more transmission opportunities:

5> randomly select the time and frequency resources for one or more transmission opportunities from the available resources, according to the amount of selected frequency resources, the selected number of HARQ retransmissions and the remaining PDB of SL data available in the logical channel(s) allowed on the carrier by ensuring the minimum time gap between any two selected resources in case that PSFCH is configured for this pool of resources;

5> consider a transmission opportunity which comes first in time as the new transmission opportunity and a transmission opportunity which comes later in time as the retransmission opportunity;

5> consider both of the transmission opportunities as the selected sidelink grant;

3> else:

4> consider the set as the selected sidelink grant;

3> use the selected sidelink grant to determine PSCCH duration(s) and PSSCH duration(s) according to TS 38.214 [7];

3> consider the selected sidelink grant to be a configured sidelink grant.

1> if a configured sidelink grant is available for retransmission(s) of a MAC PDU which has been positively acknowledged as specified in clause 5.22.1.3.3:

2> clear the PSCCH duration(s) and PSSCH duration(s) corresponding to retransmission(s) of the MAC PDU from the configured sidelink grant.

For a configured sidelink grant, the minimum time gap between any two selected resources comprises:

- a time gap between the end of the last symbol of a PSSCH transmission of the first resource and the start of the first symbol of the corresponding PSFCH reception determined by *MinTimeGapPSFCH* and *periodPSFCHresource* for the pool of resources; and

- a time required for PSFCH reception and processing plus sidelink retransmission preparation including multiplexing of necessary physical channels and any TX-RX/RX-TX switching time.

NOTE 2: How to determine the time required for PSFCH reception and processing plus sidelink retransmission preparation is left to UE implementation.

The MAC entity shall for each PSSCH duration:

1> for each configured sidelink grant occurring in this PSSCH duration:

2> if the MAC entity has been configured by RRC to transmit using a SL-RNTI or SLCS-RNTI:

3> select a MCS which is, if configured, within the range that is configured by RRC between *sl-MinMCS-PSSCH* and *sl-MaxMCS-PSSCH* included in *SL-ScheduledConfig*.

2> else:

3> select a MCS which is, if configured, within the range that is configured by RRC between *sl-MinMCS-PSSCH* and *sl-MaxMCS-PSSCH* included in *sl-PSSCH-TxConfigList* and, if configured by RRC, overlapped between *sl-MinMCS-PSSCH* and *sl-MaxMCS-PSSCH* indicated in *sl-CBR-PSSCH-TxConfigList* for the highest priority of the sidelink logical channel(s) in the MAC PDU and the CBR measured by RRC according to TS 38.2xx [xx] if CBR measurement results are available or the corresponding *sl-defaultTxConfigIndex* configured by RRC if CBR measurement results are not available.

NOTE 3: MCS selection is up to UE implementation if the MCS or the corresponding range is not configured by upper layers.

2> if the configured sidelink grant is configured grant Type 1 or Type 2, and the PSSCH duration correspondings to the first transmisison opportunity within this period of this activated configured grant Type 1 or Type 2, and it has not been received on the PDCCH indicating retransmission(s) for the MAC entity's SLCS-RNTI:

3> set the HARQ Process ID to the HARQ Process ID associated with this PSSCH duration and, if available, all subsequent PSSCH duration(s) occuring in the same *sl-periodCG* duration for the activated configured grant Type 1 or 2.

2> deliver the sidelink grant, the selected MCS, and the associated HARQ information to the Sidelink HARQ Entity for this PSSCH duration.

For configured sidelink grants, the HARQ Process ID associated with the first symbol of a SL transmission is derived from the following equation:

[FFS on the exact equation in RAN1]

#### 5.22.1.2 TX resource (re-)selection check

If the TX resource (re-)selection check procedure is triggered for a Sidelink process according to clause 5.22.1.1, the MAC entity shall for the Sidelink process:

1> if SL\_RESOURCE\_RESELECTION\_COUNTER = 0 and when SL\_RESOURCE\_RESELECTION\_COUNTER was equal to 1 the MAC entity randomly selected, with equal probability, a value in the interval [0, 1] which is above the probability configured by upper layers in *sl-ProbResourceKeep*; or

1> if a pool of resources is configured or reconfigured by upper layers; or

1> if there is no configured sidelink grant; or

1> if neither transmission nor retransmission has been performed by the MAC entity on any resource indicated in the configured sidelink grant during the last [second]; or

1> if *sl-ReselectAfter* is configured and the number of consecutive unused transmission opportunities on resources indicated in the configured sidelink grant is equal to *sl-ReselectAfter*; or

1> if the configured sidelink grant cannot accommodate a RLC SDU by using the maximum allowed MCS configured by upper layers in *sl-MaxMCS-PSSCH* and the MAC entity selects not to segment the RLC SDU; or

NOTE 1: If the configured sidelink grant cannot accommodate the RLC SDU, it is left for UE implementation whether to perform segmentation or sidelink resource reselection.

