**3GPP TSG-RAN WG1 Meeting #117 *R1-240xxxx***

**Fukuoka, Japan, May 20th – 24th, 2024**

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **38.214** | **CR** | **-** | **Rev** | **-** | **Current version:** | **18.2.0** |  |
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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:*** | Rel-18 editorial corrections for TS 38.214 | | | | | | |
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| ***Source to WG:*** | Nokia | | | | | | |
| ***Source to TSG:*** |  | | | | | | |
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| ***Work item code:*** | NR\_MIMO\_evo\_DL\_UL, NR\_MC\_enh-Core, NR\_pos\_enh2-Core, NR\_redcap\_enh-Core, NR\_MBS\_enh-Core, Netw\_Energy\_NR, NR\_SL\_enh2 | | |  | ***Date:*** | | 2024-05-30 |
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| ***Category:*** | **F** |  | | | ***Release:*** | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
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| ***Reason for change:*** | | **NR\_MIMO\_evo\_DL\_UL**  **Unified TCI framework extension for multi-TRP**  In clause 5.1.5, in S-DCI based MTRP operation, Rel-18 unified TCI framework uses different schemes (TCI selection field in the DCI, RRC configuration, or default rule) to select one or two indicated TCI states for PDSCH/PDCCH reception, rather than being based on legacy TCI field indicating one or two TCI states or MAC-CE activation command for a CORESET. Without a specification change, PDSCH/PDCCH-SFN would not work under Rel-18 unified TCI framework based on current specification.  In clause 5.1.5, a CR for Rel-17 (R1-2401739) was agreed in RAN1#116, which was intended to apply to Rel-17 unified TCI framework (i.e., for one indicated TCI state). However, the paragraph corresponding to the CR has no restriction of “for one indicated TCI state”, and it will apply to both Rel-17 and Rel-18 unified TCI frameworks.  In clause 5.2.1.5.1, whether an AP CSI-RS resource set follows the unified TCI state is determined according to the RRC parameter *followUnifiedTCI-State*. However, such RRC parameter is not provided to an AP CSI-RS resource set to inform whether the AP CSI-RS resource set should follow the unified TCI state based on current RRC design in TS 38.331 for Rel-18 unified TCI framework. Thus, a correction to the current RAN1 specification is necessary to avoid the misalignment between RAN1 and RAN2 specifications.  **Increased number of orthogonal DMRS ports**  In clause 6.1.1.1, in TS 38.331, the RRC parameter *nrofSRS-Ports-n8* is used to identify the port number of an 8-port SRS resource and whether the SRS resource is a TDMed 8-port SRS resource. However, in a paragraph of 6.1.1.1 in TS 38.214, the RRC parameter *nrofSRS-Ports-n8* is not used, which is not aligned with TS 38.331.  **UL precoding indication for multi-panel transmission**  In clauses 5.2.5 and 6.1, RAN1 has introduced the following fields in the PUSCH configuration: *applyIndicatedTCI-State*, *multipanelSchemeSDM*, *multipanelSchemeSFN* and *sTx-2Panel*. The first three parameters can only be configured with single-DCI transmission, whereas the last parameter can only be configured with multi-DCI transmission. RAN2 has attempted to capture this in 38.331 as configuration restrictions, but since the *coresetPoolIndex* is configured in a DL BWP and PUSCH in an UL BWP, it becomes difficult to formulate this accurately, since RRC configuration restrictions should be based on RRC configuration only, and not on dynamic signaling. Also, there is no relation between DL and UL BWPs.  **SRI/TPMI enhancement for enabling 8 TX UL transmission**  In clause 6.1.1.1, correct the capitalization of the *CodebookTypeUL* fields in 38.212 and 38.214 to align with 38.331 and 38.211.  In clause 6.1.1.1, remove the reference to the non-existent RRC parameter *ULcodebookFC-N1N2*.  In clause 6.1.1.1, capturing a missing agreement.  *In RAN1#117*  In clause 4.1, the RRC parameter for enhanced DMRS in TS 38.214 is not aligned with what in TS 38.331.  In clause 5.1.6.2, UE capabilities indicating supporting of PDSCH reception without scheduling restrictions are referred for clarifying UE assumption of scheduled PDSCH pattern, where the parameter names of UE capabilities need to be updated to align with the parameters defined in 38.306.  Below are the parameters defined in 38.306 for reader’s quick reference:   | ***pdsch-ReceptionSchemeA-r18***  Indicates whether the UE supports reception of PDSCH without the scheduling restriction for Rel-18 eType1 DMRS ports for PDSCH with fdmSchemeA.  A UE supporting this feature shall also indicate support of *pdsch-TypeA-DMRS-r18* or *pdsch-TypeB-DMRS-r18*. | | --- | | ***pdsch-ReceptionSchemeB-r18***  Indicates whether the UE supports reception of PDSCH without the scheduling restriction for Rel-18 eType1 DMRS ports for PDSCH with fdmSchemeB.  A UE supporting this feature shall also indicate support of *pdsch-TypeA-DMRS-r18* or *pdsch-TypeB-DMRS-r18*. | | ***pdsch-ReceptionWithoutSchedulingRestriction-r18***  Indicates whether the UE supports reception of PDSCH without the scheduling restriction for eType1 DMRS ports.  NOTE: If this feature is not supported, UE expects that gNB shall apply at least the following scheduling restriction for PDSCH for FD-OCC 4 in eType 1 DMRS:  1) The number of consecutively scheduled PRBs for PDSCH is even  2) The number of PRBs offset of scheduled PDSCH from point A (common resource block 0) is even |   **NR\_MC\_enh-Core**  In clauses 5.5, clause title needed modification  In clause 6.1.6, the behaviour described in subclauses 6.1.6.2.0 and 6.1.6.3 can be applied to UE configured with Rel-18 UL Tx switching with 3 or 4 bands when the UE performs UL Tx switching involving only 2 bands, however the parameters described in those subclauses are only for Rel-16 or Rel-17 UL Tx switching.  In clause 6.2.1.3, UE behavior for DCI 1\_3 missing from specification.  *In RAN1#117*  In clause 6.1.6, In the following RAN2 #125 agreement for R18 uplink Tx switching, the effective switching gap is determined based on RRC parameter instead of UE capability:   * *To refine the RAN4 agreed RRC configuration as below: For each band pair, a RRC parameter is introduced to configure switching period value between value 35 us and 140 us. When the RRC parameter is absent, 210us is applied.*   TS 38.331   |  | | --- | | ***switchingPeriodConfigForBandPair***  Indicates the value of switching period for the band pair as specified in TS 38.214 [19], clause 6.1.6. Value *n35us* represents 35 us, *n140us* represents 140us. If the field is absent, 210 us is applied. |   **NR\_pos\_enh2-Core**  In clause 5.1.6.5, align the naming of “DL-PRS ID” and “DL PRS ID” as “DL-PRS ID”.  In clause 6.2.1.4.1, improve clarity of the specifications by adding reference to relevant higher layer parameter names.  In clause 6.2.1.4.1, the previous agreement on timeline issue on positioning SRS transmission for Tx hopping should be for RRC\_CONNECTED state.  In clause 6.2.1.4.1, for semi-persistent case, timeline for determination of collision between SRS for frequency hopping and other signals or channels was not defined. A UE may not be able to drop an SRS symbol without enough time for decoding MAC CE.  In clause 6.2.1.4.1, the current specification text does not account for switching time in the PDCCH to aperiodic SRS with FH timeline.  In clause 6.2.1.4.1, the agreement that was made for collision handling Option 2 of positioning SRS with frequency hopping is mainly targeting for the case when positioning SRS is treated as lower priority and needs to be dropped due to prioritization rule. However, collision handling for the case when positioning SRS with frequency hopping is treated as higher priority when overlapping with other UL signals or channels is not defined.  For instance, when A-SRS overlaps with P/SP-SRS, P/SP-SRS transmission is dropped on the overlapped symbol(s). Similarly, when A-SRS including the switching time to the active UL BWP overlaps with PUCCH, e.g., carrying SP-CSI report, the PUCCH is dropped.  In clause 6.2.1.4.2, ▪ the wording of ‘switching period’ is still in bracket  ▪ the affected band(s) are not considered in the guard period in which other sig-nals/channels are not expected  ▪ clarify that UE needs to consider priority between positioning SRS and other sig-nals/channels in the affected bands. And the other signals or channels in the affect-ed band(s) have the same priority as that in the same carrier of the SRS.  In clause 8.2.4, a UE shall transmit the SL PRS in the same slot as the associated PSCCH for either dedicated SL PRS resource pool or shared SL PRS resource pool. But this feature is currently duplicated in TS 38.214 in clause 8.2.4 and clause 8.2.4.1.1.  In clause 8.2.4.3, the new processing timing capability 3 is introduced for SL-PRS Congestion control.  In clause 8.3, in case that SCI format 1-A indicates an MCS table that the UE does not support, a UE may still require to decode corresponding SCI format 2-D.  In clause 8.1, square brackets on higher layer parameters pending decision  *In RAN1#117*  Clause 5.1.6.5.1:   * Temporary placeholders for higher layer parameter names related to PRS receiver frequency hopping need to be updated.   Clause 5.1.6.5.3:   * There is no higher layer parameter of *nr-DL-PRS-JointMeasurementRequested* in current TS 37.355.   Clause 6.2.1.4:   * For Rel-18 LPHAP, the use of IE *SRS-SpatialRelationInfoPos* in the current TS 38.214 should be confirmed and brackets removed.   Clause 6.2.1.4.1:   * According to the TS38.331 and RAN1 agreement, SRS frequency hopping can be configured without window (i.e., *srs-PosUplinkTransmissionWindowConfig*). SRS frequency hopping is configured via *SRS-PosTx-Hopping*. * According to RAN1’s agreement, the starting slot offset for the first hop and that for the hops following the first hop are separately configured. Specifically, starting slot of the first hop reuse SRS-PeriodicityAndOffset IE, and a new IE *slotoffset* is introduced for the starting slot offset for the remaining hops. Further, the parameter *slotoffest* can only be used for aperiodic SRS. Current specification does not correctly reflect these details. * At the RAN1#115 meeting, it was agreed that UE is not expected to be configured with a SRS for positioning hopping cycle, including the switching time from/to active BWP required ahead of the first hop and after the last hop, partially overlapping with UTW. However, this is not accurately captured in the specification. * Temporary placeholders for higher layer parameter names related to SRS frequency hopping for positioning need to be updated.   Clause 6.2.1.4.2:   * There is no higher layer parameter of *freqInfoAdditionalCcList* in current TS 38.331.   Clause 8.2.4:   * Parameter *sl-CombSize* and *sl-PRS-comb-offset* can only be used in dedicated resource pool. *sl-PRS-CombSizeN-AndReOffset* should be used in shared resource pool. * Parameter *mNumberOfSymbols* can only be used in shared resource pool*. sl-NumberOfSymbols* should be used a dedicated resource pool.   Clause 8.2.4.2A:   * There is no ‘SL-PRS resource ID (s)’ field in SCI format 1-B. * Parameter *sl-MaxNumPerReserve* cannot be used for dedicated resource pool.   Clause 8.2.4.3:   * Parameter *sl-CR-Limit* cannot be used for dedicated resource pool.   In clause 5.1.6.5.2, UE will report the DL RSCPD measurement together with DL RSTD measurement instead of DL RSTD. The current description in TS 38.214 is not aligned with other measurement report and the following agreement:   |  | | --- | | **Agreement in RAN1#112bis-e**  Introduce DL reference carrier phase (DL RSCP) and NR DL reference carrier phase difference (DL RSCPD) as DL carrier phase measurements.   * Note: It is up to RAN4 to decide whether and how to define the requirements for DL RSCP and/or DL RSCPD. No LS needed to RAN4 for this note. * DL RSCP can be reported together with UE Rx – Tx time difference measurement * DL RSCPD can be reported together with RSTD measurement * FFS: details on how to eliminate unknown initial Rx phase with RSCP/RSCPD reporting can be further discussed |  1. For Rel-18 CPP, UE may be configured report quality metrics corresponding to phase measurement. However, the IE name *[phase quality index]* in the current TS 38.214 is not aligned with higher layer parameter.   There are several typos in 5.1.6.5.2, duplicate spaces in ‘*nr-PRU-RSCP-MeasInfo* or’ and ‘*phaseQualityValue* which’, missing spaces in ‘*NR-PhaseQuality*corresponding’ and ‘measurementfrom’.  **NR\_redcap\_enh-Core, NR\_MBS\_enh-Core**  In clause 5.1, maintenance on support for enhanced reduced capability NR devices.  In clause 5.1.2.1.1, only Type0/0B CSS is supported for multicast MCCH/MTCH PDCCH in RRC\_INACTIVE state as specified in TS 38.213. However, multicast MCCH/MTCH in RRC\_INACTIVE state using the same entries as broadcast MCCH/MTCH in the definition of applicable resource allocation table used for PDSCH in TS 38.214, which may cause the ambiguity that Type 3 CSS is also supported for multicast MCCH/MTCH PDCCH in RRC\_INACTIVE state.  *In RAN1#117*  In clause 5.1, updated the higher layer parameter name *supportOfERedCap*  **NR\_MBS\_enh-Core in RAN1#117**  In clauses 5.1, 5.1.2.2.3, 5.1.3.1, 5.1.3.2, 5.1.4, UE is configured with ‘Multicast MCCH-RNTI’ for multicast reception in RRC\_INACTIVE state according to TS 38.331. However, ‘multicast-MCCH-RNTI’ is used to scramble the DCI for scheduling multicast in RRC\_INACTIVE state, which is not aligned with TS 38.331.  In clause 5.1, for multicast reception in RRC\_INACTIVE, it was agreed to introduce a new UE capability on intra-slot TDMed unicast/broadcast/multicast PDSCHs. The UE can report whether it supports intra-slot TDMed PDSCH reception for unicast/broadcast/multicast in RRC\_INACITIVE. Therefore, the number of PDSCH for multicast in RRC\_INACTIVE that can be scheduled in a slot may not be the same as the indication for unicast. The corresponding specification should be changed.  In clause 5.1.3.1, the mcs-table of multicast PDSCH in RRC\_INACTIVE can be set to qam256 or qam64LowSE according to the endorsed CR of TS 38.331. However only the case when mcs-table set to qam256 is described in the current TS 38.214 but the case mcs-table set to qam64LowSE is missed.  PDSCH-ConfigBroadcast-r17 ::= SEQUENCE {  mcs-Table-r17 ENUMERATED {qam256, qam64LowSE} OPTIONAL, -- Need S  }  ***mcs-Table***  Indicates which MCS table the UE shall use for PDSCH. If the field is absent the UE applies the value 64QAM. The field *mcs-Table* applies to DCI format 4\_0 with CRC scrambled by MCCH-RNTI/G-RNTI for MBS broadcast or by Multicast MCCH-RNTI for MBS multicast in RRC\_INACTIVE (see TS 38.214 [19], clause 5.1.3.1).  **Netw\_Energy\_NR, in RAN1#117**  In clause 5.2.1.4.2, clarified the utilization of portAubsetIndicator in the context of report quantity configurations.  **NR\_SL\_enh2, in RAN#117**  In clauses 8, 8.1.4, 8.1.5, extra blank spaces.  In clause 8.1.4, The combination of MCSt and partial sensing is supported according to the current specification. The current description “any set of L\_"subCH" contiguous sub-channels … correspond to one candidate single-slot resource” covers only a candidate single-slot resource case, but there is no corresponding description or definition for one candidate multi-slot resource (as it is intended by the specification).  The support of interlaced RB resource allocation and SL partial sensing should be supported in Release 18. However, it is currently missing in the specification.  In clause 8, If the higher layer parameter transmissionStructureForPSCCHandPSSCH is set to ‘contiguousRB', and if more than 1 sub-channel is used for PSSCH transmission, there are two cases as depicted in the figure below:  Case 1(Sub-channels in yellow): The highest sub-channel of PSSCH overlaps with a single RB set and the highest PRB in the sub-channel overlaps with intra-cell guard band PRBs;  Case 2(Sub-channels in green): The highest sub-channel of PSSCH overlaps with a single RB set and the highest PRB in the sub-channel doesn’t overlap with intra-cell guard band PRBs;  RB set 1  RB set 2  Guard band  As the description in clause 8 in TS38.214, both case 1 and case 2 are included. But in fact, only in case 1, the UE can transmit PSSCH on the PRBs belonging to the allocated sub-channel(s) except for the intra-cell guard band PRBs within the highest sub-channel. while in case 2, the UE can transmit PSSCH on all the PRBs belonging to the allocated sub-channel(s).  However, according to the following agreement, case 2 should be supported and not included in the relevant description in clause 8.  **Agreement**  For contiguous RB-based PSCCH/PSSCH transmission in SL-U, regarding sub-channel(s) which include intra-cell guardband PRBs, support only option 3.   * FFS other details, e.g., impacts on resource selection, PSCCH mapping, etc. * Note:   + Option 2: Such sub-channel(s) can be used for PSCCH/PSSCH transmission     - Note: PRBs within intra-cell guard band are not used for PSCCH transmission as per previous agreement   + Option 3: Such sub-channel(s) cannot be used for PSCCH transmission, and can be used for PSSCH transmission   + : the number of remaining PRBs of a sub-channel belonging to a RB set after excluding the PRBs belonging to intra-cell guardband   + : the number of PRBs for PSCCH transmission | | | | | |
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| ***Summary of change:*** | | **NR\_MIMO\_evo\_DL\_UL**  **Unified TCI framework extension for multi-TRP**  In clause 5.1.5, made PDSCH/PDCCH-SFN work under Rel-18 unified TCI framework.  In clause 5.1.5, added “having one indicated TCI state” to the paragraph co rresponding to the CR to clarify the CR of Rel-17 (R1-2401739) only applies to Rel-17 unified TCI framework.  In clause 5.2.1.5.1, removed the condition “if the aperiodic CSI-RS resource set for CSI or BM is configured with *followUnifiedTCI-State*”.  **Increased number of orthogonal DMRS ports**  In clause 6.1.1.1, added the RRC parameter ‘nrofSRS-Ports-n8’ for 8-port SRS resource in TS 38.214.  **UL precoding indication for multi-panel transmission**  In clauses 5.2.5 and 6.1, the UL/DL BWP linking for applyIndicatedTCI-State, multipanelSchemeSDM, multipanelSchemeSFN and sTx-2Panel are captured in 38.214.  **SRI/TPMI enhancement for enabling 8 TX UL transmission**  In clauses 6.1.1.1, *CodebookTypeUL* fields to be “codebook1”, “codebook2”, “codebook3”, and “codebook4”, instead of “Codebook1”, “Codebook2”, “Codebook3”, and “Codebook4”.  In clause 6.1.1.1, deleted instances of referencing in section 6.1.1.1 of 38.214.  In clause 6.1.1.1, adding the statement with corrected references.  *In RAN1#117*  In clause 4.1, modified the RRC parameter enhanced-dmrs-Type to dmrs-TypeEnh in TS 38.214.  In clause 5.1.6.2, updated the parameter names in 38.214 to align the name with parameter names defined in 38.306.  **NR\_MC\_enh-Core**  In clauses 5.5, modified clause title.  In cluase 6.1.6, clarified that the Rel-16 or Rel-17 parameters in 6.1.6.2.0 or 6.1.6.3 is replaced by corresponding Rel-18 parameters when the procedure in 6.1.6.2.0 or 6.1.6.3 applies to UE configured with Rel-18 UL Tx switching with 3 or 4 bands..  In clause 6.2.1.3, added UE behavior.  *In RAN1#117*  In clause 6.1.6, For R18 uplink Tx switching, the switching gap is determined based on RRC parameter *switchingPeriodConfigForBandPair*.  **NR\_pos\_enh2-Core**  In clause 5.1.6.5, modified “DL PRS ID” as “DL-PRS ID”.  In clause 6.2.1.4.1, added reference to higher layer parameters. Correct the higher layer parameter which is associated with UL time window.  In clause 6.2.1.4.1, restricted that the timeline defined for RedCap UE SRS hopping only applicable for RRC\_CONNECTED state.  In clause 6.2.1.4.1, specify the timeline for determination of collision between SRS for positioning frequency hopping and other signals or channels for semi-persistent case.  In clause 6.2.1.4.1, clarified that when SRS with FH is used with aperiodic triggering, the switching time is added to the timeline.  In clause 6.2.1.4.1, when the reduced capability UE is configured with SRS frequency hopping for positioning, including a switching time to and from the active bandwidth part, the UE shall use the same priority rules as defined in Clause 6.2.1 during the switching time as if the SRS frequency hopping for positioning was configured.  In clause 6.2.1.4.2, ▪ replaced ‘switching period’ by ‘guard period’ for RRC\_CONNECTED state. ▪ added descriptions that the guard period may affect the signal transmission or reception on the affected band(s); ▪ added new description that UE needs to consider priority between positioning SRS and other signals/channels in the affected bands. And the other signals or channels in the affected band(s) have the same priority as that in the same carrier of the SRS.  In clause 8.2.4, deleted “Each SL PRS transmission is associated with an PSCCH transmission in the same slot.”  In clause 8.2.4.3, captured the new processing timing capability 3 for SL-PRS Congestion control  In section 8.3, in case that SCI format 1-A indicates an MCS table that the UE does not support, a UE is required to decode neither the corresponding SCI formats 2-A, 2-B, 2-C nor corresponding SCI format 2-D.  In clause 8.1, remove square brackets on higher layer parameters pending decision.  *In RAN1#117*  Clause 5.1.6.5.1:   * Replace “[*nr-Requested-DL-PRS-measurementBasedOnMultihopRx*]” with “*nr-DL-PRS-RxHoppingRequest*”. * Replace placeholder “[*higher layer parameter*]” with actual parameter name “*nr-ReportDL-PRS-MeasBasedOnSingleOrMultiHopRx*”.   Clause 5.1.6.5.3:   * Replace *nr-DL-PRS-JointMeasurementRequested* with *nr-DL-PRS-JointMeasurementRequestedPFL-List*.   Clause 6.2.1.4:   * For Rel-18 LPHAP, remove brackets around *SRS-SpatialRelationInfoPos*.   Clause 6.2.1.4.1:   * Update ‘*srs-PosUplinkTransmissionWindowConfig*’ to ‘*SRS-PosTx-Hopping*’. * Clarify in the spec that the starting slot offset for the first hop and that for the hops following the first hop are configured with different parameters. Add slot offset parameter for periodic and semi-persistent SRS. * Remove brackets for hopping cycle for SRS with Tx frequency hopping during uplink time window. * Align higher layer parameter names including replacing placeholders with actual parameter names agreed by RAN2, including references to *startPosition, nrofSymbols*, and *SRS-PosTx-Hopping*.   Clause 6.2.1.4.2:   * Replace “*freqInfoAdditionalCcList* on” with “frequency information via *freqInfo* in *SRS-PosResourceSetLinkedForAggBW* for”.   Clause 8.2.4:   * Describe comb offset and comb size for dedicated SL PRS resource pool and for shared SL PRS resource pool, respectively. Add “in a dedicated SL PRS resource pool. *sl-PRS-CombSizeN-AndReOffset* indicates a comb offset and a comb size of the SL PRS resource in a shared SL PRS resource pool”. * Change *sl-NumberOfSymbols* to *mNumberOfSymbols* for shared SL PRS resource pool.   Clause 8.2.4.2A:   * Replace “SL-PRS resource ID (s)” with “Resource ID indication”. * Add ""sl-MaxNumPerReserve” is replaced by “sl-MaxNumPerReserveDedicatedSL-PRS-RP””. * Delete “[potential parameter name changes]”.   Clause 8.2.4.3:   * Add “"*sl-CR-Limit*” is replaced by “*sl-PRS-CR-Limit*”“.   Delete “[potential parameter name changes]”.  In clause 5.1.6.5.2, 1. Correct the DL RSCPD measurement report.   1. Correct the IE name *[phase quality index] -> phaseQualityValue.* 2. Correct several typos in 5.1.6.5.2.   **NR\_redcap\_enh-Core, NR\_MBS\_enh-Core**  In clause 5.1 align RRC parameter names with TS 38.331 v18.0.0 in Clause 5.1; (replacing supportOfRedCap-r18 with supportOfERedCap and replacing FG 48-2 with eRedCapNotReducedBB-BW). 2. Remove return in middle of paragraph.  In clause 5.1.2.1.1, separate the entries of applicable PDSCH time domain resource allocation table used for multicast MCCH/MTCH in RRC\_INACTIVE from broadcast MCCH/MTCH.  *In RAN1#117*  In clause 5.1, updated the higher layer parameter name *supportOfERedCap*  **NR\_MBS\_enh-Core in RAN1#117**  In clauses 5.1, 5.1.2.2.3, 5.1.3.1, 5.1.3.2, 5.1.4, replaced ‘multicast-MCCH-RNTI’ with ‘Multicast MCCH-RNTI’.  In clause 5.1, removed the PDSCH for multicast in RRC\_INACTIVE from the description on the number of PDSCH scheduled in a slot.  In clause 5.1.3.1, added the description about the case *mcs-Table* of multicast PDSCH in RRC\_INACTIVE set to 'qam64LowSE'  **Netw\_Energy\_NR, in RAN1#117**  In clause 5.2.1.4.2, clarified the utilization of portAubsetIndicator in the context of report quantity configurations.  **NR\_SL\_enh2, in RAN#117**  In clauses 8, 8.1.4, 8.1.5, deleted extra blank spaces.  In clause 8.1.4, updated the description on “UE shall assume that any set of L\_"subCH" contiguous sub-channels or L\_"subCH" contiguous sub-channels in L\_"RBset" contiguous RB sets” as the definition for both one candidate single-slot resource and one candidate multi-slot resource in SL partial sensing.  In clause 8, clarified that in case of the highest sub-channel of PSSCH overlaps with a single RB set and the highest PRB in the sub-channel overlaps with intra-cell guard band PRBs, the UE can transmit PSSCH on the PRBs belonging to the allocated sub-channel(s) except for the intra-cell guard band PRBs within the highest sub-channel. | | | | | |
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| ***Consequences if not approved:*** | Incomplete and unclear specification for MIMO Evolution for Downlink and Uplink. | | | |
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| ***Clauses affected:*** | 2, 4.1, 5.1, 5.1.2.1.1, 5.1.2.2.3, 5.1.3.1, 5.1.3.2, 5.1.4, 5.1.5, 5.1.6.2, 5.1.6.5, 5.1.6.5.1, 5.1.6.5.2, 5.1.6.5.3, 5.2.1.4.2, 5.2.1.5.1, 5.2.5, 5.5, 6.1, 6.1.1.1, 6.1.1.2, 6.1.6, 6.2.1.3, 6.2.1.4, 6.2.1.4.1, 6.2.1.4.2, 8.1, 8.1.4, 8.2.4, 8.2.4.2A, 8.2.4.3, 8.3 | | | |
|  |  | | | |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  | Other core specifications | ... |
| ***affected:*** |  | **X** | Test specifications | ... |
| ***(show related CRs)*** |  | **X** | O&M Specifications | ... |
|  |  | | | |
| ***Other comments:*** |  | | | |
|  |  | | | |
| ***This CR's revision history:*** |  | | | |