1> if transmission(s) with the configured sidelink grant cannot fulfil the latency requirement of the data in a logical channel according to the associated priority, and the MAC entity selects not to perform transmission(s) corresponding to a single MAC PDU:

NOTE 2: If the latency requirement is not met, it is left for UE implementation whether to perform transmission(s) corresponding to single MAC PDU or sidelink resource reselection.

NOTE 3: It is left for UE implementation whether to trigger the TX resource (re-)selection due to the latancy requirement of the MAC CE triggered according to clause 5.22.1.7.

2> clear the configured sidelink grant associated to the Sidelink process, if available;

2> trigger the TX resource (re-)selection.

1> if a resource(s) of a configured sidelink grant is not in the resources indicated for re-evaluation by the physical layer as specified in TS 38.214 [7]; andor

1> if a received SCI indicating a priority value lower than *p\_preemption*, if pre-emption is enabled by RRC, schedules a sidelink transmission expected to overlap with a resource(s) of a configured sidelink grant used to transmit a MAC PDU carrying a MAC CE and/or logical channel(s) of which the highest prority value is higher than the priority value indicated by the received SCI, and a SL-RSRP result measured on the received SCI is higher than the last RSRP threshold determined according to clause 8.1.4 of TS 38.214 [7]:

2> remove the resource(s) from the configured sidelink grant associated to the Sidelink process;

2> randomly select the time and frequency resource(s) from the resources indicated by the physical layer as specified in clause 8.1.4 of TS 38.214 [7], according to the amount of selected frequency resources, the selected number of HARQ retransmissions and the remaining PDB of either SL data available in the logical channel(s) for re-evaluation or the MAC PDU for pre-emption by ensuring the minimum time gap between any two selected resources of the configured sidelink grant in case that PSFCH is configured for this pool of resources;

2> replace the removed resource(s) by the selected sidelink grant for the configured sidelink grant.

NOTE 4: The MAC entity may also replace other resource(s) from the configured sidelink grant by the selected sidelink grant to ensure the minimum time gap between any two selected resources of the configured sidelink grant after re-evaluation or pre-emption, in case that PSFCH is configured for this pool of resources. It is left for UE implementation whether to replace the other resource(s) by the selected sidelink grant.

#### 5.22.1.3 Sidelink HARQ operation

##### 5.22.1.3.1 Sidelink HARQ Entity

The MAC entity includes at most one Sidelink HARQ entity for transmission on SL-SCH, which maintains a number of parallel Sidelink processes.

The maximum number of transmitting Sidelink processes associated with the Sidelink HARQ Entity is [TBD1]. A sidelink process may be configured for transmissions of multiple MAC PDUs. For transmissions of multiple MAC PDUs, the maximum number of transmitting Sidelink processes associated with the Sidelink HARQ Entity is [TBD2].

A delivered sidelink grant and its associated Sidelink transmission information are associated with a Sidelink process. Each Sidelink process supports one TB.

For each sidelink grant, the Sidelink HARQ Entity shall:

1> if the MAC entity determines that the the sidelink grant is used for initial transmission; and

1> if no MAC PDU has been obtained:

NOTE 1: For the configured grant Type 1 and 2, only one new TB can be transmitted in a periodicity of the configured grant.

2> associate a Sidelink process to this grant, and for each associated Sidelink process:

3> obtain the MAC PDU to transmit from the Multiplexing and assembly entity, if any;

3> if a MAC PDU to transmit has been obtained:

4> if a HARQ Process ID has been set for the sidelink grant:

5> associate the HARQ Process ID corresponding to the sidelink grant to the associated Sidelink process;

4> determines Sidelink tranmssion information of the TB for the source and destination pair of the MAC PDU as follows:

5> set the Source Layer-1 ID to the 16 MSB of the Source Layer-2 ID of the MAC PDU;

5> set the Destination Layer-1 ID to the 8 MSB of the Destination Layer-2 ID of the MAC PDU;

5> consider the NDI to have been toggled and set the NDI to the toggled value;

NOTE 2: The initial value of the NDI set to the very first transmission for the Sidelink HARQ Entity is left to UE implementation.