<omitted text>

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications"

[2] 3GPP TS 38.201: " NR; Physical Layer – General Description"

[3] 3GPP TS 38.202: "NR; Services provided by the physical layer"

[4] 3GPP TS 38.211: "NR; Physical channels and modulation"

[5] 3GPP TS 38.212: "NR; Multiplexing and channel coding"

[6] 3GPP TS 38.213: "NR; Physical layer procedures for control"

[7] 3GPP TS 38.215: "NR; Physical layer measurements"

[8] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone"

[9] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception"

[10] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification"

[11] 3GPP TS 38.133: "NR; Requirements for support of radio resource management"

[12] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification"

[13] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities"

[14] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)"

[15] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation"

[16] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access"

[17] 3GPP TS 37.355: "LTE Positioning Protocol (LPP)"

[18] 3GPP TS 38.822: "NR; User Equipment (UE) feature list"

[19] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures"

[20] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN"

[21] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone"

<omitted text>

## 4.1 Power allocation for downlink

The gNB determines the downlink transmit EPRE.

For the purpose of SS-RSRP, SS-RSRQ and SS-SINR measurements, the UE may assume downlink EPRE is constant across the bandwidth. For the purpose of SS-RSRP, SS-RSRQ and SS-SINR measurements, the UE may assume downlink EPRE is constant over SSS carried in different SS/PBCH blocks. For the purpose of SS-RSRP, SS-RSRQ and SS-SINR measurements, the UE may assume that the ratio of SSS EPRE to PBCH DM-RS EPRE is 0 dB.

For the purpose of CSI-RSRP, CSI-RSRQ and CSI-SINR measurements, the UE may assume downlink EPRE of a port of CSI-RS resource configuration is constant across the configured downlink bandwidth and constant across all configured OFDM symbols.

The downlink SS/PBCH SSS EPRE can be derived from the SS/PBCH downlink transmit power given by the parameter *ss-PBCH-BlockPower* provided by higher layers. The downlink SSS transmit power is defined as the linear average over the power contributions (in [W]) of all resource elements that carry the SSS within the operating system bandwidth.

The downlink CSI-RS EPRE can be derived from the SS/PBCH block downlink transmit power given by the parameter *ss-PBCH-BlockPower* and CSI-RS power offset given by the parameter *powerControlOffsetSS* provided by higher layers if the SS/PBCH block is associated with serving cell PCI, or derived from *ss-PBCH-BlockPower-r17* in *SSB-MTC-AdditionalPCI-r17* and *powerControlOffsetSS* provided by higher layersif the SS/PBCH block is associated with additional PCI different from serving cell PCI, where the CSI-RS is QCLed with the SS/PBCH block. The downlink reference-signal transmit power is defined as the linear average over the power contributions (in [W]) of the resource elements that carry the configured CSI-RS within the operating system bandwidth.

For downlink DM-RS associated with PDSCH, the UE may assume the ratio of PDSCH EPRE to DM-RS EPRE ( [dB]) is given by Table 4.1-1 according to the number of DM-RS CDM groups without data as described in Clause 5.1.6.2. The DM-RS scaling factor  specified in Clause 7.4.1.1.2 of [4, TS 38.211] is given by .

Table 4.1-1: The ratio of PDSCH EPRE to DM-RS EPRE

|  |  |  |
| --- | --- | --- |
| Number of DM-RS CDM groups without data | DM-RS configuration type 1 and enhanced type 1 | DM-RS configuration type 2 and enhanced type 2 |
| 1 | 0 dB | 0 dB |
| 2 | -3 dB | -3 dB |
| 3 | - | -4.77 dB |

When the UE is scheduled with one or two PT-RS ports associated with the PDSCH,

- if the UE is configured with the higher layer parameter *epre-Ratio*, the ratio of PT-RS EPRE to PDSCH EPRE per layer per RE for each PT-RS port () is given by Table 4.1-2 or Table 4.1-2A according to the *epre-Ratio*, the PT-RS scaling factor specified in clause 7.4.1.2.2 of [4, TS 38.211] is given by.

- otherwise, the UE shall assume *epre-Ratio* is set to state '0' in Table 4.1-2 if not configured.

Table 4.1-2: PT-RS EPRE to PDSCH EPRE per layer per RE (), if *dmrs-TypeEnh* is not configured in *DMRS-DownlinkConfig*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *epre-Ratio* | The number of PDSCH layers with DM-RS associated to the PT-RS port | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 0 | 0 | 3 | 4.77 | 6 | 7 | 7.78 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Reserved | | | | | |
| 3 | Reserved | | | | | |

Table 4.1-2A: PT-RS EPRE to PDSCH EPRE per layer per RE (), if *dmrs-TypeEnh* is configured in *DMRS-DownlinkConfig*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***epre-Ratio*** | **The number of PDSCH layers with DM-RS associated to the PT-RS port** | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 0 | 0 | 3 | 4.77 | 6 | 7 | 7.78 | 8.45 | 9 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | reserved | | | | | | | |
| 3 | reserved | | | | | | | |

For link recovery, as described in clause 6 of [6, TS 38.213] the ratio of the PDCCH EPRE to NZP CSI-RS EPRE is assumed as 0 dB.

# 5 Physical downlink shared channel related procedures

## 5.1 UE procedure for receiving the physical downlink shared channel

For downlink, a maximum of 16 HARQ processes per cell are supported by the UE, or subject to UE capability, a maximum of 32 HARQ processes per cell as defined in [13, TS 38.306]. The number of processes the UE may assume will at most be used for the downlink is configured to the UE for each cell separately by higher layer parameter *nrofHARQ-ProcessesForPDSCH* or *nrofHARQ-ProcessesForPDSCH-v1700*, and when no configuration is provided the UE may assume a default number of 8 processes.

A UE shall upon detection of a PDCCH with a configured DCI format 1\_0, 1\_1, 1\_2, 1\_3, 4\_0, 4\_1, or 4\_2 decode the corresponding PDSCHs as indicated by that DCI. When the UE is scheduled with multiple PDSCHs on a serving cell by a DCI, HARQ process ID indicated by this DCI applies to the first PDSCH not overlapping with a UL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, HARQ process ID is then incremented by 1 for each subsequent PDSCH(s) in the scheduled order, with modulo operation of *nrofHARQ-ProcessesForPDSCH* applied if *nrofHARQ-ProcessesForPDSCH* is provided, or with modulo operation of *nrofHARQ-ProcessesForPDSCH-v1700* applied if or *nrofHARQ-ProcessesForPDSCH-v1700* is provided, or with modulo operation of 8 applied, otherwise. HARQ process ID is not incremented for PDSCH(s) not received if at least one of the symbols indicated by the indexed row of the used resource allocation table in the slot overlaps with a UL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided. When a UE is configured by the higher layer parameter *repetitionScheme* set to 'tdmSchemeA', the PDSCH includes two PDSCH transmission occasions. For each PDSCH, if either PDSCH occasion overlaps with a UL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, the PDSCH is not received and HARQ process ID is not increment for the PDSCH. For any HARQ process ID(s) in a given scheduled cell, the UE is not expected to receive a PDSCH that overlaps in time with another PDSCH if the UE is not capable of receiving FDMed unicast and multicast PDSCH per slot per carrier. When HARQ feedback for the HARQ process ID is not disabled, or for the HARQ process associated with the first SPS PDSCH when *HARQ-feedbackEnablingforSPSactive* is provided and enabled, the UE is not expected to receive another PDSCH for a given HARQ process until after the end of the expected transmission of HARQ-ACK for that HARQ process, where the timing is given by Clause 9.2.3 of [6, TS 38.213]. For HARQ-ACK subject to HARQ-ACK deferral described in Clause 9.2.5.4 of [6 TS 38.213], the expected transmission of HARQ-ACK corresponds to the expected transmission HARQ-ACK in a first slot. When HARQ feedback for the HARQ process ID is disabled, the UE is not expected to receive another PDCCH carrying a DCI scheduling a PDSCH or set of slot-aggregated PDSCH scheduled for the given HARQ process or to receive another PDSCH without corresponding PDCCH for the given HARQ process that starts until Tproc,1 after the end of the reception of the last PDSCH or slot-aggregated PDSCH for that HARQ process. Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* in a given scheduled cell, the UE is not expected to receive a first PDSCH and a second PDSCH, starting later than the first PDSCH, with its corresponding HARQ-ACK assigned to be transmitted on a resource ending before the start of a different resource for the HARQ-ACK assigned to be transmitted for the first PDSCH, where the two resources are in different slots for the associated HARQ-ACK transmissions, each slot is composed of symbols [4] or a number of symbols indicated by *subslotLengthForPUCCH* if provided, and the HARQ-ACK for the two PDSCHs are associated with the HARQ-ACK codebook of the same priority. Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* in a given scheduled cell, the UE is not expected to receive a first PDSCH, and a second PDSCH, starting later than the first PDSCH, with its corresponding HARQ-ACK assigned to be transmitted on a resource ending before the start of a different resource for the HARQ-ACK assigned to be transmitted for the first PDSCH if the HARQ-ACK for the two PDSCHs are associated with HARQ-ACK codebooks of different priorities. For any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start receiving a first PDSCH starting in symbol *j* by a PDCCH ending in symbol *i* on a scheduling cell, the UE is not expected to be scheduled to receive a PDSCH starting earlier than the end of the first PDSCH with a PDCCH that ends later than symbol *i* of a scheduling cell,. When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], the PDCCH ending in symbol *i* is determined based on the PDCCH candidate that ends later in time. In a given scheduled cell, for any PDSCH corresponding to SI-RNTI, the UE is not expected to decode a re-transmission of an earlier PDSCH with a starting symbol less than *N* symbols after the last symbol of that PDSCH, where the value of *N* depends on the PDSCH subcarrier spacing configuration *μ,* with *N*=13 for *μ*=0, *N*=13 for *μ*=1, *N*=20 for *μ*=2, *N*=24 for *μ*=3, *N*=96 for *m*=5, and *N*=192 for *m*=6.

When receiving PDSCH scheduled with SI-RNTI, P-RNTI, MCCH-RNTI, G-RNTI for broadcast, Multicast MCCH-RNTI, G-RNTI for multicast in RRC\_INACTIVE state, the UE may assume that the DM-RS port of PDSCH is quasi co-located with the associated SS/PBCH block with respect to Doppler shift, Doppler spread, average delay, delay spread, spatial RX parameters when applicable.

When receiving PDSCH scheduled with RA-RNTI, or MSGB-RNTI, the UE may assume that the DM-RS port of PDSCH is quasi co-located with the SS/PBCH block or the CSI-RS resource the UE used for RACH association as applicable, and transmission with respect to Doppler shift, Doppler spread, average delay, delay spread, spatial RX parameters when applicable. When receiving a PDSCH scheduled with RA-RNTI in response to a random access procedure triggered by a PDCCH order which triggers contention-free random access procedure for the SpCell [10, TS 38.321], the UE may assume that the DM-RS port of the received PDCCH order and the DM-RS ports of the corresponding PDSCH scheduled with RA-RNTI are quasi co-located with the same SS/PBCH block or CSI-RS with respect to Doppler shift, Doppler spread, average delay, delay spread, spatial RX parameters when applicable. If a UE is configured with *SSB-MTC-AddtionalPCI* and with *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, and if the UE is configured with [*twoTAGs*]for the SpCell, if the UE attempts to detect the DCI format 1\_0 with CRC scrambled by the corresponding RA-RNTI or when receiving a PDSCH scheduled with RA-RNTI in response to a random access procedure triggered by a PDCCH order which triggers contention-free random access procedure for the SpCell [10, TS 38.321], and if the CORESET used for the PDCCH order transmission is not associated with the serving cell physical cell ID, the UE may assume that the DM-RS ports of the received PDSCH are quasi co-located with the DM-RS antenna port associated with PDCCH receptions in the CORESET for Type1-PDCCH CSS set with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial RX parameters when applicable.

When receiving PDSCH in response to a PUSCH transmission scheduled by a RAR UL grant or corresponding PUSCH retransmission, or when receiving PDSCH in response to a PUSCH for Type-2 random access procedure, or a PUSCH scheduled by a fallbackRAR UL grant or corresponding PUSCH retransmission, the UE may assume that the DM-RS port of PDSCH is quasi co-located with the SS/PBCH block the UE selected for RACH association and transmission with respect to Doppler shift, Doppler spread, average delay, delay spread, spatial RX parameters when applicable.

If the UE is not configured for PUSCH/PUCCH transmission for at least one serving cell configured with slot formats comprised of DL and UL symbols, and if the UE is not capable of simultaneous reception and transmission on serving cell *c1*and serving cell *c2*, the UE is not expected to receive PDSCH on serving cell *c1* if the PDSCH overlaps in time with SRS transmission (including any interruption due to uplink or downlink RF retuning time [10]) on serving cell *c2* not configured for PUSCH/PUCCH transmission.

The UE is not expected to decode a PDSCH in a serving cell scheduled by a PDCCH with C-RNTI, CS-RNTI, MCS-C-RNTI, G-RNTI, G-CS-RNTI or MCCH-RNTI and one or multiple PDSCH(s) required to be received according to this Clause in the same serving cell without a corresponding PDCCH transmission if the PDSCHs partially or fully overlap in time except if the PDCCH scheduling the PDSCH ends at least 14 symbols before the earliest starting symbol of the PDSCH(s) without the corresponding PDCCH transmission, where *m* and the symbol duration are based on the smallest numerology between the scheduling PDCCH and the PDSCH, in which case the UE shall decode the PDSCH scheduled by the PDCCH. When the PDCCH reception incudes two PDCCH candidates from two respective search space sets, as described in clause 10 of [6, TS 38.213], for the purpose of determining the PDCCH with C-RNTI, CS-RNTI or MCS-C-RNTI scheduling the PDSCH ends at least 14 symbols before the earliest starting symbol of the PDSCH(s) without the corresponding PDCCH transmission, the PDCCH candidate that ends later in time is used.

The UE is not expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, G-RNTI for multicast or broadcast, MCCH-RNTI, Multicast-MCCH-RNTI, G-CS-RNTI or CS-RNTI if another PDSCH in the same cell scheduled with RA-RNTI or MSGB-RNTI partially or fully overlap in time.

Furthermore, a UE indicating *supportOfERedCap* capability but not indicating *eRedCapNotReducedBB-BW* is not expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, G-RNTI for multicast or broadcast, MCCH-RNTI, Multicast-MCCH-RNTI, G-CS-RNTI or CS-RNTI in the same or next slot if another PDSCH in the same cell is scheduled with RA-RNTI or MSGB-RNTI, when the PDSCH scheduled with RA-RNTI or MSGB-RNTI is allocated more than 25 PRBs when configured with SCS m = 0 or more than 12 PRBs when configured with SCS m = 1.

The UE in RRC\_IDLE and RRC\_INACTIVE modes shall be able to decode two PDSCHs each scheduled with SI-RNTI, P-RNTI, RA-RNTI or TC-RNTI, where the PDSCH scheduled with TC-RNTI for a reduced capability UE that indicates *supportOfERedCap* is allocated no more than 25 PRBs when configured with SCS m = 0 or no more than 12 PRBs when configured with SCS m = 1, with the two PDSCHs partially or fully overlapping in time in non-overlapping PRBs.

The UE:

- is expected to decode PDSCH scheduled with MCCH-RNTI or Multicast-MCCH-RNTI, and PBCH in PCell that partially or fully overlaps in time in non-overlapping PRBs in PCell.

- is not expected to decode PDSCH scheduled with G-RNTI for broadcast and PBCH in PCell that partially or fully overlaps in time in non-overlapping PRBs in PCell.

- is not expected to decode PDSCH scheduled with G-RNTI for multicast and PBCH in PCell that partially or fully overlaps in time in non-overlapping PRBs in PCell.

On a frequency range 1 cell, the UE shall be able to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI and, during a process of P-RNTI triggered SI acquisition, another PDSCH scheduled with SI-RNTI that partially or fully overlap in time in non-overlapping PRBs, unless the PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI requires Capability 2 processing time according to clause 5.3 in which case the UE may skip decoding of the scheduled PDSCH with C-RNTI, MCS-C-RNTI, or CS-RNTI.

On a frequency range 2 cell, the UE is not expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI if in the same cell, during a process of P-RNTI triggered SI acquisition, another PDSCH scheduled with SI-RNTI partially or fully overlap in time.

A UE that indicates *supportOfERedCap* capability but does not indicate *eRedCapNotReducedBB-BW*, during a process of P-RNTI triggered SI acquisition, when the total number of PRBs for the PDSCH scheduled with SI-RNTI and the PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI scheduled in the slot is larger than 25 PRBs if configured with SCS µ = 0 or larger than 12 PRBs if configured with SCS µ = 1, the UE may skip decoding of the scheduled PDSCH with C-RNTI, MCS-C-RNTI, or CS-RNTI.

The UE is expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI during a process of autonomous SI acquisition.

In RRC\_CONNECTED state, the maximum number of PDSCHs scheduled per slot per component carrier with C-RNTI/CS-RNTI and G-RNTI/G-CS-RNTI/MCCH-RNTI that the UE shall be able to decode is the same as the indicated UE capability for the number of unicast PDSCHs per slot per component carrier. If the UE is capable of receiving FDMed unicast and multicast PDSCH per slot per carrier, the UE shall be able to decode a PDSCH scheduled by a DCI format with C-RNTI or a PDSCH scheduled for a retransmission of a TB by a DCI format with CS-RNTI and a PDSCH scheduled by a DCI format with G-RNTI for multicast or a PDSCH scheduled for a retransmission of a TB by a DCI format with G-CS-RNTI that partially or fully overlap in time in non-overlapping PRBs. If the UE is capable of receiving FDMed unicast and broadcast PDSCH per slot per carrier, the UE shall be able to decode a PDSCH scheduled by a DCI format with C-RNTI or a PDSCH scheduled for a retransmission of a TB by a DCI format with CS-RNTI and a PDSCH scheduled with G-RNTI for broadcast/MCCH-RNTI that partially or fully overlap in time in non-overlapping PRBs. For a reduced capability UE that indicates *supportOfERedCap* but not indicating *eRedCapNotReducedBB-BW*, if the UE is capable of receiving FDMed unicast and multicast/broadcast PDSCH per slot, the UE can decode the two PDSCHs, with the two PDSCHs partially or fully overlapping in time in non-overlapping PRBs,

- if the total number of PRBs allocated is no more than 25 PRBs when configured with SCS m = 0 or no more than 12 PRBs when configured with SCS m = 1,

- otherwise, the UE may skip decoding one of the two PDSCHs.

If the UE is configured by higher layers to decode a PDCCH with its CRC scrambled by a CS-RNTI or G-CS-RNTI, the UE shall receive PDSCH transmissions without corresponding PDCCH transmissions using the higher-layer-provided PDSCH configuration for those PDSCHs.

The UE is not expected to support reception of:

- FDMed broadcast MCCH PDSCH and broadcast MTCH PDSCH in PCell or SCell, or

- FDMed multiple broadcast MTCH PDSCHs in PCell or SCell, or

- FDMed broadcast MCCH/broadcast MTCH/multicast PDSCH and SIB PDSCH in PCell, or

- FDMed multicast PDSCHs in PCell or SCell, or

- FDMed multicast PDSCH and MCCH/broadcast MTCH PDSCH in PCell or SCell, or

- FDMed broadcast MCCH/broadcast MTCH/multicast PDSCH and paging PDSCH.

The UE in RRC\_INACTIVE state is not expected to support reception of:

- FDMed multicast MCCH PDSCH and multicast MTCH PDSCH in Pcell, or

- FDMed multiple multicast MTCH PDSCHs in Pcell, or

- FDMed broadcast MCCH/broadcast MTCH/multicast MCCH/multicast MTCH and SIB PDSCH in Pcell, or

- FDMed multicast MCCH/multicast MTCH and broadcast MCCH/broadcast MTCH in Pcell, or

- FDMed multicast MCCH/multicast MTCH and paging PDSCH in Pcell.

If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, the UE may expect to receive multiple PDCCHs scheduling fully/partially/non-overlapped PDSCHs in time and frequency domain. The UE may expect the reception of full/partially-overlapped PDSCHs in time, only when PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex*. For a *ControlResourceSet* without *coresetPoolIndex*, the UE may assume that the *ControlResourceSet* is assigned with *coresetPoolIndex* as 0. When the UE is configured with *SSB-MTC-AdditionalPCI*, *ControlResourceSets* corresponding to different *coresetPoolIndex* values may be associated with different physical cell IDs via activated TCI states of the *ControlResourceSets*, where *ControlResourceSets* corresponding to one *coresetPoolIndex* is associated with the serving cell physical cell ID and *ControlResourceSets* corresponding to another *coresetPoolIndex* can be associated with another physical cell ID. When the UE is scheduled with full/partially/non-overlapped PDSCHs in time and frequency domain, the full scheduling information for receiving a PDSCH is indicated and carried only by the corresponding PDCCH, the UE is expected to be scheduled with the same active BWP and the same SCS. When the UE is scheduled with full/partially-overlapped PDSCHs in time and frequency domain, the UE can be scheduled with at most two codewords simultaneously. When PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* the following operations are allowed:

- For any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start receiving a first PDSCH starting in symbol *j* by a PDCCH associated with a value of *coresetPoolIndex* ending in symbol *i*, the UE can be scheduled to receive a PDSCH starting earlier than the end of the first PDSCH with a PDCCH associated with a different value of *coresetPoolIndex* that ends later than symbol *i*.

- In a given scheduled cell, the UE can receive a first PDSCH in slot *i*, with the corresponding HARQ-ACK assigned to be transmitted in slot *j*, and a second PDSCH associated with a value of *coresetPoolIndex* different from that of the first PDSCH starting later than the first PDSCH with its corresponding HARQ-ACK assigned to be transmitted in a slot before slot *j*.

If PDCCHs that schedule corresponding PDSCHs are associated to the same or different *ControlResourceSets* having the same value of *coresetPoolIndex*, the UE procedure for receiving the PDSCH upon detection of a PDCCH follows Clause 5.1.

A UE does not expect to be configured with *repetitionScheme* if the UE is configured with higher layer parameter *repetitionNumber* for the same PDSCH.

When a UE is configured by higher layer parameter *repetitionScheme* set to one of 'fdmSchemeA*'*, 'fdmSchemeB*'*, 'tdmSchemeA*'*, if the UE not configured with *dl-OrJointTCI-StateList* is indicated with two TCI states in a codepoint of the DCI field *'Transmission Configuration Indication'* or if the UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI States to be applied to PDSCH and the UE is indicated with DM-RS port(s) within one CDM group in the DCI field '*Antenna Port(s)'*.

- When the UE is set to 'fdmSchemeA*',* the UE shall receive a single PDSCH transmission occasion of the TB with each TCI state associated to a non-overlapping frequency domain resource allocation as described in Clause 5.1.2.3.

- When the UE is set to 'fdmSchemeB*'*, the UE shall receive two PDSCH transmission occasions of the same TB with each TCI state associated to a PDSCH transmission occasion which has non-overlapping frequency domain resource allocation with respect to the other PDSCH transmission occasion as described in Clause 5.1.2.3.

- When the UE is set to 'tdmSchemeA*'*, the UE shall receive two PDSCH transmission occasions of the same TB with each TCI state associated to a PDSCH transmission occasion which has non-overlapping time domain resource allocation with respect to the other PDSCH transmission occasion and both PDSCH transmission occasions shall be received within a given slot as described in Clause 5.1.2.1.

When a UE is configured by the higher layer parameter *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation*, the UE not configured with *dl-OrJointTCI-StateList* may expect to be indicated with one or two TCI states in a codepoint of the DCI field *'Transmission Configuration Indication'* or when the UE configured with *dl-OrJointTCI-StateList* may expect to apply one or two indicated TCI states to the PDSCH, together with the DCI field '*Time domain resource assignment*' indicating an entry which contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* and DM-RS port(s) within one CDM group in the DCI field '*Antenna Port(s)'*.

- When two TCI states are indicated in a DCI with '*Transmission Configuration Indication*' field for the UE not configured with *dl-OrJointTCI-StateList*, or when the UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI States to be applied to PDSCH, the UE may expect to receive multiple slot level PDSCH transmission occasions of the same TB with two TCI states used across multiple PDSCH transmission occasions in the *repetitionNumber* consecutive slots as defined in Clause 5.1.2.1.

- When one TCI state is indicated in a DCI with '*Transmission Configuration Indication*' field for the UE not configured with *dl-OrJointTCI-StateList*, or when the UE configured with *dl-OrJointTCI-StateList* is having one indicated TCI states to be applied to PDSCH, the UE may expect to receive multiple slot level PDSCH transmission occasions of the same TB with one TCI state used across multiple PDSCH transmission occasions in the *repetitionNumber* consecutive slots as defined in Clause 5.1.2.1.

When a UE is not indicated with a DCI that DCI field '*Time domain resource assignment*' indicating an entry which contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation*, and it is indicated with two TCI states in a codepoint of the DCI field *'Transmission Configuration Indication'* for the UE not configured with *dl-OrJointTCI-StateList*, or when the UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI States to be applied to PDSCH, and is indicated with DM-RS port(s) within two CDM groups in the DCI field '*Antenna Port(s)'* and it is not configured with higher layer parameter *sfnSchemePDSCH*, the UE may expect to receive a single PDSCH where the association between the DM-RS ports and the TCI states are as defined in Clause 5.1.6.2.

When a UE is not indicated with a DCI that DCI field '*Time domain resource assignment*' indicating an entry which contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation*, and it is not configured with *dl-OrJointTCI-StateList* and is indicated with one TCI states in a codepoint of the DCI field *'Transmission Configuration Indication',* or it is configured with *dl-OrJointTCI-StateList* and is expected to apply one indicated TCI states to PDSCH, the UE procedure for receiving the PDSCH upon detection of a PDCCH follows Clause 5.1.

When a UE is configured with higher layer parameter *sfnSchemePDSCH* set to either *'*sfnSchemeA*'* or *'*sfnSchemeB*'* and

- if the UE reports its capability of *sfn-SchemeA-DynamicSwitching* or *sfn-SchemeB-DynamicSwitching*, the UE not configured with *dl-OrJointTCI-StateList* is indicated with one or two TCI state(s) in a codepoint of the DCI field *'Transmission Configuration Indication'* in DCI format 1\_1/1\_2, or the UE configured with *dl-OrJointTCI-StateList* is having one or two indicated TCI States to be applied to PDSCH

- otherwise, the UE not configured with *dl-OrJointTCI-StateList* is not expected to be indicated with one TCI state per any of TCI codepoint by MAC CE, and the UE is indicated with two TCI states in a codepoint of the DCI field *'Transmission Configuration Indication'* in DCI format 1\_1/1\_2, or the UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI States to be applied to PDSCH

the UE procedure for receiving the PDSCH upon detection of a PDCCH follows clause 5.1 and the QCL assumption for the PDSCH as defined in clause 5.1.5.

When a UE is configured with both *sfnSchemePDSCH* and *sfnSchemePDCCH*, the UE shall expect that *sfnSchemePDSCH* and *sfnSchemePDCCH* are set to the same scheme, either *'*sfnSchemeA*'* or *'*sfnSchemeB*'*.

If a UE not configured with *dl-OrJointTCI-StateList* is configured with *sfnSchemePDCCH* set to 'sfnSchemeA' and activated with two TCI states by MAC CE, and the UE does not report its capability of *sfn-SchemeA-PDCCH-only*, the UE is expected to be configured with *sfnSchemePDSCH* set to *'sfnSchemeA'* and indicated with two TCI states in a codepoint of the DCI field *'Transmission Configuration Indication',* if the PDSCH is scheduled by DCI format 1\_1/1\_2.

If a UE configured with *dl-OrJointTCI-StateList* and having two indicated TCI-States is configured with *sfnSchemePdcch* set to 'sfnSchemeA' for a DL BWP and signaled by the higher layer parameter [applyIndicatedTCIState] to apply both indicated TCI-States to a PDCCH on a CORESET, and the UE does not report its capability of *sfn-SchemeA-PDCCH-only*, the UE is expected to be configured with *sfnSchemePdsch* set to *'sfnSchemeA'* and both indicated TCI-States are applicable to PDSCH, if the PDSCH is scheduled by DCI format 1\_1/1\_2 on the PDCCH.

If a UE not configured with *dl-OrJointTCI-StateList* is configured with *sfnSchemePDCCH* set to 'sfnSchemeB' and activated with two TCI states by MAC CE, the UE is expected to be configured with *sfnSchemePDSCH* set to *'sfnSchemeB'* and indicated with two TCI states in a codepoint of the DCI field *'Transmission Configuration Indication',* if the PDSCH is scheduled by DCI format 1\_1/1\_2.

If a UE configured with *dl-OrJointTCI-StateList* and having two indicated TCI-States is configured with *sfnSchemePdcch* set to 'sfnSchemeB' for a DL BWP, and signaled by the higher layer parameter [applyIndicatedTCIState] to apply both indicated TCI-States to a PDCCH on a CORESET, the UE is expected to be configured with *sfnSchemePdsch* set to *'sfnSchemeB'* and both indicated TCI-States are applicable to PDSCH*,* if the PDSCH is scheduled by DCI format 1\_1/1\_2 on the PDCCH.