5> associate the Sidelink process to a Sidelink process ID;

NOTE 3: How UE determine Sidelink process ID in SCI is left to UE implementation for NR sidelink.

5> if *sl-HARQ-FeedbackEnabled* has been set to *Enabled* for the logical channel(s) in the MAC PDU;

6> enable HARQ feedback;

5> else:

6> disable HARQ feedback;

5> set the priority to the value of the highest priority of the logical channel(s) and a MAC CE, if any, if included, in the MAC PDU;

5> if HARQ feedback is enabled for groupcast:

6> if both a group size and a member ID are provided by upper layers and the group size is not greater than the number of candidate PSFCH resources associated with this sidelink grant:

7> select either positive-negative acknowledgement or negative-only acknowledgement.

6> else:

7> select negative-only acknowledgement;

7> if UE’s location information is available:

8> set the communication range requirement to the value of the longest communication range of the logical channel(s) in the MAC PDU, if configured;

8> set the location information of Sidelink transmission information to the Zone\_id determined as specified in TS 38.331 [5], if configured.

4> deliver the MAC PDU, the sideink grant and the Sidelink transmission information of the TB to the associated Sidelink process;

4> instruct the associated Sidelink process to trigger a new transmission.

3> else:

4> flush the HARQ buffer of the associated Sidelink process.

1> else (i.e. retransmission):

2> if the HARQ Process ID corresponding to the sidelink grant received on PDCCH is associated to a Sidelink process of which HARQ buffer is empty; or

2> if the HARQ Process ID corresponding to the sidelink grant received on PDCCH is not associated to any Sidelink process:

3> ignore the sidelink grant.

2> else:

3> identify the Sidelink process associated with this grant, and for each associated Sidelink process:

4> if *sl-MaxTransNum* corresponding to the highest priority of the logical channel(s) in the MAC PDU has been configured in *sl-CG-MaxTransNumList* for the sidelink grant by RRC and the maximum number of transmissions of the MAC PDU has been reached to *sl-MaxTransNum*; or

4> if a positive acknowledgement to a transmission of the MAC PDU has been received according to clause 5.22.1.3.2; or

4> if only a negative acknowledgement was enabled in the SCI and no negative acknowledgement was received for the the most recent (re-)transmission of the MAC PDU according to clause 5.x.1.3.2:

5> flush the HARQ buffer of the associated Sidelink process;

4> else:

5> deliver the sidelink grant of the MAC PDU to the associated Sidelink process;

5> instruct the associated Sidelink process to trigger a retransmission.

##### 5.22.1.3.x Sidelink process

The Sidelink process is associated with a HARQ buffer.

New transmissions and retransmissions are performed on the resource indicated in the sidelink grant as specified in clause 5.x.1.1 and with the MCS selected as specified in clause 8.1.3.1 of TS 38.214 [7] and clause 5.x.1.1.

If the Sidelink process is configured to perform transmissions of multiple MAC PDUs the process maintains a counter SL\_RESOURCE\_RESELECTION\_COUNTER. For other configurations of the Sidelink process, this counter is not available.

If the Sidelink HARQ Entity requests a new transmission, the Sidelink process shall:

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

1> store the sidelink grant received from the Sidelink HARQ Entity;

1> generate a transmission as described below;

If the Sidelink HARQ Entity requests a retransmission, the Sidelink process shall:

1> generate a transmission as described below;

To generate a transmission, the Sidelink process shall:

1> if there is no uplink transmission; or

1> if the MAC entity is able to simultaneously perform uplink transmission(s) and sidelink transmission at the time of the transmission; or

1> if the other MAC entity and the MAC entity are able to simultaneously perform uplink transmission(s) and sidelink transmission at the time of the transmission respectively; or

1> if there is a MAC PDU to be transmitted for this duration in uplink, except a MAC PDU obtained from the Msg3 buffer or prioritized as specified in clause 5.4.2.2, and the sidelink transmission is prioritized over uplink transmission:

2> instruct the physical layer to transmit SCI according to the stored sidelink grant with the associated Sidelink transmission information;

2> instruct the physical layer to generate a transmission according to the stored sidelink grant;

2> if *sl-HARQ-FeedbackEnabled* has been set to *enabled* for the logical channel(s) in the MAC PDU:

3> instruct the physical layer to monitor PSFCH for the transmission and perform PSFCH reception as specified in clause 5.22.1.3.2.