When a UE is configured with *sfnSchemePDSCH* and/or *sfnSchemePDCCH*, the UE shall expect that the *sfnSchemePDSCH* and/or *sfnSchemePDCCH* configuration are the same within a CC, and the UE shall expect that the *sfnSchemePDSCH* and/or *sfnSchemePDCCH* configuration are the same in all CCs in a same frequency band if the UE is configured with CA, where the UE does not expect to be configured with *sfnSchemePDSCH* and/or *sfnSchemePDCCH* in initial BWP in each CC.

If more than one PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot, after resolving overlapping with symbols in the slot indicated as uplink by *tdd-UL-DL-ConfigurationCommon*, or by *tdd-UL-DL-ConfigurationDedicated*, or determined as non-active periods of cell DTX, if the serving cell is activated with cell DTX, based on [10, TS 38.321], a UE receives one or more PDSCHs without corresponding PDCCH transmissions in the slot as specified below.

‒ Step 0: set *j=0*, where *j* is thenumber of selected PDSCH(s) for decoding. *Q* is the set of activated PDSCHs without corresponding PDCCH transmissions within the slot

‒ Step 1: A UE receives one PDSCH with the lowest configured *sps-ConfigIndex* within *Q*, set *j=j+1*. Designate the received PDSCH as survivor PDSCH.

‒ Step 2: The survivor PDSCH in step 1 and any other PDSCH(s) overlapping (even partially) with the survivor PDSCH in step 1 are excluded from *Q*.

‒ Step 3: Repeat step 1 and 2 until *Q* is empty or *j* is equal to the number of unicast/multicast PDSCHs in a slot supported by the UE.

For a cell detected in cell search procedure with synchronization raster defined in Table 5.4.3.1-2 or Table 5.4.3.1-3 of [8, TS 38.101-1], the size of CORESET 0 for the cell in this clause refers to the size of punctured CORESET 0 as defined in clause 7.3.2.2 of [4, TS 38.211] if any.

<omitted text>

##### 5.1.2.1.1 Determination of the resource allocation table to be used for PDSCH

Table 5.1.2.1.1-1 and Table 5.1.2.1.1-1A define which PDSCH time domain resource allocation configuration to apply. Either a default PDSCH time domain allocation A, B or C according to tables 5.1.2.1.1-2, 5.1.2.1.1-3, 5.1.2.1.1-4 and 5.1.2.1.1-5 is applied, or the higher layer configured *pdsch-TimeDomainAllocationList* or *pdsch-TimeDomainAllocationListForMultiPDSCH* or *pdsch-TimeDomainAllocationListDCI-1-2* is applied. For operation with shared spectrum channel access in frequency range 1, as described in [16, TS 37.213], UE reinterprets *S* and *L* in row 9 of Table 5.1.2.1.1-2 as *S=6* and *L=7*.

Table 5.1.2.1.1-1: Applicable PDSCH time domain resource allocation for DCI formats 1\_0, 1\_1, 1\_3, 4\_0, 4\_1 and 4\_2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **RNTI** | **PDCCH search space** | **SS/PBCH block and CORESET multiplexing pattern** | ***PDSCH-ConfigCommon* includes *pdsch-TimeDomainAllocationList*** | ***PDSCH-Config* includes *pdsch-TimeDomainAllocationList*** | ***pdsch-ConfigMCCH / pdsch-ConfigMTCH*  includes *pdsch-TimeDomainAllocationList***  ***Or***  ***pdsch-ConfigMulticast* includes *pdsch-TimeDomainAllocationList*** | ***PDSCH-Config* includes *pdsch-TimeDomainAllocationListForMultiPDSCH*** | **PDSCH time domain resource allocation to apply** |
| SI-RNTI | Type0 common | 1 | - | - | - | - | Default A for normal CP |
| 2 | - | - | - | - | Default B |
| 3 | - | - | - | - | Default C |
| SI-RNTI | Type0A common | 1 | No | - | - | - | Default A |
| 2 | No | - | - | - | Default B |
| 3 | No | - | - | - | Default C |
| 1,2,3 | Yes | - | - | - | *Pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| RA-RNTI, MSGB-RNTI, TC-RNTI | Type1 common | 1,2,3 | No | - | - | - | Default A |
| 1,2,3 | Yes | - | - | - | *Pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| P-RNTI | Type2 common | 1 | No | - | - | - | Default A |
| 2 | No | - | - | - | Default B |
| 3 | No | - | - | - | Default C |
| 1,2,3 | Yes | - | - | - | *Pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| MCCH-RNTI, | Type 0/0B/3 common for broadcast | 1 | No | - | No | *-* | Default A |
| 2 | No | - | No | *-* | Default B |
| 3 | No | - | No | *-* | Default C |
| 1,2,3 | Yes | - | No | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| 1,2,3 | No/Yes | - | Yes | *-* | *pdsch-TimeDomainAllocationList provided in pdsch-ConfigMCCH* |
| multicast-MCC-RNTI | Type 0/0B common for multicast | 1 | No | - | No | *-* | Default A |
| 2 | No | - | No | *-* | Default B |
| 3 | No | - | No | *-* | Default C |
| 1,2,3 | Yes | - | No | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| 1,2,3 | No/Yes | - | Yes | *-* | *pdsch-TimeDomainAllocationList provided in pdsch-ConfigMCCH* |
| G-RNTI for broadcast | Type 0/0B/3 common for broadcast | 1 | No | - | No | *-* | Default A |
| 2 | No | - | No | *-* | Default B |
| 3 | No | - | No | *-* | Default C |
| 1,2,3 | Yes | - | No | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| 1,2,3 | No/Yes | - | Yes | *-* | *pdsch-TimeDomainAllocationList* provided in *pdsch-ConfigMTCH,* if configured, otherwise *pdsch-TimeDomainAllocationList* provided in *pdsch-ConfigMCCH* |
| G-RNTI for multicast in RRC\_INACTIVE | Type 0/0B common for multicast | 1 | No | - | No | *-* | Default A |
| 2 | No | - | No | *-* | Default B |
| 3 | No | - | No | *-* | Default C |
| 1,2,3 | Yes | - | No | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| 1,2,3 | No/Yes | - | Yes | *-* | *pdsch-TimeDomainAllocationList* provided in *pdsch-ConfigMTCH,* if configured, otherwise *pdsch-TimeDomainAllocationList* provided in *pdsch-ConfigMCCH* |
| C-RNTI, MCS-C-RNTI, CS-RNTI | Any common search space associated with CORESET 0 | 1, 2, 3 | No | - | - | - | Default A |
| 1, 2, 3 | Yes | - | - | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| C-RNTI, MCS-C-RNTI, CS-RNTI | Any common search space not associated with CORESET 0  UE specific search space | 1,2,3 | No | No | - | - | Default A |
| 1,2,3 | Yes | No | - | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| 1,2,3 | No/Yes | Yes | - | *-* | *pdsch-TimeDomainAllocationList* provided in *PDSCH-Config* |
| 1,2,3 | No/Yes | - | - | Yes | *pdsch-TimeDomainAllocationListForMultiPDSCH* provided in *PDSCH-Config (Note 2)* |
| G-RNTI for multicast, G-CS-RNTI | Type 3 common search space for multicast | 1,2,3 | No | - | No | - | *Default A* |
| 1,2,3 | Yes | - | No | - | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon (Note 1)* |
| 1,2,3 | No/Yes | - | Yes | - | *pdsch-TimeDomainAllocationList* provided in *pdsch-ConfigMulticast*  *(Note 1)* |
| Note 1: For a UE that supports multicast, the same TDRA table applies to all G-RNTIs and G-CS-RNTIs (configured for multicast) if configured on a given serving cell.  Note 2: If *pdsch-TimeDomainAllocationListForMultiPDSCH* is provided, it is applicable to DCI format 1\_1 only. | | | | | | | |

Table 5.1.2.1.1-1A: Applicable PDSCH time domain resource allocation for DCI format 1\_2

|  |  |  |  |
| --- | --- | --- | --- |
| *PDSCH-ConfigCommon* includes *pdsch-TimeDomainAllocationList* | *PDSCH-Config includes pdsch-TimeDomainAllocationList* | *PDSCH-Config* includes *pdsch- TimeDomainAllocationListDCI-1-2* | PDSCH time domain resource allocation to apply |
| No | No | No | Default A |
| Yes | No | No | *pdsch-TimeDomainAllocationList* provided in *PDSCH-ConfigCommon* |
| No/Yes | Yes | No | *pdsch-TimeDomainAllocationList* provided in *PDSCH-Config* |
| No/Yes | No/Yes | Yes | *pdsch-TimeDomainAllocationListDCI-1-2* provided in *PDSCH-Config* |

Table 5.1.2.1.1-2: Default PDSCH time domain resource allocation A for normal CP

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Row index | *dmrs-TypeA-Position* | PDSCH mapping type | *K0* | *S* | *L* |
| 1 | 2 | Type A | 0 | 2 | 12 |
| 3 | Type A | 0 | 3 | 11 |
| 2 | 2 | Type A | 0 | 2 | 10 |
| 3 | Type A | 0 | 3 | 9 |
| 3 | 2 | Type A | 0 | 2 | 9 |
| 3 | Type A | 0 | 3 | 8 |
| 4 | 2 | Type A | 0 | 2 | 7 |
| 3 | Type A | 0 | 3 | 6 |
| 5 | 2 | Type A | 0 | 2 | 5 |
| 3 | Type A | 0 | 3 | 4 |
| 6 | 2 | Type B | 0 | 9 | 4 |
| 3 | Type B | 0 | 10 | 4 |
| 7 | 2 | Type B | 0 | 4 | 4 |
| 3 | Type B | 0 | 6 | 4 |
| 8 | 2,3 | Type B | 0 | 5 | 7 |
| 9 | 2,3 | Type B | 0 | 5 | 2 |
| 10 | 2,3 | Type B | 0 | 9 | 2 |
| 11 | 2,3 | Type B | 0 | 12 | 2 |
| 12 | 2,3 | Type A | 0 | 1 | 13 |
| 13 | 2,3 | Type A | 0 | 1 | 6 |
| 14 | 2,3 | Type A | 0 | 2 | 4 |
| 15 | 2,3 | Type B | 0 | 4 | 7 |
| 16 | 2,3 | Type B | 0 | 8 | 4 |

Table 5.1.2.1.1-3: Default PDSCH time domain resource allocation A for extended CP

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Row index | *dmrs-TypeA-Position* | PDSCH mapping type | *K0* | *S* | *L* |
| 1 | 2 | Type A | 0 | 2 | 6 |
| 3 | Type A | 0 | 3 | 5 |
| 2 | 2 | Type A | 0 | 2 | 10 |
| 3 | Type A | 0 | 3 | 9 |
| 3 | 2 | Type A | 0 | 2 | 9 |
| 3 | Type A | 0 | 3 | 8 |
| 4 | 2 | Type A | 0 | 2 | 7 |
| 3 | Type A | 0 | 3 | 6 |
| 5 | 2 | Type A | 0 | 2 | 5 |
| 3 | Type A | 0 | 3 | 4 |
| 6 | 2 | Type B | 0 | 6 | 4 |
| 3 | Type B | 0 | 8 | 2 |
| 7 | 2 | Type B | 0 | 4 | 4 |
| 3 | Type B | 0 | 6 | 4 |
| 8 | 2,3 | Type B | 0 | 5 | 6 |
| 9 | 2,3 | Type B | 0 | 5 | 2 |
| 10 | 2,3 | Type B | 0 | 9 | 2 |
| 11 | 2,3 | Type B | 0 | 10 | 2 |
| 12 | 2,3 | Type A | 0 | 1 | 11 |
| 13 | 2,3 | Type A | 0 | 1 | 6 |
| 14 | 2,3 | Type A | 0 | 2 | 4 |
| 15 | 2,3 | Type B | 0 | 4 | 6 |
| 16 | 2,3 | Type B | 0 | 8 | 4 |

Table 5.1.2.1.1-4: Default PDSCH time domain resource allocation B

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Row index** | ***dmrs-TypeA-Position*** | **PDSCH mapping type** | ***K0*** | ***S*** | ***L*** |
| 1 | 2,3 | Type B | 0 | 2 | 2 |
| 2 | 2,3 | Type B | 0 | 4 | 2 |
| 3 | 2,3 | Type B | 0 | 6 | 2 |
| 4 | 2,3 | Type B | 0 | 8 | 2 |
| 5 | 2,3 | Type B | 0 | 10 | 2 |
| 6 | 2,3 | Type B | 1 | 2 | 2 |
| 7 | 2,3 | Type B | 1 | 4 | 2 |
| 8 | 2,3 | Type B | 0 | 2 | 4 |
| 9 | 2,3 | Type B | 0 | 4 | 4 |
| 10 | 2,3 | Type B | 0 | 6 | 4 |
| 11 | 2,3 | Type B | 0 | 8 | 4 |
| 12 (Note 1) | 2,3 | Type B | 0 | 10 | 4 |
| 13 (Note 1) | 2,3 | Type B | 0 | 2 | 7 |
| 14 (Note 1) | 2 | Type A | 0 | 2 | 12 |
| 3 | Type A | 0 | 3 | 11 |
| 15 | 2,3 | Type B | 1 | 2 | 4 |
| 16 | Reserved | | | | |
| Note 1: If the PDSCH was scheduled with SI-RNTI in PDCCH Type0 common search space, the UE may assume that this PDSCH resource allocation is not applied | | | | | |

Table 5.1.2.1.1-5: Default PDSCH time domain resource allocation C

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Row index** | ***dmrs-TypeA-Position*** | **PDSCH mapping type** | ***K0*** | ***S*** | ***L*** |
| 1 (Note 1) | 2,3 | Type B | 0 | 2 | 2 |
| 2 | 2,3 | Type B | 0 | 4 | 2 |
| 3 | 2,3 | Type B | 0 | 6 | 2 |
| 4 | 2,3 | Type B | 0 | 8 | 2 |
| 5 | 2,3 | Type B | 0 | 10 | 2 |
| 6 (Note 2) | 2,3 | Type B | 0 | 11 | 2 |
| 7 | Reserved | | | | |
| 8 | 2,3 | Type B | 0 | 2 | 4 |
| 9 | 2,3 | Type B | 0 | 4 | 4 |
| 10 | 2,3 | Type B | 0 | 6 | 4 |
| 11 | 2,3 | Type B | 0 | 8 | 4 |
| 12 | 2,3 | Type B | 0 | 10 | 4 |
| 13 (Note 1) | 2,3 | Type B | 0 | 2 | 7 |
| 14 (Note 1) | 2 | Type A | 0 | 2 | 12 |
| 3 | Type A | 0 | 3 | 11 |
| 15 (Note 1) | 2,3 | Type A | 0 | 0 | 6 |
| 16 (Note 1) | 2,3 | Type A | 0 | 2 | 6 |
| Note 1: The UE may assume that this PDSCH resource allocation is not used, if the PDSCH was scheduled with SI-RNTI in PDCCH Type0 common search space  Note 2: This applies for Case F and Case G candidate SS/PBCH block pattern described in clause 4 of [6, TS 38.213] | | | | | |

<omitted text>

##### 5.1.2.2.3 Downlink resource allocation type 1 for multicast/broadcast

In downlink resource allocation of type 1 scheduled using DCI format 4\_0 or DCI format 4\_1 with CRC scrambled by G-RNTI, G-CS-RNTI, MCCH-RNTI or Multicast-MCCH-RNTI, the resource block assignment information indicates to a scheduled UE a set of contiguously allocated non-interleaved or interleaved virtual resource blocks.

<omitted text>

#### 5.1.3.1 Modulation order and target code rate determination

For the PDSCH scheduled by a PDCCH with DCI format 1\_0, format 1\_1, format 1\_2, format 1\_3, format 4\_0, format 4\_1 or format 4\_2 with CRC scrambled by C-RNTI, MCS-C-RNTI, TC-RNTI, CS-RNTI, SI-RNTI, RA-RNTI, MSGB-RNTI, G-RNTI, G-CS-RNTI, Multicast-MCCH-RNTI, MCCH-RNTI or P-RNTI, or for the PDSCH scheduled without corresponding PDCCH transmissions using the higher-layer-provided PDSCH configuration *SPS-Config*,

if the higher layer parameter *mcs-Table-r17* given by *PDSCH-Config* is set to 'qam1024', and the PDSCH is scheduled by a PDCCH with DCI format 1\_1 or 1\_3 with CRC scrambled by C-RNTI

- the UE shall use *IMCS* and Table 5.1.3.1-4 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif *mcs-TableDCI-1-2-r17* given by *PDSCH-Config* is set to 'qam1024', and the PDSCH is scheduled by a PDCCH with DCI format 1\_2 with CRC scrambled by C-RNTI

- the UE shall use *IMCS* and Table 5.1.3.1-4 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the higher layer parameter *mcs-TableDCI-1-2* given by *PDSCH-Config* is set to 'qam256', and the PDSCH is scheduled by a PDCCH with DCI format 1\_2 with CRC scrambled by C-RNTI

- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is not configured with MCS-C-RNTI, the higher layer parameter *mcs-TableDCI-1-2* given by *PDSCH-Config* is set to 'qam64LowSE', and the PDSCH is scheduled by a PDCCH with DCI format 1\_2 scrambled by C-RNTI

- the UE shall use *IMCS* and Table 5.1.3.1-3 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the higher layer parameter *mcs-Table* given by *PDSCH-Config* is set to 'qam256', and the PDSCH is scheduled by a PDCCH with DCI format 1\_1 or 1\_3 with CRC scrambled by C-RNTI

- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the higher layer parameter *mcs-Table* given by *pdsch-ConfigMulticast* is set to 'qam256', and the PDSCH is scheduled by a PDCCH with DCI format 4\_1 or 4\_2 with CRC scrambled by G-RNTI for multicast

- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the higher layer parameter *mcs-Table* given by *pdsch-ConfigMCCH and pdsch-ConfigMTCH* for MBS boardcast is set to 'qam256', and the PDSCH is scheduled by a PDCCH with DCI format 4\_0 with CRC scrambled by MCCH-RNTI or G-RNTI for broadcast

- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the higher layer parameter *mcs-Table* given by *pdsch-ConfigMCCH and pdsch-ConfigMTCH* for MBS multicast is set to ‘qam256’, and the PDSCH is scheduled by a PDCCH with DCI format 4\_0 with CRC scrambled by Multicast-MCCH-RNTI or by a PDCCH with DCI format 4\_1 with CRC scrambled by G-RNTI for multicast in RRC\_INACTIVE

- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate I used in the physical downlink shared channel.