1> if this transmission corresponds to the last transmission of the MAC PDU:

2> decrement SL\_RESOURCE\_RESELECTION\_COUNTER by 1, if available.

The transmission of the MAC PDU is prioritized over uplink transmissions of the MAC entity or the other MAC entity if the following conditions are met:

1> if the MAC entity is not able to perform this sidelink transmission simultaneously with all uplink transmissions at the time of the transmission, and

1> if uplink transmission is neither prioritized as specified in clause 5.4.2.2 nor prioritized by upper layer according to TS [24.386] [xx]; and

1> if the value of the highest priority of logical channel(s) and a MAC CE in the MAC PDU is lower than *sl-PrioritizationThres* if *sl-PrioritizationThres* is configured.

NOTE: If the MAC entity is not able to perform this sidelink transmission simultaneously with all uplink transmissions as specified in clause 5.4.2.2 of TS 36.321 [22] at the time of the transmission, and prioritization-related information is not available prior to the time of this sidelink transmission due to processing time restriction, it is up to UE implementation whether this sidelink transmission is performed.

##### 5.22.1.3.2 PSFCH reception

The MAC entity shall for each PSSCH transmission:

1> if an acknowledgement corresponding to the PSSCH transmission in clause 5.22.1.3.x is obtained from the physical layer:

2> deliver the acknowledgement to the corresponding Sidelink HARQ entity for the Sidelink process;

1> else:

2> deliver a negative acknowledgement to the corresponding Sidelink HARQ entity for the Sidelink process;

1> if the PSSCH transmission occurs for a pair of Source Layer-2 ID and Destination Layer-2 ID corresponding to a PC5-RRC connection which has been established by upper layer:

2> perform the HARQ-Based Sidelink RLF Detection procedure as specified in clause 5.22.1.3.y.

If *sl-PUCCH-Config* is configured by RRC, the MAC entity shall fo r each MAC PDU:

1> if the *timeAlignmentTimer*, associated with the TAG containing the Serving Cell on which the HARQ feedback is to be transmitted, is stopped or expired:

2> not instruct the physical layer to generate acknowledgement(s) of the data in this TB.

1> else:

2> if the PSSCH transmission was not prioritized as specified in clause 5.x.1.3.x:

3> instruct the physical layer to signal a negative acknowledgement on the PUCCH according to clause 16.5 of TS 38.213 [6].

2> else:

3> instruct the physical layer to signal an acknowledgement corresponding to the transmission on the PUCCH according to clause 16.5 of TS 38.213 [6].

##### 5.22.1.3.y HARQ-based Sidelink RLF detection

The HARQ-based Sidelink RLF detection procedure is used to detect Sidelink RLF based on a number of consecutive DTX on PSFCH reception occasions for a PC5-RRC connection.

RRC configures the following parameter to control HARQ-based Sidelink RLF detection:

- *maxNumConsecutiveDTX*.

The following UE variable is used for HARQ-based Sidelink RLF detection.

- *numConsecutiveDTX*, which is maintained for each PC5-RRC connection.

The Sidelink HARQ Entity shall (re-)initialize *numConsecutiveDTX* to zero for each PC5-RRC connection which has been established by upper layers, if any, upon (re)configuration of *maxNumConsecutiveDTX*.

The Sidelink HARQ Entity shall for each PSFCH reception occasion associated to the PSSCH transmission:

1> if PSFCH reception is absent on the PSFCH reception occasion:

2> increment *numConsecutiveDTX*;

2> if *numConsecutiveDTX* reaches *maxNumConsecutiveDTX*:

3> indicate HARQ-based Sidelink RLF detection to upper layers;

1> else:

2> re-initialize *numConsecutiveDTX* to zero.

#### 5.22.1.4 Multiplexing and assembly

For PDU(s) associated with one SCI, MAC shall consider only logical channels with the same Source Layer-2 ID-Destination Layer-2 ID pair for one of unicast, groupcast and broadcast which is associated with the pair. Multiple transmissions for different Sidelink processes are allowed to be independently performed in different PSSCH durations.

##### 5.22.1.4.1 Logical channel prioritization

###### 5.22.1.4.1.1 General

The sidelink Logical Channel Prioritization procedure is applied whenever a new transmission is performed.

RRC controls the scheduling of sidelink data by signalling for each logical channel:

- *sl-Priority* where an increasing priority value indicates a lower priority level;

- *sl-PrioritisedBitRate* which sets the sidelink Prioritized Bit Rate (sPBR);

- *sl-BucketSizeDuration* which sets the sidelink Bucket Size Duration (sBSD).