elseif the higher layer parameter *mcs-Table* given by *pdsch-ConfigMulticast* is set to 'qam64LowSE', and the PDSCH is scheduled by a PDCCH with DCI format 4\_1 or 4\_2 with CRC scrambled by G-RNTI for multicast

- the UE shall use *IMCS* and Table 5.1.3.1-3 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the higher layer parameter *mcs-Table* given by *pdsch-ConfigMCCH and pdsch-ConfigMTCH* for MBS multicast is set to ‘qam64LowSE’, and the PDSCH is scheduled by a PDCCH with DCI format 4\_0 with CRC scrambled by Multicast MCCH-RNTI or by a PDCCH with DCI format 4\_1 with CRC scrambled by G-RNTI for multicast in RRC\_INACTIVE

- the UE shall use *IMCS* and Table 5.1.3.1-3 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is not configured with MCS-C-RNTI, the higher layer parameter *mcs-Table* given by *PDSCH-Config* is set to 'qam64LowSE', and the PDSCH is scheduled by a PDCCH with a DCI format other than DCI format 1\_2 in a UE-specific search space with CRC scrambled by C-RNTI

- the UE shall use *IMCS* and Table 5.1.3.1-3 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is configured with MCS-C-RNTI, and the PDSCH is scheduled by a PDCCH with CRC scrambled by MCS-C-RNTI

- the UE shall use *IMCS* and Table 5.1.3.1-3 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is not configured with the higher layer parameter *mcs-Table* given by *SPS-config*, and the higher layer parameter *mcs-Table-r17* given by *PDSCH-Config* is set to 'qam1024',

- if the PDSCH is scheduled by a PDCCH with DCI format 1\_1 with CRC scrambled by CS-RNTI or

- if the PDSCH with SPS activated by DCI format 1\_1 is scheduled without corresponding PDCCH transmission using *SPS-Config*,

- the UE shall use *IMCS* and Table 5.1.3.1-4 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is not configured with the higher layer parameter *mcs-Table* given by *SPS-config*, and the higher layer parameter *mcs-TableDCI-1-2-r17* given by *PDSCH-Config* is set to 'qam1024',

- if the PDSCH is scheduled by a PDCCH with DCI format 1\_2 with CRC scrambled by CS-RNTI or

- if the PDSCH with SPS activated by DCI format 1\_2 is scheduled without corresponding PDCCH transmission using *SPS-Config*,

- the UE shall use *IMCS* and Table 5.1.3.1-4 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is not configured with the higher layer parameter *mcs-Table* given by *SPS-config*, and the higher layer parameter *mcs-TableDCI-1-2* given by *PDSCH-Config* is set to 'qam256',

- if the PDSCH is scheduled by a PDCCH with DCI format 1\_2 with CRC scrambled by CS-RNTI or

- if the PDSCH with SPS activated by DCI format 1\_2 is scheduled without corresponding PDCCH transmission using *SPS-Config*,

- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is not configured with the higher layer parameter *mcs-Table* given by *SPS-Config*, and the higher layer parameter *mcs-Table* given by *PDSCH-Config* is set to 'qam256',

- if the PDSCH is scheduled by a PDCCH with DCI format 1\_1 with CRC scrambled by CS-RNTI or

- if the PDSCH with SPS activated by DCI format 1\_1 is scheduled without corresponding PDCCH transmission using *SPS-Config*,

- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is configured with the higher layer parameter *mcs-Table* given by *SPS-Config* set to 'qam64LowSE'

- if the PDSCH is scheduled by a PDCCH with CRC scrambled by CS-RNTI or

- if the PDSCH is scheduled without corresponding PDCCH transmission using *SPS-Config*,

- the UE shall use *IMCS* and Table 5.1.3.1-3 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

elseif the UE is configured with the higher layer parameter *mcs-Table* given by *SPS-Config* or *mcs-Table* of *pdsch-ConfigMulticast* in the same *CFR-ConfigMulticast* set to 'qam64LowSE'

- if the GC-PDSCH is scheduled by a GC-PDCCH with CRC scrambled by G-CS-RNTI or

- if the GC-PDSCH is scheduled without corresponding GC-PDCCH transmission using *SPS-Config*,

- the UE shall use *IMCS* and Table 5.1.3.1-3 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

else

- the UE shall use *IMCS* and Table 5.1.3.1-1 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

end

<omitted text>

#### 5.1.3.2 Transport block size determination

In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* in *PDSCH-config* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 1\_1 or 1\_3 if *IMCS* = 26 and if *rvid* = 1 for the corresponding transport block. In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* in *pdsch-ConfigMulticast* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 4\_2 if *IMCS* = 26 and if *rvid* = 1 for the corresponding transport block. When the UE is configured with higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH*, either the first or the second transport block of all scheduled PDSCHs is disabled by the DCI format 1\_1 if *IMCS* = 26 and if *rvid* = 2 for the corresponding transport block of all scheduled PDSCHs. If both transport blocks are enabled, transport block 1 and 2 are mapped to codeword 0 and 1 respectively. If only one transport block is enabled, then the enabled transport block is always mapped to the first codeword.

For the PDSCH assigned by a PDCCH with DCI format 1\_0, 1\_1, 1\_2, 1\_3, 4\_0, 4\_1, or 4\_2 with CRC scrambled by C-RNTI, MCS-C-RNTI, TC-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI, Multicast-MCCH-RNTI or SI-RNTI, if Table 5.1.3.1-2 is used and *,* else if Table 5.1.3.1-4 is used and or a table other than Table 5.1.3.1-2 and Table 5.1.3.1-4 is usedand *,* the UE shall, except if the transport block is disabled in DCI format 1\_1 or 1\_3, first determine the TBS as specified below:

<omitted text>

### 5.1.4 PDSCH resource mapping

When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 0, the UE shall assume that no SS/PBCH block, after puncturing if applicable, is transmitted in REs used by the UE for a reception of the PDSCH.

When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, MSGB-RNTI, P-RNTI or TC-RNTI, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst*, and if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources the UE shall assume that the PRBs containing SS/PBCH block transmission resources, after puncturing if applicable, are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.

A UE expects a configuration provided by *ssb-PositionsInBurst* in *ServingCellConfigCommon* to be same as a configuration provided by *ssb-PositionsInBurst* in *SIB1*.

When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI, Multicast-MCCH-RNTI or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, after puncturing if applicable, and the UE shall assume that the PRBs containing SS/PBCH block transmission resources, after puncturing if applicable, are not available for PDSCH in the OFDM symbols where SS/PBCH block associated with the same PCI is transmitted.

A UE is not expected to handle the case where PDSCH DM-RS REs are overlapping, even partially, with any RE(s) not available for PDSCH*.*

For operation with shared spectrum channel access, SS/PBCH block transmission according to *ssb-PositionsInBurst* represents all of the candidate SS/PBCH blocks corresponding to SS/PBCH block indices provided by *ssb-PositionsInBurst* as described in Clause 4.1 of [6, TS 38.213].

<omitted text>

### 5.1.5 Antenna ports quasi co-location

The UE can be configured with a list of up to *M* *TCI-State* configurations within the higher layer parameter *PDSCH-Config* to decode PDSCH according to a detected PDCCH with DCI intended for the UE and the given serving cell, where M depends on the UE capability *maxNumberConfiguredTCIstatesPerCC*. Each *TCI-State* contains parameters for configuring a quasi co-location relationship between one or two downlink reference signals and the DM-RS ports of the PDSCH, the DM-RS port of PDCCH or the CSI-RS port(s) of a CSI-RS resource. The quasi co-location relationship is configured by the higher layer parameter *qcl-Type1* for the first DL RS, and *qcl-Type2* for the second DL RS(if configured). For the case of two DL RSs, the QCL types shall not be the same, regardless of whether the references are to the same DL RS or different DL RSs. The quasi co-location types corresponding to each DL RS are given by the higher layer parameter *qcl-Type* in *QCL-Info* and may take one of the following values:

- 'typeA': {Doppler shift, Doppler spread, average delay, delay spread}

- 'typeB': {Doppler shift, Doppler spread}

- 'typeC': {Doppler shift, average delay}

- 'typeD': {Spatial Rx parameter}

The UE can be configured with a list of up to *128* *TCI-State* configurations, within the higher layer parameter *dl-OrJointTCI-StateList* in *PDSCH-Config* for providing a reference signal for the quasi co-location for DM-RS of PDSCH and DM-RS of PDCCH in a BWP/CC, for CSI-RS, and to provide a reference, if applicable, for determining UL TX spatial filter for dynamic-grant and configured-grant based PUSCH and PUCCH resource in a BWP/CC, and SRS.

If the *TCI-State* or *TCI-UL-State* configurations are absent in a BWP of the CC, the UE can apply the *TCI-State* or *TCI-UL-State* configurations from a reference BWP of a reference CC configured by *unifiedTCI-StateRef*. The UE is not expected to be configured with *tci-StatesToAddModList*, *SpatialRelationInfo* or *PUCCH-SpatialRelationInfo*, except *SpatialRelationInfoPos* in a CC in a band, if the UE is configured with *dl-OrJointTCI-StateList* or *ul-TCI-StateList* in any CC in the same band. The UE can assume that when the UE is configured with *tci-StatesToAddModList* in any CC in the CC list configured by *simultaneousTCI-UpdateList1-r16, simultaneousTCI-UpdateList2-r16,* *simultaneousSpatial-UpdatedList1-r16, or simultaneousSpatial-UpdatedList2-r16,* the UE is not configured with *dl-OrJointTCI-StateList* or *ul-TCI-StateList* in any CC within the same band in the CC list.

The UE receives an activation command, as described in clause 6.1.3.xx of [10, TS 38.321], 6.1.3.47 of [10, TS 38.321] or 6.1.4.xx of [10, TS 38.321], used to map up to 8 TCI states and/or pairs of TCI states, with one TCI state for DL channels/signals and/or one TCI state for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* for one or for a set of CCs/DL BWPs, [and/] or up to 8 sets of TCI states, where each set is comprised of up to two TCI state(s) for DL and UL signals/channels, or up to two TCI state(s) for DL channels/signals and up to two TCI state(s) for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* for one or for a set of CCs/DL BWPs, and if applicable, for one or for a set of CCs/UL BWPs. When a set of TCI state IDs are activated for a set of CCs/DL BWPs and if applicable, for a set of CCs/UL BWPs, where the applicable list of CCs is determined by the indicated CC in the activation command, the same set of TCI state IDs are applied for all DL and/or UL BWPs in the indicated CCs. If the activation command maps *TCI-State(s)* and/or *TCI-UL-State(s)* to only one TCI codepoint, the UE shall apply the indicated *TCI-State(s)* and/or *TCI-UL-State(s)* to one or to a set of CCs /DL BWPs, and if applicable, to one or to a set of CCs /UL BWPs once the indicated mapping for the one single TCI codepoint is applied as described in [11, TS 38.133].

When the *bwp-id* or *cell* for QCL-TypeA/D source RS in a QCL-Info of the TCI state is not configured, the UE assumes that QCL-TypeA/D source RS is configured in the CC/DL BWP where TCI state applies.

When *tci-PresentInDCI* is set as 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET, a UE configured with *dl-OrJointTCI-StateList* with activated *TCI-State* or *ul-TCI-StateList* with activated *TCI-UL-State* receives DCI format 1\_1/1\_2/1\_3 providing indicated *TCI-State(s)* and/or *TCI-UL-State(s)* for a CC or all CCs in the same CC list configured by *simultaneousU-TCI-UpdateList1-r17, simultaneousU-TCI-UpdateList2-r17, simultaneousU-TCI-UpdateList3-r17, simultaneousU-TCI-UpdateList4-r17*. The DCI format 1\_1/1\_2 can be with or without, if applicable, DL assignment. If the DCI format 1\_1/1\_2/ is without DL assignment, the UE can assume the following:

- CS-RNTI is used to scramble the CRC for the DCI

- The values of the following DCI fields are set as follows:

- RV = all '1's

- MCS = all '1's

- NDI = 0

- Set to all '0's for FDRA Type 0, or all '1's for FDRA Type 1, or all '0's for dynamicSwitch (same as in Table 10.2-4 of [6, TS 38.213]).

After a UE receives an initial higher layer configuration of *dl-OrJointTCI-StateList* with more than one *TCI-State* and before application of an indicated TCI state from the configured TCI states:

- The UE assumes that DM-RS of PDSCH and DM-RS of PDCCH and the CSI-RS applying the indicated TCI state are quasi co-located with the SS/PBCH block the UE identified during the initial access procedure

After a UE receives an initial higher layer configuration of *dl-OrJointTCI-StateList* with more than one *TCI-State* or *ul-TCI-StateList* with more than one *TCI-UL-State* and before application of an indicated TCI state from the configured TCI states:

- The UE assumes that the UL TX spatial filter, if applicable, for dynamic-grant and configured-grant based PUSCH and PUCCH, and for SRS applying the indicated TCI state, is the same as that for a PUSCH transmission scheduled by a RAR UL grant or a MsgA PUSCH transmission during the initial access procedure

After a UE receives a higher layer configuration of *dl-OrJointTCI-StateList* with more than one *TCI-State* as part of a Reconfiguration with sync procedure as described in [12, TS 38.331]and before applying an indicated TCI state from the configured TCI states:

- The UE assumes that DM-RS of PDSCH and DM-RS of PDCCH, and the CSI-RS applying the indicated TCI state are quasi co-located with the SS/PBCH block or the CSI-RS resource the UE identified during the random access procedure initiated by the Reconfiguration with sync procedure as described in [12, TS 38.331].

After a UE receives a higher layer configuration of *dl-OrJointTCI-StateList* with more than one *TCI-State* or more than one *TCI-UL-State* as part of a Reconfiguration with sync procedure as described in [12, TS 38.331] and before applying an indicated TCI state from the configured TCI states:

- The UE assumes that the UL TX spatial filter, if applicable, for dynamic-grant and configured-grant based PUSCH and PUCCH, and for SRS applying the indicated TCI state, is the same as that for a PUSCH transmission scheduled by a RAR UL grant or a MsgA PUSCH transmission during random access procedure initiated by the Reconfiguration with sync procedure as described in [12, TS 38.331].

If a UE receives a higher layer configuration of *dl-OrJointTCI-StateList* with a single TCI-State, that can be used as an indicated TCI state, the UE obtains the QCL assumptions from the configured TCI state for DM-RS of PDSCH and DM-RS of PDCCH, and the CSI -RS applying the indicated TCI state.

If a UE receives a higher layer configuration of *dl-OrJointTCI-StateList* with a single TCI-State or *ul-TCI-StateList* with a single *TCI-UL-State*, that can be used as an indicated TCI state, the UE determines an UL TX spatial filter, if applicable, from the configured TCI state for dynamic-grant and configured-grant based PUSCH and PUCCH, and SRS applying the indicated TCI state.

When a UE configured with *dl-OrJointTCI-StateList* would transmit a PUCCH with positive HARQ-ACK or a PUSCH with positive HARQ-ACK corresponding to the DCI carrying the TCI State indication and without DL assignment, or corresponding to the PDSCH scheduled by the DCI carrying the TCI State indication, and if the indicated TCI State(s) is/are different from the previously indicated one(s), the indicatedTCI-State(s) and/or *TCI-UL-State*(s)should be applied starting from the first slot that is at least symbols after the last symbol of the PUCCH or the PUSCH, and if the UE receives more than one indicated TCI state for a CC/BWP to be applied starting from the first slot that is at least symbols after the last symbol of the PUCCH or the PUSCH, the indicated TCI state carried in the latest DCI in time corresponding to positive HARQ-ACK value is applied. The first slot and the symbols are both determined on the active BWP with the smallest SCS among the BWP(s) from the CCs applying the indicated *TCI-State*(s) or *TCI-UL-State*(s) that are active at the end of the PUCCH or the PUSCH carrying the positive HARQ-ACK.

When a UE is configured with *dl-OrJointTCI-StateList* and is having one indicated *TCI-state*, and if the UE is configured with *unifiedTCI-StateType* is set as ‘separate’, and if the UE receives a TCI codepoint mapped with either of {TCI-State, *TCI-UL-State*}, the UE shall update the one indicated {TCI-State, *TCI-UL-State*} and maintain the other {TCI-State, *TCI-UL-State*} that is not updated by the received TCI codepoint.

When a UE is configured with *dl-OrJointTCI-StateList* and is having two indicated *TCI-states*, if the UE receives a TCI codepoint mapped with a sub-set of first and second *TCI-State(s)* and/or a sub-set offirst and second *TCI-UL-State(s)*, the UE shall update the first/second *TCI-State(s)* and/or first/second *TCI-UL-State(s)* mapped to the TCI codepoint, when applicable, and keep the previously indicated first/second *TCI-State(s)* and/or first/second *TCI-UL-State(s)* that is/are not updated by the TCI codepoint.

If a UE is configured with *pdsch-TimeDomainAllocationListForMultiPDSCH* in which one or more rows contain multiple *SLIV*s for PDSCH on a DL BWP of a serving cell, and the UE is receiving a DCI carrying the *TCI-State* indication and without DL assignment, the UE does not expect that the number of indicated *SLIV*s in the row of the *pdsch-TimeDomainAllocationListForMultiPDSCH* by the DCI is more than one.

If the UE is configured with *SSB-MTC-AddtionalPCI* and with *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, the UE receives an activation command for CORESET associated with each *coresetPoolIndex*, as described in clause 6.1.3.14 of [10, TS 38.321] or 6.1.3.xx of [10, TS 38.321], used to map up to 8 TCI states and/or pairs of TCI states, with one TCI state for DL channels/signals and/or one TCI state for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* in one CC/DL BWP. When a set of TCI state IDs are activated for a *coresetPoolIndex*, the activated TCI states corresponding to one *coresetPoolIndex* is associated with the serving cell physical cell ID and activated TCI states corresponding to another *coresetPoolIndex* can be associated with another physical cell ID.

When a UE supports two TCI states in a codepoint of the DCI field '*Transmission Configuration Indication'* the UE may receive an activation command, as described in clause 6.1.3.24 of [10, TS 38.321], the activation command is used to map up to 8 combinations of one or two TCI states to the codepoints of the DCI field *'Transmission Configuration Indication'*. The UE is not expected to receive more than 8 TCI states in the activation command.

When the DCI field *'Transmission Configuration Indication'* is present in DCI format 1\_2 and when the number of codepoints S in the DCI field *'Transmission Configuration Indication'* of DCI format 1\_2 is smaller than the number of TCI codepoints that are activated by the activation command, as described in clause 6.1.3.14, 6.1.3.24 and 6.1.3.47 of [10, TS38.321], only the first S activated codepoints are applied for DCI format 1\_2.

When the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the activation command, the indicated mapping between TCI states and codepoints of the DCI field *'Transmission Configuration Indication'* should be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH and is the subcarrier spacing configuration for with a value of 0 for frequency range 1, and is provided by *K-Mac* or if *K-Mac* is not provided. If *tci-PresentInDCI* is set to 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET scheduling the PDSCH, and the time offset between the reception of the DL DCI and the corresponding PDSCH is equal to or greater than *timeDurationForQCL* if applicable, after a UE receives an initial higher layer configuration of TCI states and before reception of the activation command, the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the SS/PBCH block determined in the initial access procedure with respect to *qcl-Type* set to 'typeA', and when applicable, also with respect to *qcl-Type* set to 'typeD'.

If a UE is configured with the higher layer parameter *tci-PresentInDCI* that is set as 'enabled'for the CORESET scheduling a PDSCH, the UE assumes that the TCI field is present in the DCI format 1\_1 or format 1\_3 of the PDCCH transmitted on the CORESET. If a UE is configured with the higher layer parameter *tci-PresentDCI-1-2* for the CORESET scheduling the PDSCH, the UE assumes that the TCI field with a DCI field size indicated by *tci-PresentDCI-1-2* is present in the DCI format 1\_2 of the PDCCH transmitted on the CORESET. If a UE is configured with the higher layer parameter *tci-PresentInDCI* that is set as 'enabled'for the CORESET scheduling the multicast PDSCH, the UE assumes that the TCI field is present in the DCI format 4\_2 of the PDCCH transmitted on the CORESET. If the PDSCH is scheduled by a DCI format not having the TCI field present, and the time offset between the reception of the DL DCI and the corresponding PDSCH of a serving cell is equal to or greater than a threshold *timeDurationForQCL* if applicable, where the threshold is based on reported UE capability [13, TS 38.306], for determining PDSCH antenna port quasi co-location, the UE assumes that the TCI state or the QCL assumption for the PDSCH is identical to the TCI state or QCL assumption whichever is applied for the CORESET used for the PDCCH transmission within the active BWP of the serving cell.

When a UE is configured with both *sfnSchemePDCCH* and *sfnSchemePDSCH* scheduled by DCI format 1\_0 or by DCI format 1\_1/1\_2, if the time offset between the reception of the DL DCI and the corresponding PDSCH of a serving cell is equal to or greater than a threshold *timeDurationForQCL* if applicable:

- if the UE supports *sfn-DefaultDL-BeamSetup-r17* for DCI scheduling without TCI field, the UE assumes that the TCI state(s) or the QCL assumption(s) for the PDSCH is identical to the TCI state(s) or QCL assumption(s) whichever is applied for the CORESET used for the reception of the DL DCI within the active BWP of the serving cell regardless of the number of active TCI states of the CORESET. If the UE does not support *sfn-SchemeA-DynamicSwitching-r17* or *sfn-SchemeB-DynamicSwitching-r17*, the UE should be activated with the CORESET with two TCI states.

- else if the UE does not support *sfn-DefaultDL-BeamSetup-r17* for DCI scheduling without TCI field, the UE shall expect TCI field present when scheduled by DCI format 1\_1/1\_2.

When a UE is configured with *sfnSchemePDSCH* and *sfnSchemePDCCH* is not configured, when scheduled by DCI format 1\_1/1\_2, if the time offset between the reception of the DL DCI and the corresponding PDSCH of a serving cell is equal to or greater than a threshold *timeDurationForQCL* if applicable, the UE shall expect TCI field present.

For PDSCH scheduled by DCI format 1\_0, 1\_1, 1\_2, when a UE is configured with *sfnSchemePDCCH* set to 'sfnSchemeA' and *sfnSchemePDSCH* is not configured, and there is no TCI codepoint with two TCI states in the activation command, and if the time offset between the reception of the DL DCI and the corresponding PDSCH is equal or larger than the threshold *timeDurationForQCL* if applicable and the CORESET which schedules the PDSCH is indicated with two TCI states, the UE assumes that the TCI state or the QCL assumption for the PDSCH is identical to the first TCI state or QCL assumption which is applied for the CORESET used for the PDCCH transmission within the active BWP of the serving cell.

If a UE is not provided *dl-OrJointTCI-StateList-r17*, and if a PDSCH is scheduled by a DCI format having the TCI field present, the TCI field in DCI in the scheduling component carrier points to the activated TCI states in the scheduled component carrier or DL BWP, the UE shall use the *TCI-State* according to the value of the '*Transmission Configuration Indication*' field in the detected PDCCH with DCI for determining PDSCH antenna port quasi co-location. The UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) in the TCI state with respect to the QCL type parameter(s) given by the indicated TCI state if the time offset between the reception of the DL DCI and the corresponding PDSCH is equal to or greater than a threshold *timeDurationForQCL*, where the threshold is based on reported UE capability [13, TS 38.306]. For a single slot PDSCH, the indicated TCI state(s) should be based on the activated TCI states in the slot with the scheduled PDSCH. For a multi-slot PDSCH or the UE is configured with higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH*, the indicated TCI state(s) should be based on the activated TCI states in the first slot with the scheduled PDSCH(s), and UE shall expect the activated TCI states are the same across the slots with the scheduled PDSCH(s). When the UE is configured with CORESET associated with a search space set for cross-carrier scheduling and the UE is not configured with *enableDefaultBeamForCCS*, the UE expects *tci-PresentInDCI* is set as 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET, and if one or more of the TCI states configured for the serving cell scheduled by the search space set contains *qcl-Type* set to 'typeD', the UE expects the time offset between the reception of the detected PDCCH in the search space set and a corresponding PDSCH is larger than or equal to the threshold *timeDurationForQCL.*

Independent of the configuration of *tci-PresentInDCI* and *tci-PresentDCI-1-2* in RRC connected mode, if the UE is not provided *dl-OrJointTCI-StateList-r17*, and if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL* and at least one configured TCI state for the serving cell of scheduled PDSCH contains *qcl-Type* set to 'typeD',

- the UE may assume that the DM-RS ports of PDSCH(s) of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE. In this case, if the *qcl-Type* is set to 'typeD' of the PDSCH DM-RS is different from that of the PDCCH DM-RS with which they overlap in at least one symbol, the UE is expected to prioritize the reception of PDCCH associated with that CORESET. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers).

- If a UE is configured with *enableDefaultTCI-StatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets,*

- the UE may assume that the DM-RS ports of PDSCH associated with a value of *coresetPoolIndex* of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* among CORESETs, which are configured with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH, in the latest slot in which one or more CORESETs associated with the same value of *coresetPoolIndex* as the PDCCH scheduling that PDSCH within the active BWP of the serving cell are monitored by the UE. In this case, if the 'QCL-TypeD' of the PDSCH DM-RS is different from that of the PDCCH DM-RS with which they overlap in at least one symbol and they are associated with same value of *coresetPoolIndex*, the UE is expected to prioritize the reception of PDCCH associated with that CORESET. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers).

- If a UE is configured with *enableTwoDefaultTCI-States*, and at least one TCI codepoint indicates two TCI states, the UE may assume that the DM-RS ports of PDSCH or PDSCH transmission occasions of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) associated with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states. When the UE is configured by higher layer parameter *repetitionScheme* set to 'tdmSchemeA' or is configured with higher layer parameter *repetitionNumber*, and the offset between the reception of the DL DCI and the first PDSCH transmission occasion is less than the threshold *timeDurationForQCL,* the mapping of the TCI states to PDSCH transmission occasions is determined according to clause 5.1.2.1 by replacing the indicated TCI states with the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states based on the activated TCI states in the slot with the first PDSCH transmission occasion. In this case, if the 'QCL-TypeD' in both of the TCI states corresponding to the lowest codepoint among the TCI codepoints containing two different TCI states is different from that of the PDCCH DM-RS with which they overlap in at least one symbol, the UE is expected to prioritize the reception of PDCCH associated with that CORESET. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers)

- If a UE is not configured with *sfnSchemePDSCH*, and the UE is configured with *sfnSchemePDCCH* set to 'sfnSchemeA' and there is no TCI codepoint with two TCI states in the activation command and the CORESET with the lowest ID in the latest slot is indicated with two TCI states, the UE may assume that the DM-RS ports of PDSCH of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) associated with the first TCI state of two TCI states indicated for the CORESET. In this case, if the *qcl-Type* is set to 'typeD' of the PDSCH DM-RS is different from that of the PDCCH DM-RS with which they overlap in at least one symbol, the UE is expected to prioritize the reception of PDCCH associated with that CORESET with single active TCI state. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers).

- In all cases above, if none of configured TCI states for the serving cell of scheduled PDSCH is configured with *qcl-Type* set to 'typeD', the UE shall obtain the other QCL assumptions from the indicated TCI state(s) for its scheduled PDSCH irrespective of the time offset between the reception of the DL DCI and the corresponding PDSCH.

Independent of the configuration of *tci-PresentInDCI* and *tci-PresentDCI-1-2* in RRC connected mode, if the UE is provided *dl-OrJointTCI-StateList-r17*, and if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL* and at least one configured TCI state for the serving cell of scheduled PDSCH contains *qcl-Type* set to 'typeD', regardless of configuration of *followUnifiedTCI-State*,

- if the indicated TCI state is associated with the PCI of the serving cell, the indicated TCI state is applied to PDSCH reception.

- if the indicated TCI state is associated with a PCI different from the serving cell, the UE may assume that the DM-RS ports of PDSCH(s) of a serving cell are quasi co-located with the RS(s) with respect to the QCL parameter(s) used for PDCCH quasi co-location indication of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored by the UE. In the CA case, if the 'QCL-TypeD' of the PDSCH DM-RSs from respective CCs in a band are different in a slot, the QCL-TypeD assumption of the PDSCH DM-RS in the CC with lowest CC ID in the band is applied to all the PDSCH DM-RSs in the CCs in the band. In this case, if the *qcl-Type* is set to 'typeD' of the PDSCH DM-RS is different from that of the PDCCH DM-RS with which they overlap in at least one symbol, the UE is expected to prioritize the reception of PDCCH associated with that CORESET. This also applies to the intra-band CA case (when PDSCH and the CORESET are in different component carriers).

If the PDCCH carrying the scheduling DCI is received on one component carrier, and a PDSCH scheduled by that DCI is on another component carrier:

- The *timeDurationForQCL* is determined based on the subcarrier spacing of the scheduled PDSCH. If µPDCCH < µPDSCH an additional timing delay is added to the *timeDurationForQCL*, where *d* is defined in 5.2.1.5.1a-1, otherwise *d* is zero;

- When the UE is configured with *enableDefaultBeamForCCS*, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL,* or if the DL DCI does not have the TCI field present, the UE obtains its QCL assumption for the scheduled PDSCH from the activated TCI state with the lowest ID applicable to PDSCH in the active BWP of the scheduled cell.

A UE that has indicated a capability *beamCorrespondenceWithoutUL-BeamSweeping* set to 'supported', as described in [13, TS 38.306], can determine a spatial domain filter to be used while performing the applicable channel access procedures described in [16, TS 37.213] prior to a UL transmission on the channel as follows:

- if UE is indicated with an SRI corresponding to the UL transmission, the UE may use a spatial domain filter that is same as the spatial domain transmission filter associated with the indicated SRI,

- if UE is configured with *SRS-spatialRelationInfo* for the UL transmission, the UE may use a spatial domain filter that is same as the spatial domain filter associated with *referenceSignal* in the corresponding *SRS-spatialRelationInfo*,

- if UE is configured with *TCI-State* in *dl-OrJointTCI-StateList* or *TCI-UL-State* in *ul-TCI-StateList*, the UE may use a spatial domain filter that is same as the spatial domain receive filter the UE may use to receive the DL reference signal associated with the indicated TCI state.

When the PDCCH reception includes two PDCCH from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the time offset between the reception of the DL DCI and the corresponding PDSCH, the PDCCH candidate that ends later in time is used. When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the configuration of *tci-PresentInDCI* or *tci-PresentDCI-1-2*, the UE expects the same configuration in the first and second CORESETs associated with the two PDCCH candidates; and if the PDSCH is scheduled by a DCI format not having the TCI field present and if the scheduling offset is equal to or larger than *timeDurationForQCL,* if applicable, PDSCH QCL assumption is based on the CORESET with lower ID among the first and second CORESETs associated with the two PDCCH candidates.

For a periodic CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*, the UE shall expect that a TCI-State indicates one of the following quasi co-location type(s):

- 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block where SS/PBCH block may have a PCI different from the PCI of the serving cell. The UE can assume center frequency, SCS, SFN offset are the same for SS/PBCH block from the serving cell and SS/PBCH block having a PCI different from the serving cell, or

- 'typeC' with an SS/PBCH block and, when applicable,'typeD' with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition,* where SS/PBCH block may have a PCI different from the PCI of the serving cell. The UE can assume center frequency, SCS, SFN offset are the same for SS/PBCH block from the serving cell and SS/PBCH block having a PCI different from the serving cell.

For periodic/semi-persistent CSI-RS, if the UE is configured with *dl-OrJointTCI-StateList,* the UE can assume that the indicated *TCI-State* is not applied.

For an aperiodic CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info,* the UE shall expect that a *TCI-State* indicates *qcl-Type* set to 'typeA' with a periodic CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, *qcl-Type* set to 'typeD' with the same periodic CSI-RS resource.

For a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured without higher layer parameter *trs-Info* and without the higher layer parameter *repetition*, the UE shall expect that a TCI-State indicates one of the following quasi co-location type(s):

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with the same CSI-RS resource, or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with an SS/PBCH block, where SS/PBCH block may have a PCI different from the PCI of the serving cell. The UE can assume center frequency, SCS, SFN offset are the same for SS/PBCH block from the serving cell and SS/PBCH block having a PCI different from the serving cell, or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or

- 'typeB' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* when 'typeD' is not applicable.

For a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition,* the UE shall expect that a TCI-State indicates one of the following quasi co-location type(s):

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with the same CSI-RS resource, or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or

- 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block, the reference RS may additionally be an SS/PBCH block having a PCI different from the PCI of the serving cell. The UE can assume center frequency, SCS, SFN offset are the same for SS/PBCH block from the serving cell and SS/PBCH block having a PCI different from the serving cell.

For the DM-RS of PDCCH, if the UE is not configured with *dl-OrJointTCI-StateList,* the UE shall expect that a *TCI-State* indicates one of the following quasi co-location type(s):

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with the same CSI-RS resource, or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured without higher layer parameter trs-Info and without higher layer parameter *repetition* and,when applicable, 'typeD' with the same CSI-RS resource.

When a UE is configured with *sfnSchemePdcch* set to 'sfnSchemeA', and CORESET is activated with two TCI states or is configured with *apply-IndicatedTCIState* set to 'both', the UE shall assume that the DM-RS port(s)of the PDCCH in the CORESET is quasi co-located with the DL-RSs of the two TCI states. When a UE is configured with *sfnSchemePdcch* set to 'sfnSchemeB', and a CORESET is activated with two TCI states or is configured with *apply-IndicatedTCIState* set to 'both', the UE shall assume that the DM-RS port(s)of the PDCCH is quasi co-located with the DL-RSs of the two TCI states except for quasi co-location parameters {Doppler shift, Doppler spread} of the second indicated TCI state.

When a UE is configured by higher layer parameter *cjtSchemePDSCH* and *dl-OrJointTCI-StateList* and is indicated with two TCI-States applied for PDSCH reception and reports [support for two joint TCI states for PDSCH-CJT]:

- if the UE is configured with *cjtSchemeA*, the UE assumes that PDSCH DM-RS port(s) are QCLed with the DL RSs of both indicated TCI-States with respect to QCL-TypeA.

- if the UE is configured with *cjtSchemeB*, the UE assumes that PDSCH DM-RS port(s) are QCLed with the DL RSs of both indicated TCI-States with respect to QCL-TypeA except for QCL parameters {Doppler shift, Doppler spread} of the second indicated joint TCI state.

For the DM-RS of PDSCH, if the UE is not configured with *dl-OrJointTCI-StateList,* the UE shall expect that a *TCI-State* indicates one of the following quasi co-location type(s):

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with the same CSI-RS resource*,* or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*,or

- typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured without higher layer parameter *trs-Info* and without higher layer parameter *repetition* and, when applicable, 'typeD' with the same CSI-RS resource.

For the DM-RS of PDCCH, if the UE is configured with *dl-OrJointTCI-StateList,* the UE shall expect that an indicated *TCI-State* indicates one of the following quasi co-location type(s):

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with the same CSI-RS resource, or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition.*

For the DM-RS of PDSCH, if the UE is configured with *dl-OrJointTCI-StateList,* the UE shall expect that an indicated *TCI-State* indicates one of the following quasi co-location type(s):

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with the same CSI-RS resource*,* or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition.*

When a UE is configured with *sfnSchemePDSCH* set to 'sfnSchemeA', and the UE not configured with *dl-OrJointTCI-StateList* is indicated with two TCI states in a codepoint of the DCI field 'Transmission Configuration Indication' in a DCI scheduling a PDSCH or the UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI States to be applied to PDSCH, the UE shall assume that the DM-RS port(s)of the PDSCH is quasi co-located with the DL-RSs of the two TCI states. When a UE is configured with *sfnSchemePDSCH* set to 'sfnSchemeB', and the UE not configured with *dl-OrJointTCI-StateList* is indicated with two TCI states in a codepoint of the DCI field 'Transmission Configuration Indication' in a DCI scheduling a PDSCH or the UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI States to be applied to PDSCH, the UE shall assume that the DM-RS port(s)of the PDSCH is quasi co-located with the DL-RSs of the two TCI states except for quasi co-location parameters {Doppler shift, Doppler spread} of the second indicated TCI state.

When a UE is configured with *dl-OrJointTCI-StateList* or *TCI-UL-State* and is configured by higher layer parameter *PDCCH-Config* that contains two different values of coresetPoolIndex in *ControlResourceSet*, an indicated TCI state is specific to a coresetPoolIndex value, when it is indicated by the DCI field 'Transmission Configuration Indication' in DCI format 1\_1/1\_2 associated with the coresetPoolIndex value.

When a UE is configured with *dl-OrJointTCI-StateList* and is having two indicated TCI-states, if the UE does not report its capability of *[two default beams for S-DCI based MTRP]* in frequency range 2 and when the offset between the reception of the scheduling/activation DCI format 1\_0/1\_1/1\_2 and the scheduled or activated PDSCH reception is less than *[timeDurationForQCL]* in frequency range 2, the UE shall apply the first indicated TCI-State to the scheduled or activated PDSCH reception.

When a UE is configured with *dl-OrJointTCI-StateList*, is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, if the UE does not report its capability of [default beam per *coresetPoolIndex* for M-DCI based MTRP] in frequency range 2

- when the offset between the reception of the scheduling/activation DCI format 1\_0/1\_1/1\_2 in a CORESET associated with *coresetPoolIndex* value 0 and the scheduled or activated PDSCH reception is less than *[timeDurationForQCL]* in frequency range 2, the UE shall apply the indicated joint/DL TCI state specific to *coresetPoolIndex* value 0 to the scheduled or activated PDSCH reception.