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

- *sl-configuredSLGrantType1Allowed* which sets whether a configured grant Type 1 can be used for sidelink transmission.

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

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

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

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

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

1> if the value of *SBj* is greater than the sidelink bucket size (i.e. sPBR × sBSD):

2> set *SBj* to the sidelink bucket size.

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

###### 5.22.1.4.1.2 Selection of logical channels

The MAC entity shall for each SCI corresponding to a new transmission:

1> select a Destination associated to one of unicast, groupcast and broadcast, having the logical channel with the highest priority or the MAC CE, among the logical channels that satisfy all the following conditions and MAC CE(s), if any, for the SL grant associated to the SCI:

2> SL data is available for transmission; and

2> *SBj* > 0, in case there is any logical channel having *SBj* > 0; and

2> *sl-configuredSLGrantType1Allowed*, if configured, is set to *true* in case the SL grant is a Configured Grant Type 1;

2> *sl-HARQ-FeedbackEnabled* set to *disabled*, if PSFCH is not configured for the SL grant associated to the SCI.

NOTE: If multiple Destinations have the logical channels satisfying all conditions above with the same highest priority or if multiple Destinations have the MAC CE, which Destination is selected among them is up to UE implementation.

1> select the logical channels satisfying all the following conditions among the logical channels belonging to the selected Destination:

2> SL data is available for transmission; and

2> *sl-configuredSLGrantType1Allowed*, if configured, is set to *true* in case the SL grant is a Configured Grant Type 1; and

2> if the MAC entity has been configured by RRC to transmit using a SL-RNTI or SLCS-RNTI and PSFCH is configured for the sidelink grant associated to the SCI:

3> *sl-HARQ-FeedbackEnabled* is set to *enabled*, if *sl-HARQ-FeedbackEnabled* is set to *enabled* for the highest priority logical channel satisfying the above conditions*;* or

3> *sl-HARQ-FeedbackEnabled* set to *disabled*,if *sl-HARQ-FeedbackEnabled* is set to *disabled* for the highest priority logical channel satisfying the above conditions.

2> else if the MAC entity has been configured by RRC to transmit using a SL-RNTI or SLCS-RNTI:

3> *sl-HARQ-FeedbackEnabled* set to *disabled*.

###### 5.22.1.4.1.3 Allocation of sidelink resources

The MAC entity shall for each SCI corresponding to a new transmission:

1> allocate resources to the logical channels as follows:

2> logical channels selected in clause 5.22.1.4.1.2 for the SL grant with *SBj* > 0 are allocated resources in a decreasing priority order. If the SL-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 sPBR of the lower priority logical channel(s);

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

2> if any resources remain, all the logical channels selected in clause 5.22.1.4.1.2 are served in a strict decreasing priority order (regardless of the value of *SBj*) until either the data for that logical channel or the SL grant is exhausted, whichever comes first. Logical channels configured with equal priority should be served equally.

NOTE: The value of *SBj* can be negative.

The UE shall also follow the rules below during the SL 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 sidelink grant size that is equal to or larger than 12 bytes while having data available and allowed (according to clause 5.22.1.4.1) for transmission, the MAC entity shall not transmit only padding;

- A logical channel configured with *sl-HARQ-FeedbackEnabled* set to *enabled* and a logical channel configured with *sl-HARQ-FeedbackEnabled* set to *disabled* cannot be multiplexed into the same MAC PDU.

The MAC entity shall not generate a MAC PDU for the HARQ entity if the following conditions are satisfied:

- there is no Sidelink CSI Reporting MAC CE generated for this PSSCH transmission as specified in clause 5.22.1.7; and

- the MAC PDU includes zero MAC SDUs.

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

- data from SCCH;

- Sidelink CSI Reporting MAC CE;

- data from any STCH.

##### 5.22.1.4.2 Multiplexing of MAC SDUs

The MAC entity shall multiplex MAC SDUs in a MAC PDU according to clauses 5.22.1.3.1 and 6.1.6.

#### 5.22.1.5 Scheduling Request

In addition to clause 5.4.4, the Scheduling Request (SR) is also used for requesting SL-SCH resources for new transmission when triggered by the Sidelink BSR (clause 5.22.1.6) or the SL-CSI reporting (clause 5.22.1.7). If configured, the MAC entity performs the SR procedure as specified in this clause unless otherwise specified in clause 5.4.4.