- the UE does not expect that the offset between reception of the scheduling/activation DCI format 1\_0/1\_1/1\_2 in a CORESET associated with *coresetPoolIndex* value 1 and scheduled or activated PDSCH reception is less than [timeDurationForQCL] in frequency range 2.

When a UE is configured with *dl-OrJointTCI-StateList* and is having two indicated TCI-states:

- Regardless of the offset between the reception of the scheduling DCI format 1\_0/1\_1/1\_2 and the scheduled/activated PDSCH reception, if the UE is in frequency range 1, or the UE reports its capability of *[two default beams for S-DCI based MTRP]* in frequency range 2, or

- If the UE does not report its capability of *[two default beams for S-DCI based MTRP]*in frequency range 2 and if the scheduling offset between the reception of the scheduling DCI format 1\_0/1\_1/1\_2 and the scheduled/activated PDSCH reception is equal to or larger than [*timeDurationForQCL]*

- The UE can be configured by higher layer parameter *applyIndicatedTCIState* to indicate whether the first, the second, or both of the indicated TCI-state(s) is/are applied to PDSCH reception scheduled or activated by DCI format 1\_0. The UE can be configured with *applyIndicatedTCIState* with value *both* only when the UE is configured with *cjtSchemePDSCH* and the UE reports [*support for two joint TCI states for PDSCH-CJT*] or the UE is configured with *sfnSchemePdsch*. In that case, the UE shall apply both indicated TCI-states to PDSCH reception scheduled or activated by DCI format 1\_0 on a search space other than Type0/0A/2 CSS on CORESET#0.

- If the UE is not configured with *applyIndicatedTCIState*, the first indicated TCI-state is applied to PDSCH reception scheduled or activated by DCI format 1\_0.

- When the UE is configured with *tciSelection-PresentInDCI* jointly for both DCI formats 1\_1 and 1\_2 in the same DL BWP,and when the UE receives a DCI format 1\_1/1\_2 that schedules or activates PDSCH reception, the UE shall determine the indicated joint/DL TCI state(s) for the PDSCH reception according to the following:

- If the DCI format 1\_1/1\_2 indicates codepoint "00" for the [TCI selection field], the UE shall apply the first one of two indicated joint/DL TCI states to all PDSCH DM-RS port(s) of corresponding PDSCH transmission occasion(s) scheduled or activated by the DCI format 1\_1/1\_2.

- If the DCI format 1\_1/1\_2 indicates codepoint "01" for the [TCI selection field], the UE shall apply the second one of two indicated joint/DL TCI states to all PDSCH DM-RS port(s) of corresponding PDSCH transmission occasion(s) scheduled or activated by the DCI format 1\_1/1\_2.

- If the DCI format 1\_1/1\_2 indicates codepoint "10" for the [TCI selection field], the UE shall apply both indicated joint/DL TCI states to the PDSCH reception scheduled or activated by the DCI format 1\_1/1\_2.

- If the UE is not configured with *tciSelection-PresentInDCI* and when the UE receives a DCI format 1\_1/1\_2 that schedules/activates PDSCH reception, the UE shall apply both indicated TCI-States to the scheduled or activated PDSCH reception

<omitted text>

#### 5.1.6.2 DM-RS reception procedure

The DM-RS reception procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* instead of *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB*. The DM-RS reception procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_3.

The DM-RS reception procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2, by applying the parameters of *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB* in *pdsch-ConfigMulticast* instead of *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB in PDSCH-Config*.

When receiving PDSCH scheduled by DCI format 1\_0, 4\_0, or 4\_1, or receiving PDSCH before dedicated higher layer configuration of any of the parameters *dmrs-AdditionalPosition*, *maxLength* and *dmrs-Type,* the UE shall assume that the PDSCH is not present in any symbol carrying DM-RS except for PDSCH with allocation duration of 2 symbols with PDSCH mapping type B (described in clause 7.4.1.1.2 of [4, TS 38.211]), and a single symbol front-loaded DM-RS of configuration type 1 on DM-RS port 1000 is transmitted, and that all the remaining orthogonal antenna ports are not associated with transmission of PDSCH to another UE and in addition

- For PDSCH with mapping type A and type B, the UE shall assume *dmrs-AdditionalPosition*='pos2' and up to two additional single-symbol DM-RS present in a slot according to the PDSCH duration indicated in the DCI as defined in Clause 7.4.1.1 of [4, TS 38.211], and

- For PDSCH with allocation duration of 2 symbols with mapping type B, the UE shall assume that the PDSCH is present in the symbol carrying DM-RS.

When receiving PDSCH scheduled by DCI format 1\_1 or 1\_3 by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, or CS-RNTI or DCI format 4\_2 by PDCCH with CRC scrambled by G-RNTI for multicast or G-CS-RNTI,

- the UE may be configured with the higher layer parameter *dmrs-Type* and/or *dmrs-TypeEnh*, and the configured DM-RS configuration type is used for receiving PDSCH in as defined in Clause 7.4.1.1 of [4, TS 38.211].

- the UE may be configured with the maximum number of front-loaded DM-RS symbols for PDSCH by higher layer parameter *maxLength* given by *DMRS-DownlinkConfig..*

- if *maxLength* is set to 'len1', single-symbol DM-RS can be scheduled for the UE by DCI, and the UE can be configured with a number of additional DM-RS for PDSCH by higher layer parameter *dmrs-AdditionalPosition,* which can be set to 'pos0', 'pos1', 'pos2' or 'pos3'.

- if *maxLength* is set to 'len2', both single-symbol DM-RS and double symbol DM-RS can be scheduled for the UE by DCI, and the UE can be configured with a number of additional DM-RS for PDSCH by higher layer parameter *dmrs-AdditionalPosition,* which can be set to 'pos0' or 'pos1'.

- and the UE shall assume to receive additional DM-RS as specified in Table 7.4.1.1.2-3 and Table 7.4.1.1.2-4 as described in Clause 7.4.1.1.2 of [4, TS 38.211].

For the UE-specific reference signals generation as defined in Clause 7.4.1.1 of [4, TS 38.211], a UE can be configured by higher layers with one or two scrambling identity(s), *i* = 0,1 which are the same for both PDSCH mapping Type A and Type B.

A UE may be scheduled with a number of DM-RS ports by the antenna port index in DCI format 1\_1 as described in Clause 7.3.1.2 of [5, TS 38.212].

For DM-RS configuration type 1,

- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of {2, 9, 10, 11 or 30} in Table 7.3.1.2.2-1 and Table 7.3.1.2.2-2 of Clause 7.3.1.2 of [5, TS 38.212], or

- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of {2, 9, 10, 11 or 12} in Table 7.3.1.2.2-1A and {2, 9, 10, 11, 30 or 31} in Table 7.3.1.2.2-2A of Clause 7.3.1.2 of [5, TS 38.212], or

- if a UE is scheduled with two codewords,

the UE may assume that all the remaining orthogonal antenna ports are not associated with transmission of PDSCH to another UE.

For DM-RS configuration type 2,

- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of {2, 10 or 23} in Table 7.3.1.2.2-3 and Table 7.3.1.2.2-4 of Clause 7.3.1.2 of [5, TS38.212], or

- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of {2, 10, 23 or 24} in Table 7.3.1.2.2-3A and {2, 10, 23 or 58} in Table 7.3.1.2.2-4A of Clause 7.3.1.2 of [5, TS 38.212], or

- if a UE is scheduled with two codewords,

the UE may assume that all the remaining orthogonal antenna ports are not associated with transmission of PDSCH to another UE.

For DM-RS configuration enhanced type 1,

- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of {9, 10, 11 and 27 when applicable} in Table 7.3.1.2.2-7 and Table 7.3.1.2.2-7A of Clause 7.3.1.2 of [5, TS 38.212], or

- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of {9, 10, 11, 39, 40, 41, 42, 43, 44, 45 and 66 when applicable} in Table 7.3.1.2.2-8 and Table 7.3.1.2.2-8A of Clause 7.3.1.2 of [5, TS 38.212],

the UE may assume that all the remaining orthogonal antenna ports of the CDM groups, from which the antenna ports are indicated to the UE, are not associated with transmission of PDSCH to another UE, or

- if a UE is scheduled with two codewords, the UE may assume that all the remaining orthogonal antenna ports are not associated with transmission of PDSCH to another UE.

For DM-RS configuration enhanced type 2,

- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of {9, 10, 20, 21, 22, 23 and 54 when applicable} in Table 7.3.1.2.2-9 and Table 7.3.1.2.2-9A of Clause 7.3.1.2 of [5, TS38.212], or

- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of {9, 10, 20, 21, 22, 23, 72, 73, 74, 75, 76, 77 and 136 when applicable} in Table 7.3.1.2.2-10 and in Table 7.3.1.2.2-10A of Clause 7.3.1.2 of [5, TS 38.212],

The UE may assume that all the remaining orthogonal antenna ports of CDM groups, from which the antenna ports are indicated to the UE, are not associated with transmission of PDSCH to another UE, or

- if a UE is scheduled with two codewords, the UE may assume that all the remaining orthogonal antenna ports are not associated with transmission of PDSCH to another UE.

For DM-RS configuration enhanced type 1,

- if a UE is configured with the higher layer parameter *repetitionScheme* set to *'fdmSchemeA'* or '*fdmSchemeB*', and is indicated with two TCI states to be applied to the PDSCH, and DM-RS port(s) within one CDM group in the DCI field 'Antenna Port(s)',

- if a UE is not indicating UE capability of *pdsch-ReceptionSchemeA* or *pdsch-ReceptionSchemeB*, the UE shall assume that the number of consecutively scheduled PRBs for PDSCH for each TCI-state is even, and the offset of each set of consecutively scheduled PRB from common resource block 0 for PDSCH for each TCI-state is even number.

- otherwise,

- if the UE is not indicating UE capability of *pdsch-ReceptionWithoutSchedulingRestriction*, the UE shall assume the number of consecutively scheduled PRBs for PDSCH is even, and the offset of each set of consecutively scheduled PRB for PDSCH from common resource block 0 is even number.

If a UE receiving PDSCH scheduled by DCI format 1\_2 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* or *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* or a UE receiving PDSCH scheduled by DCI format 1\_0, 1\_1 or 1\_3 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA* or *dmrs-DownlinkForPDSCH-MappingTypeB*, the UE may assume that the following configurations are not occurring simultaneously for the received PDSCH:

- any DM-RS ports among

1004-1007 or 1006-1011 for DM-RS configurations type 1 and type 2, respectively or,

1004-1007 or 1012-1015 for DM-RS configuration enhanced type 1 or,

1006-1011 or 1018-1023 for DM-RS configuration enhanced type 2,

are scheduled for the UE and the other UE(s) sharing the DM-RS REs on the same CDM group(s), and

- PT-RS is transmitted to the UE.

The UE is not expected to simultaneously be configured with the maximum number of front-loaded DM-RS symbols for PDSCH by higher layer parameter *maxLength* being set equal to 'len2' and more than one additional DM-RS symbol as given by the higher layer parameter *dmrs-AdditionalPosition*.

The UE is not expected to assume co-scheduled UE(s) with different DM-RS configuration with respect to the actual number of front-loaded DM-RS symbol(s), the actual number of additional DM-RS, the DM-RS symbol locationas described in Clause 7.4.1.1 of [4, TS 38.211]. The UE configured with DM-RS configuration type 1 or enhanced type 1 is not expected to assume co-scheduled UE(s) with DM-RS configuration type 2 or enhanced type 2. The UE configured with DM-RS configuration type 2 or enhanced type 2 is not expected to assume co-scheduled UE(s) with DM-RS configuration type 1 or enhanced type 1.

The UE does not expect the precoding of the potential co-scheduled UE(s) in other DM-RS ports of the same CDM group to be different in the PRG-level grid configured to this UE with PRG =2 or 4.

When the UE is configured with the higher layer parameter *dmrs-TypeEnh* and indicated with at least one DM-RS ports 1008-1015 for enhanced Type 1 DM-RS or DM-RS ports 1012-1023 for enhanced Type 2 DM-RS, the UE does not expect that any co-scheduled UE(s) in the same CDM group is not configured with the higher layer- parameter *dmrs-TypeEnh* When the UE is not configured with the higher layer parameter *dmrs-TypeEnh*, the UE does not expect that any co-scheduled UE(s) in the same CDM group(s) is configured with the higher layer parameter *dmrs-TypeEnh* and indicated with at least one of DMRS ports 1008-1015 for enhanced Type 1 DMRS or DMRS ports 1012-1023 for enhanced Type 2 DMRS.

The UE does not expect the resource allocation of the potential co-scheduled UE(s) in other DM-RS ports of the same CDM group to be misaligned in the PRG-level grid to this UE with PRG=2 or 4.

When receiving PDSCH scheduled by DCI format 1\_1, the UE shall assume that the CDM groups indicated in the configured index from Tables 7.3.1.2.2-1, 7.3.1.2.2-1A, 7.3.1.2.2-7, 7.3.1.2.2-7A, 7.3.1.2.2-2, 7.3.1.2.2-2A, 7.3.1.2.2-8, 7.3.1.2.2-8A, 7.3.1.2.2-3, 7.3.1.2.2-3A, 7.3.1.2.2-9, 7.3.1.2.2-9A, 7.3.1.2.2-4, 7.3.1.2.2-4A, 7.3.1.2.2-10, 7.3.1.2.2-10A of [5, TS. 38.212] contain potential co-scheduled downlink DM-RS and are not used for data transmission, where "1", "2" and "3" for the number of DM-RS CDM group(s) in Tables 7.3.1.2.2-1, 7.3.1.2.2-1A, 7.3.1.2.2-7, 7.3.1.2.2-7A, 7.3.1.2.2-2, 7.3.1.2.2-2A, 7.3.1.2.2-8, 7.3.1.2.2-8A, 7.3.1.2.2-3, 7.3.1.2.2-3A, 7.3.1.2.2-9, 7.3.1.2-9A, 7.3.1.2.2-4, 7.3.1.2.2-4A, 7.3.1.2.2-10, 7.3.1.2.2-10A of [5, TS. 38.212] correspond to CDM group 0, {0,1}, {0,1,2}, respectively.

When receiving PDSCH scheduled by DCI format 1\_0, 4\_0, or 4\_1, the UE shall assume the number of DM-RS CDM groups without data is 1 which corresponds to CDM group 0 for the case of PDSCH with allocation duration of 2 symbols, and the UE shall assume that the number of DM-RS CDM groups without data is 2 which corresponds to CDM group {0,1} for all other cases.

The UE is not expected to receive PDSCH scheduling DCI which indicates CDM group(s) with potential DM-RS ports which overlap with any configured CSI-RS resource(s) for that UE.

If the UE receives the DM-RS for PDSCH and an SS/PBCH block associated with the same PCI in the same OFDM symbol(s), then the UE may assume that the DM-RS and SS/PBCH block are quasi co-located with 'typeD', if 'typeD' is applicable. Furthermore, the UE shall not expect to receive DM-RS in resource elements that overlap with those of the SS/PBCH block associated with the same PCI as the DM-RS, and the UE can expect that the same or different subcarrier spacing is configured for the DM-RS and SS/PBCH block in a CC except for the case of 240 kHz where only different subcarrier spacing is supported. A DM-RS for PDSCH is said to be associated with an additional PCI if the indicated TCI state for the PDSCH is associated with the additional PCI, otherwise a DM-RS for PDSCH is associated with serving cell PCI.

If at least one TCI codepoint indicates two TCI states for a UE not configured with *dl-OrJointTCI-StateList*, or if the UE configured with *dl-OrJointTCI-StateList* is having two indicated TCI states and the UE receives the DM-RS for PDSCH and an SS/PBCH block in the same OFDM symbol(s), then the UE may assume that at least one DM-RS port for the PDSCH and SS/PBCH block are quasi co-located with 'QCL-TypeD', if 'QCL-TypeD' is applicable.

If the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of CORESETPoolIndex in different ControlResourceSets, and the UE receives the DM-RS for PDSCH(s) and an SS/PBCH block in the same OFDM symbol(s), then the UE may assume that at least one DM-RS port for the PDSCH(s) and SS/PBCH block are quasi co-located with 'QCL-TypeD', if 'QCL-TypeD' is applicable.

If a UE is configured by the higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, the UE may be scheduled with fully or partially overlapping PDSCHs in the time and frequency domain by multiple PDCCHs with the following restrictions,

- the UE is not expected to assume different DM-RS configuration with respect to the actual number of front-loaded DM-RS symbol(s), the actual number of additional DM-RS symbol(s), the actual DM-RS symbol location, and DM-RS configuration type.

- the UE is not expected to assume DM-RS ports in a CDM group indicated by two TCI states.

When a UE is not indicated with a DCI that DCI field '*Time domain resource assignment*' indicating an entry which contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation,* the UE is not configured with *sfnSchemePDSCH* and it is indicated with two TCI states to be applied to the PDSCH and indicated DM-RS port(s) within two CDM groups in the DCI field '*Antenna Port(s)',*

- the first TCI state corresponds to the CDM group of the first antenna port indicated by the antenna port indication table, and the second TCI state corresponds to the other CDM group.

If a UE is configured with higher layer parameter *dmrs-FD-OCC-DisabledForRank1-PDSCH* and the UE is scheduled with PDSCH with single DM-RS port, the UE may assume that set of orthogonal DM-RS antenna ports from the same CDM group using different set of *w*f(*k*') codes are not associated with the transmission of PDSCH to another UE. If a UE is configured with higher layer parameter *dmrs-TypeEnh*, the UE does not expect to be configured with *dmrs-FD-OCC-DisabledForRank1-PDSCH*.

<omitted text>

#### 5.1.6.5 PRS reception procedure

The UE can be configured with one or more DL PRS resource set configuration(s) as indicated by the higher layer parameters *NR-DL-PRS-ResourceSet* and *NR-DL-PRS-Resource* as defined by Clause 6.4.3 [17, TS 37.355]. Each DL PRS resource set consists of K≥1 DL PRS resource(s) where each has an associated spatial transmission filter. The UE can be configured with one or more DL PRS positioning frequency layer configuration(s) as indicated by the higher layer parameter *NR-DL-PRS-PositioningFrequencyLayer.* A DL PRS positioning frequency layer is defined as a collection of DL PRS resource sets which have common parameters configured by *NR-DL-PRS-PositioningFrequencyLayer*.

The UE assumes that the following parameters for each DL PRS resource(s) are configured via higher layer parameters *NR-DL-PRS-PositioningFrequencyLayer, NR-DL-PRS-ResourceSet* and *NR-DL-PRS-Resource*.