The SR configuration of the logical channel that triggered the Sidelink BSR (clause 5.22.1.6) (if such a configuration exists) is also considered as corresponding SR configuration for the triggered SR (clause 5.4.4). The priority of the triggered SR corresponds to the priority of the logical channel.

If the SL-CSI reporting procedure is enabled by RRC, the SL-CSI reporting is mapped to [zero or] one SR configuration for all PC5-RRC connections established by RRC. The SR configuration of the SL-CSI reporting triggered according to 5.22.1.7 is considered as corresponding SR configuration for the triggered SR (clause 5.4.4). The priority of the triggered SR corresponds to the priority of the SL-CSI reporting.

All pending SR(s) triggered according to the Sidelink BSR procedure (clause 5.22.1.6) prior to the MAC PDU assembly shall be cancelled and each respective *sr-ProhibitTimer* shall be stopped when the MAC PDU is transmitted and this PDU includes a Sidelink BSR MAC CE which contains buffer status up to (and including) the last event that triggered a Sidelink BSR (see clause 5.22.1.4) prior to the MAC PDU assembly.

All pending SR(s) triggered according to the Sidelink BSR procedure (clause 5.22.1.6) shall be cancelled and each respective *sr-ProhibitTimer* shall be stopped when the SL grant(s) can accommodate all pending data available for transmission in sidelink.

[The pending SR triggered according to the SL-CSI reporting shall be cancelled and each respective *sr-ProhibitTimer* shall be stopped when the SL grant(s) can accommodate all SL-CSI reporting(s) that have been triggered but not cancelled.] All pending SR(s) triggered by either Sidelink BSR or Sidelink CSI report shall be cancelled, when RRC configures autonomous resource selection.

#### 5.22.1.6 Buffer Status Reporting

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

RRC configures the following parameters to control the SL-BSR:

- *periodicBSR-Timer*;

- *retxBSR-Timer*;

- *sl-logicalChannelSR-DelayTimerApplied*;

- *logicalChannelSR-DelayTimer*;

- *sl-logicalChannelGroup*.

Each logical channel which belongs to a Destination is allocated to an LCG as specified in TS 38.331 [5] or TS 36.331 [21]. The maximum number of LCGs is eight.

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

A SL-BSR shall be triggered if any of the following events occur:

1> if the MAC entity has a SL-RNTI or SLCS-RNTI:

2> SL data, for a logical channel of a Destination, becomes available to the MAC entity; and either

3> this SL data belongs to a logical channel with higher priority than the priorities of the logical channels containing available SL data which belong to any LCG belonging to the same Destination; or

3> none of the logical channels which belong to an LCG belonging to the same Destination contains any available SL data.

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

2> UL resources are allocated and number of padding bits remaining after a Padding BSR has been triggered is equal to or larger than the size of the SL-BSR MAC CE plus its subheader, in which case the SL-BSR is referred below to as 'Padding SL-BSR';

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

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

1> else:

2> An SL-RNTI is configured by RRC and SL data is available for transmission in the RLC entity or in the PDCP entity, in which case the Sidelink BSR is referred below to as "Regular Sidelink BSR".

For Regular SL-BSR, the MAC entity shall:

1> if the SL-BSR is triggered for a logical channel for which *sl-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 SL-BSR, the MAC entity shall:

1> if *sl-PrioritizationThres* is configured and the value of the highest priority of the logical channels that belong to any LCG and contain SL data for any Destination is lower than *sl-PrioritizationThres*; and

1> if either *ul-PrioritizationThres* is not configured or *ul-PrioritizationThres* is configured and the value of the highest priority of the logical channels that belong to any LCG and contain UL data is equal to or higher than *ul-PrioritizationThres* according to clause 5.4.5:

2> prioritize the LCG(s) for the Destination(s).

1> if the Buffer Status reporting procedure determines that at least one BSR has been triggered and not cancelled according to clause 5.4.5 and the UL grant cannot accommodate a SL-BSR MAC CE containing buffer status only for all prioritized LCGs having data available for transmission plus the subheader of the SL-BSR according to clause 5.4.3.1.3, in case the SL-BSR is considered as not prioritized:

2> prioritize the SL-BSR for logical channel prioritization specified in clause 5.4.3.1;

2> report Truncated SL-BSR containing buffer status for as many prioritized LCGs having data available for transmission as possible, taking the number of bits in the UL grant into consideration.

1> else if the number of bits in the UL grant is expected to be equal to or larger than the size of a SL-BSR containing buffer status for all LCGs having data available for transmission plus the subheader of the SL-BSR according to clause 5.4.3.1.3:

2> report SL-BSR containing buffer status for all LCGs having data available for transmission.

1> else:

2> report Truncated SL-BSR containing buffer status for as many LCGs having data available for transmission as possible, taking the number of bits in the UL grant into consideration.

For Padding BSR:

1> if the number of padding bits remaining after a Padding BSR has been triggered is equal to or larger than the size of a SL-BSR containing buffer status for all LCGs having data available for transmission plus its subheader:

2> report SL-BSR containing buffer status for all LCGs having data available for transmission;

1> else:

2> report Truncated SL-BSR containing buffer status for as many LCGs having data available for transmission as possible, taking the number of bits in the UL grant into consideration.

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

The MAC entity shall:

1> if the sidelink Buffer Status reporting procedure determines that at least one SL-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 SL-BSR MAC CE plus its subheader as a result of logical channel prioritization according to clause 5.4.3.1:

3> instruct the Multiplexing and Assembly procedure in clause 5.4.3 to generate the SL-BSR MAC CE(s);

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

3> start or restart *retxBSR-Timer*.

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

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

4> trigger a Scheduling Request.

NOTE 1: UL-SCH resources are considered available if the MAC entity has an active configuration for either type of configured uplink grants, or if the MAC entity has received a dynamic uplink grant, or if both of these conditions are met. 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 SL-BSR MAC CE, even when multiple events have triggered a SL-BSR. The Regular SL-BSR and the Periodic SL-BSR shall have precedence over the padding SL-BSR.

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

All triggered SL-BSRs may be cancelled when the SL grant(s) can accommodate all pending data available for transmission. All BSRs triggered prior to MAC PDU assembly shall be cancelled when a MAC PDU is transmitted and this PDU includes a SL-BSR MAC CE which contains buffer status up to (and including) the last event that triggered a SL-BSR prior to the MAC PDU assembly. All triggered SL-BSRs shall be cancelled, and *retx-BSR-Timer* and *periodic-BSR-Timer* shall be stopped, when RRC configures autonomous resource selection.

NOTE 2: MAC PDU assembly can happen at any point in time between uplink grant reception and actual transmission of the corresponding MAC PDU. SL-BSR and SR can be triggered after the assembly of a MAC PDU which contains a SL-BSR MAC CE, but before the transmission of this MAC PDU. In addition, SL-BSR and SR can be triggered during MAC PDU assembly.

#### 5.22.1.7 CSI Reporting

The Sidelink Channel State Information (SL-CSI) reporting procedure is used to provide a peer UE with sidelink channel state information as specified in clause 8.5 of TS 38.214 [7].

RRC configures the following parameters to control the SL-CSI reporting procedure:

- *latencyBoundCsiReport-SL*, which is maintained for each PC5-RRC connection.

The MAC entity shall for each pair of the Source Layer-2 ID and the Destination Layer-2 ID corresponding to a PC5-RRC connection which has been established by upper layer:

1> if the SL-CSI reporting has been triggered by a SCI and not cancelled:

2> if the latency requirement of the SL-CSI reporting in *latencyBoundCsiReport-SL* cannot be met:

3> cancel the triggered SL-CSI reporting.

2> else if the MAC entity has SL resources allocated for new transmission:

3> instruct the Multiplexing and Assembly procedure to generate a Sidelink CSI Reporting MAC CE as defined in clause 6.1.3.35;

3> cancel the triggered SL-CSI reporting.

2> else if the MAC entity has been configured by RRC to transmit using a SL-RNTI or SLCS-RNTI:

3> trigger a Scheduling Request.

### 5.22.2 SL-SCH Data reception

#### 5.22.2.1 SCI reception

SCI indicate if there is a transmission on SL-SCH and provide the relevant HARQ information. A SCI consists of two parts: the 1st stage SCI on PSCCH and the 2nd stage SCI on PSSCH as specified in clause 8.1 of TS 38.214 [7].

The MAC entity shall:

1> for each PSCCH duration during which the MAC entity monitors PSCCH:

2> if a 1st stage SCI for this PSSCH duration has been received on the PSCCH:

3> determine the set of PSSCH durations in which reception of a 2nd stage SCI and the transport block occur using the received part of the SCI;

3> if the 2nd stage SCI for this PSSCH duration has been received on the PSSCH:

4> store the SCI as a valid SCI for the PSSCH durations corresponding to transmission(s) of the transport block and the associated HARQ information and QoS information;

1> for each PSSCH duration for which the MAC entity has a valid SCI:

2> deliver the SCI and the associated Sidelink transmission information to the Sidelink HARQ Entity.

#### 5.22.2.2 Sidelink HARQ operation

##### 5.22.2.2.1 Sidelink HARQ Entity

There is at most one Sidelink HARQ Entity at the MAC entity for reception of the SL-SCH, which maintains a number of parallel Sidelink processes.

Each Sidelink process is associated with SCI in which the MAC entity is interested. This interest is as determined by the Destination Layer-1 ID and the Source Layer-1 ID of the SCI. The Sidelink HARQ Entity directs Sidelink transmission information and associated TBs received on the SL-SCH to the corresponding Sidelink processes.

The number of Receiving Sidelink processes associated with the Sidelink HARQ Entity is defined in [TBD].

For each PSSCH duration, the Sidelink HARQ Entity shall:

1> for each SCI valid for this PSSCH duration:

2> if the NDI has been toggled compared to the value of the previous received transmission corresponding to this TB or this is the very first received transmission for this TB:

3> allocate the TB received from the physical layer and the associated Sidelink transmission information to an unoccupied Sidelink process, associate the Sidelink process with this SCI and consider this transmission to be a new transmission.

NOTE: When a new TB arrives, if there is no unoccupied Sidelink process in the Sidelink HARQ entity, how to manage receiving Sidelink processes is up to UE implementation.

1> for each Sidelink process:

2> if the NDI has been not toggled compared to the value of the previous received transmission corresponding to this TB for the Sidelink process according to its associated SCI:

3> allocate the TB received from the physical layer to the Sidelink process and consider this transmission to be a retransmission.

2> else if the HARQ buffer of the Sidelink process is not empty:

3> flush the HARQ buffer.

##### 5.22.2.2.2 Sidelink process

For each PSSCH duration where a transmission takes place for the Sidelink process, one TB and the associated HARQ information is received from the Sidelink HARQ Entity.

For each received TB and associated Sidelink transmission information, the Sidelink process shall:

1> if this is a new transmission:

2> attempt to decode the received data.

1> else if this is a retransmission:

2> if the data for this TB has not yet been successfully decoded:

3> instruct the physical layer to combine the received data with the data currently in the soft buffer for this TB and attempt to decode the combined data.

1> if the data which the MAC entity attempted to decode was successfully decoded for this TB; or

1> if the data for this TB was successfully decoded before:

2> if this is the first successful decoding of the data for this TB:

3> if this TB is associated to unicast, the DST field of the decoded MAC PDU subheader is equal to the 8 MSB of any of the Source Layer-2 ID(s) of the UE for which the 16 LSB are equal to the Destination ID in the corresponding SCI, and the SRC field of the decoded MAC PDU subheader is equal to the 16 MSB of any of the Destination Layer-2 ID(s) of the UE for which the 8 LSB are equal to the Source ID in the corresponding SCI; or

3> if this TB is associated to groupcast or broadcast and the DST field of the decoded MAC PDU subheader is equal to the 8 MSB of any of the Destination Layer-2 ID(s) of the UE for which the 16 LSB are equal to the Destination ID in the corresponding SCI:

4> deliver the decoded MAC PDU to the disassembly and demultiplexing entity;

2> consider the Sidelink process as unoccupied.

1> else:

2> instruct the physical layer to replace the data in the soft buffer for this TB with the data which the MAC entity attempted to decode.

1> if HARQ feedback is enabled by the SCI in which the 16 LSB of any of the Source Layer-2 ID(s) of the UE are equal to the Destination Layer-1 ID and the 8 LSB of any of the Destination Layer-2 ID(s) of the UE are equal to the Source Layer-1 ID:

2> if type 1 groupcast is indicated by the SCI according to clause 8.4.1 of TS 38.212 [9] and distance beteween UE’s location and the central location of the nearest zone indicated by the *Zone\_id* in the SCI is smaller or equal to the communication range; or

2> if type 1 groupcast is not indicated by the SCI according to clause 8.4.1 of TS 38.212 [9]::

3> if the data which the MAC entity attempted to decode was successfully decoded for this TB or the data for this TB was successfully decoded before; and

3> if positive-negative acknowledgement is indicated by the SCI:

4> instruct the physical layer to generate a positive acknowledgement of the data in this TB.

3> else:

4> instruct the physical layer to generate a negative acknowledgement of the data in this TB.

#### 5.22.2.3 Disassembly and demultiplexing

The MAC entity shall disassemble and demultiplex a MAC PDU as defined in clause 6.1.6.

END OF THE CHANGE