A DL PRS positioning frequency layer is configured by *NR-DL-PRS-PositioningFrequencyLayer,* consists of one or more DL PRS resource sets and it is defined by:

*- dl-PRS-SubcarrierSpacing* defines the subcarrier spacing for the DL PRS resource. All DL PRS resources and DL PRS resource sets in the same DL PRS positioning frequency layer have the same value of *dl-PRS-SubcarrierSpacing*. The supported values of *dl-PRS-SubcarrierSpacing* are given in Table 4.2-1 of [4, TS38.211], excluding the values of 240kHz, 480 kHz, and 960 kHz.

*- dl-PRS-CyclicPrefix* defines the cyclic prefix for the DL PRS resource. All DL PRS Resources and DL PRS Resource sets in the same DL PRS positioning frequency layer have the same value of *dl-PRS-CyclicPrefix.* The supported values of *dl-PRS-CyclicPrefix* are given in Table 4.2-1 of [4, TS38.211].

*- dl-PRS-PointA* defines the absolute frequency of the reference resource block. Its lowest subcarrier is also known as Point A. All DL PRS resources belonging to the same DL PRS resource set have common Point A and all DL PRS resources sets belonging to the same DL PRS positioning frequency layer have a common Point A.

The UE expects that it will be configured with *dl-PRS-ID* each of which is defined such that it is associated with multiple DL PRS resource sets. The UE expects that one of these *dl-PRS-ID* along with a *nr-DL-PRS-ResourceSetID* and a *nr-DL-PRS-ResourceID-r16* can be used to uniquely identify a DL PRS resource.

The UE may be configured by the network with *nr-PhysCellID*, *nr-CellGlobalID*, and *nr-ARFCN* [17, TS 37.355] associated with a *dl-PRS-ID*.

- If *nr-PhysCellID* or *nr-CellGlobalID* is provided, and if *nr-PhysCellID*, *nr-CellGlobalID* and *nr-ARFCN* associated with the *dl-PRS-ID*, if provided, are the same as the corresponding information of a serving cell, the UE may assume that the DL PRS is transmitted from the serving cell;

- Otherwise, the UE may assume that the DL PRS is not transmitted from a serving cell.

If the UE assumes that the DL PRS is transmitted from a serving cell, and if the serving cell is the same as the serving cell defined by the SS/PBCH block, the UE may assume that the DL PRS and the SS/PBCH block are transmitted from the same serving cell.

If the UE assumes that the DL PRS is not transmitted from a serving cell, and if *nr-PhysCellID* is provided, and is the same as physical cell ID of the SS/PBCH block from a non-serving cell of the same band as the DL PRS, the UE may assume that the DL PRS and the SS/PBCH block are transmitted from the same non-serving cell.

A DL PRS resource set is configured by *NR-DL-PRS-ResourceSet*, consists of one or more DL PRS resources and it is defined by:

*- nr-DL-PRS-ResourceSetID* defines the identity of the DL PRS resource set configuration.

*- dl-PRS-Periodicity-and-ResourceSetSlotOffset* defines the DL PRS resource periodicity and takes values slots, where for *dl-PRS-SubcarrierSpacing*=15, 30, 60 and 120 kHz respectively and the slot offset for DL PRS resource set with respect to SFN0 slot 0. All the DL PRS resources within one DL PRS resource set are configured with the same DL PRS resource periodicity. The UE does not expect that the product of DL PRS resource periodicity , the higher layer parameter *dl-prs-MutingBitRepetitionFactor* and the size of the bitmap of *dl-PRS-MutingOption1* exceeds , where for *dl-PRS-SubcarrierSpacing*=15, 30, 60 and 120 kHz respectively.

*- dl-PRS-ResourceRepetitionFactor* defines how many times each DL-PRS resource is repeated for a single instance of the DL-PRS resource set and takes values . All the DL PRS resources within one resource set have the same resource repetition factor.

*- dl-PRS-ResourceTimeGap* defines the offset in number of slots between two repeated instances of a DL PRS resource with the same *nr-DL-PRS-ResourceID* within a single instance of the DL PRS resource set. The UE only expects to be configured with *dl-PRS-ResourceTimeGap* if *dl-PRS-ResourceRepetitionFactor* is configured with value greater than 1. The time duration spanned by one instance of a *nr-DL-PRS-ResourceSet* is not expected to exceed the configured value of DL PRS periodicity. All the DL PRS resources within one resource set have the same value of *dl-PRS-ResourceTimeGap.*

*- dl-PRS-MutingOption1* and *dl-PRS-MutingOption2* define the time locations where the DL PRS resource is expected to not be transmitted for a DL PRS resource set. If *dl-PRS-MutingOption1* is configured, each bit in the bitmap of *dl-PRS-MutingOption1* corresponds to a configurable number provided by higher layer parameter *dl-prs-MutingBitRepetitionFactor* of consecutive instances of a DL PRS resource set where all the DL PRS resources within the set are muted for the instance that is indicated to be muted. The length of the bitmap can be {2, 4, 6, 8, 16, 32} bits. If *dl-PRS-MutingOption2* is configured each bit in the bitmap of *dl-PRS-MutingOption2* corresponds to a single repetition index for each of the DL PRS resources within each instance of a *nr-DL-PRS-ResourceSet* and the length of the bitmap is equal to the values of *dl-PRS-ResourceRepetitionFactor*. Both *dl-PRS-MutingOption1* and *dl-PRS-MutingOption2* may be configured at the same time in which case the logical AND operation is applied to the bit maps as described in Clause 7.4.1.7.4 of [4, TS 38.211].

*- NR-DL-PRS-SFN0-Offset* defines the time offset of the SFN0 slot 0 for the DL PRS resource set with respect to SFN0 slot 0 of reference provided by *nr-DL-PRS-ReferenceInfo*.

*- dl-PRS-ResourceList* determines the DL PRS resources that are contained within one DL PRS resource set.

*- dl-PRS-CombSizeN* defines the comb size of a DL PRS resource where the allowable values are given in Clause 7.4.1.7.3 of [TS38.211]. All DL PRS resource sets belonging to the same DL PRS positioning frequency layer have the same value of *dl-PRS-CombSizeN*.

*- dl-PRS-ResourceBandwidth* defines the number of resource blocks configured for DL PRS transmission. The parameter has a granularity of 4 PRBs with a minimum of 24 PRBs and a maximum of 272 PRBs. All DL PRS resources sets within a DL PRS positioning frequency layer have the same value of *dl-PRS-ResourceBandwidth*.

*- dl-PRS-StartPRB* defines the starting PRB index of the DL PRS resource with respect to reference Point A, where reference Point A is given by the higher-layer parameter *dl-PRS-PointA*. The starting PRB index has a granularity of one PRB with a minimum value of 0 and a maximum value of 2176 PRBs. All DL PRS resource sets belonging to the same DL PRS positioning frequency layer have the same value of *dl-PRS-StartPRB*.

*- dl-PRS-NumSymbols* defines the number of symbols of the DL PRS resource within a slot where the allowable values are given in Clause 7.4.1.7.3 of [4, TS38.211].

A DL PRS resource is defined by:

*- nr-DL-PRS-ResourceID* determines the DL PRS resource configuration identity. All DL PRS resource IDs are locally defined within a DL PRS resource set.

*- dl-PRS-SequenceID* is used to initialize cinit value used in pseudo random generator as described in Clause 7.4.1.7.2 of [4, TS 38.211] for generation of DL PRS sequence for a given DL PRS resource.

*- dl-PRS-CombSizeN-AndReOffset* defines the starting RE offset of the first symbol within a DL PRS resource in frequency. The relative RE offsets of the remaining symbols within a DL PRS resource are defined based on the initial offset and the rule described in Clause 7.4.1.7.3 of [4, TS 38.211].

*- dl-PRS-ResourceSlotOffset* determines the starting slot of the DL PRS resource with respect to corresponding DL PRS resource set slot offset.

*- dl-PRS-ResourceSymbolOffset* determines the starting symbol of a slot configured with the DL PRS resource.

*- dl-PRS-QCL-Info* defines any quasi co-location information of the DL PRS resource with other reference signals. The DL PRS may be configured with QCL 'typeD' with a DL PRS associated with the same *dl-PRS-ID*, or with *rs-Type* set to 'typeC', 'typeD', or 'typeC-plus-typeD' with a SS/PBCH Block from a serving or non-serving cell.

- *dl-PRS-ResourcePrioritySubset* defines a subset of DL-PRS resources for the DL PRS resource for the purpose of prioritization of measurement reporting as described in [17, TS 37.355].

The UE assumes constant EPRE is used for all REs of a given DL PRS resource.

The UE may be indicated by the network that DL PRS resource(s) can be used as the reference for the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, and UE Rx-Tx time difference measurements in a higher layer parameter *nr-DL-PRS-ReferenceInfo*. The reference indicated by the network to the UE can also be used by the UE to determine how to apply higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty*. The UE expects the reference to be indicated whenever it is expected to receive the DL PRS. This reference provided by *nr-DL-PRS-ReferenceInfo* may include a *dl-PRS-ID*, a DL PRS resource set ID, and optionally a single DL PRS resource ID or a list of DL PRS resource IDs [17, TS 37.355]. The UE may use different DL PRS resources or a different DL PRS resource set to determine the reference for the RSTD measurement as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met. If the UE chooses to use a different reference than indicated by the network, then it is expected to report the *dl-PRS-ID*, the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference.

The UE may be configured to report quality metrics *NR-TimingQuality* corresponding to the DL RSTD and UE Rx-Tx time difference measurements which include the following fields:

*- timingQualityValue* which provides the best estimate of the uncertainty of the measurement

*- timingQualityResolution* which specifies the resolution levels used in the *timingQualityValue* field.

The UE expects to be configured with higher layer parameter *nr-DL-PRS-ExpectedRSTD*, which defines the time difference with respect to the received DL subframe timing the UE is expected to receive DL PRS, and *nr-DL-PRS-ExpectedRSTD-Uncertainty*, which defines a search window around the *nr-DL-PRS-ExpectedRSTD*.

For DL UE positioning measurement reporting in higher layer parameters *NR-DL-TDOA-SignalMeasurementInformation* or *NR-Multi-RTT-SignalMeasurementInformation* the UE can be configured to report the DL PRS resource ID(s) or the DL PRS resource set ID(s) associated with the DL PRS resource(s) or the DL PRS resource set(s) which are used in determining the UE measurements DL RSTD, or UE Rx-Tx time difference, respectively.

For the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, and UE Rx-Tx time difference measurements the UE reports an associated higher layer parameter *nr-TimeStamp*. The *nr-TimeStamp* can include the *dl-PRS-ID*, the SFN and the slot number for a subcarrier spacing. These values correspond to the reference which is provided by *nr-DL-PRS-ReferenceInfo*.

The UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP if the measurement is made during a configured measurement gap. When the UE is expected to measure the DL PRS resource, the UE may request a measurement gap via higher layer parameter *NR-PRS-MeasurementInfoList* [12, TS 38.331] or as specified in clause 6.1.3.40 of [10, TS 38.321]. The UE may be preconfigured with one or more measurement gaps each associated with a *measPosPreConfigGapId*. When the UE requests activation or deactivation of a measurement gap as specified in clause 6.1.3.40 of [10, TS 38.321]it can request one of the preconfigured measurement gaps by referring to the *measPosPreConfigGapId*. The UE may have one of the preconfigured measurement gap(s) activated or deactivated as specified in clause 6.1.3.41 of [10, TS 38.321].

The UE assumes that the DL PRS from the serving cell is not mapped to any symbol that contains SS/PBCH block from the serving cell. If the time frequency location of the SS/PBCH block transmissions from non-serving cells are provided to the UE then the UE also assumes that the DL PRS from a non-serving cell is not mapped to any symbol that contains the SS/PBCH block of the same non-serving cell.

The UE may be configured to measure and report, subject to UE capability, up to 4 DL RSTD measurements per pair of *dl-PRS-ID* with each measurement between a different pair of DL PRS resources or DL PRS resource sets within the DL PRS configured for those *dl-PRS-ID*. If the UE is not configured to report with *multiMeasInSameReport-r17*, the up to 4 measurements being performed on the same pair of *dl-PRS-ID* and all DL RSTD measurements in the same report use a single reference timing. If the UE is configured to report with *multiMeasInSameReport-r17*, the up to 4 measurements being performed on the same pair of *dl-PRS-ID* and all DL RSTD measurements in the same measurement instance of the same report use a single reference timing.

The UE may be configured to measure and report, subject to UE capability, up to 24 DL PRS-RSRP measurements on DL PRS resources associated with the same *dl-PRS-ID*. When the UE reports DL PRS-RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS-RSRP measurements associated with the same higher layer parameter *nr-DL-PRS-RxBeamIndex* [17, TS 37.355] have been performed using the same spatial domain filter for reception if for each *nr-DL-PRS-RxBeamIndex* reported there are at least 2 DL PRS-RSRP measurements associated with it within the DL PRS resource set. When the UE reports DL PRS-RSRP measurements for a DL PRS resource, the reported multiple DL PRS-RSRP measurements associated with the same or different higher layer parameter *nr-DL-PRS-RxBeamIndex* may have the same or different timestamps.

The UE may be configured to measure and optionally report, subject to UE capability, up to 24 DL PRS-RSRPP for the first detected path on DL PRS resources associated with the same *dl-PRS-ID*. When the UE reports DL PRS-RSRPP measurements for a DL PRS resource, the reported multiple DL PRS-RSRPP measurements associated with the same or different higher layer parameter *nr-DL-PRS-RxBeamIndex* may have the same or different timestamps. When the UE reports DL PRS-RSRPP measurements from one DL PRS resource set, the UE may indicate which DL PRS-RSRPP measurements associated with the same higher layer parameter *nr-DL-PRS-RxBeamIndex* [17, TS 37.355] have been performed using the same spatial domain filter for reception if for each *nr-DL-PRS-RxBeamIndex* reported there are at least 2 DL PRS-RSRPP measurements associated with it within the DL PRS resource set.

The UE may be configured to optionally report a differential DL PRS-RSRPP for a DL PRS resource with reference to *nr-DL-PRS-FirstPathRSRP-Result* and/or a differential DL PRS RSRP with reference to *nr-DL-PRS-RSRP-Result* via higher layer parameter *NR-DL-AoD-AdditionalMeasurementElement*.

For each DL PRS resource, the UE may be configured, subject to UE capability, with *dl-PRS-ResourcePrioritySubset* that is associated with this DL PRS resource, where the subset of DL PRS resources associated with the DL PRS resource can be in the same or different DL PRS resource set than the DL PRS resource. The UE may include UE measurements for the subset of DL PRS resources in *NR-DL-AoD-AdditionalMeasurementElement* if the UE measurements of the associated PRS resource are reported, where the UE measurement can be DL PRS-RSRP and/or DL PRS-RSRPP. The UE may report DL PRS-RSRP and/or DL PRS-RSRPP measurements only for the subset of DL PRS resources. Subject to UE capability, the UE may be configured with boresight direction via higher layer parameter *DL-PRS-BeamInfoElement* for each DL PRS resource.

The UE may be provided with beam/antenna information via higher layer parameter *NR-TRP-BeamAntennaInfo*.

The UE may request to be provided with either expected DL-AoD/ZoD and uncertainty range(s) of expected DL-AoD/ZoD, or expected DL-AoA/ZoA and uncertainty range(s) of the expected DL-AoA/ZoA. The UE may be provided with expected DL-AoD/ZoD and uncertainty range(s) of the expected DL-AoD/ZoD. The UE may be provided with expected DL-AoA/ZoA and uncertainty range(s) of the expected DL-AoA/ZoA. The uncertainty range(s) of the expected DL-AoD/DL-AoA may be configured within [0, 60]. The uncertainty range(s) of expected DL-ZoD/DL-ZoA may be configured within [0, 30].

The UE may be configured to measure and report, subject to UE capability, up to 4 UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in different DL PRS positioning frequency layers.

The UE may be configured to measure and report via higher layer parameter *additionalPaths* or *additionalPathsExt*, subject to UE capability, the timing and the quality metrics of up to 8 additional detected paths, that are associated with each RSTD or UE Rx – Tx time difference. The timing of each additional path is reported relative to the path timing used for determining *nr-RSTD* or *nr-UE-RxTxTimeDiff*. For UE positioning measurement reporting in higher layer parameters *NR-DL-TDOA-SignalMeasurementInformation* or *NR-Multi-RTT-SignalMeasurementInformation*, the UE may be configured to measure and report, subject to UE capability, the DL PRS-RSRPP of the first path and the up to 8 additional paths that are associated with each RSTD or UE Rx – Tx time difference.

The UE may be requested, subject to UE capability, to measure and report one or more of the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, or UE Rx-Tx time difference measurements with either or 4 samples, where = 1 or 2 is as defined in [11, TS 38.133], via higher layer parameter *reducedDL-PRS-ProcessingSamples* [17, TS 37.355] which applies for all DL PRS positioning frequency layers.

The UE may be requested, subject to UE capability, to report LoS/NLoS indicator(s) via higher layer parameter *nr-los-nlos-IndicatorRequest*. The UE can report LoS/NLoS indicator(s) via higher layer parameter *nr-los-nlos-Indicator* associated with each DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, and UE Rx-Tx time difference measurements. The UE can report LoS/NLoS indicator(s) via higher layer parameter *nr-los-nlos-Indicator* associated with each *dl-PRS-ID* in a measurement report. For the LoS/NLoS indicator(s) associated with DL RSTD, the UE may report one indicator associated with the *dl-PRS-ID* indicated by higher layer parameter *dl-PRS-ReferenceInfo* and one indicator associated with the *dl-PRS-ID* of the DL RSTD measurement. A UE may be provided with LoS/NLoS indicator(s) via higher layer parameter *nr-los-nlos-Indicator*, and it may be associated with each DL PRS resource of each configured *dl-PRS-ID* or may be associated with each configured *dl-PRS-ID*. The values of the higher layer parameter *LOS-NLOS-Indicator* may be soft values (0, 0.1, …, 0.9, 1) or hard values (0, 1) with the values corresponding to the likelihood of LoS, with a value of 1 corresponding to LoS and a value of 0 corresponding to NLoS.

If the UE is configured with *DL-PRS-QCL-Info* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are associated with the same *dl-PRS-ID*. If *DL-PRS-QCL-Info* is configured to the UE with QCL set to 'type-D' with a source DL PRS resource then the *nr-DL-PRS-ResourceSetId* and the *nr-DL-PRS-ResourceId* of the source DL PRS resource are expected to be indicated to the UE.

The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter *DL-PPW-PreConfig*. The UE is not expected to measure the DL PRS outside the measurement gap if the expected received timing difference between the DL PRS from the non-serving cell and that from the serving cell, determined by the higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty,* is larger than maximum Rx timing difference provided by UE capability*.* For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, the priority between DL PRS and SSB is defined in [11, TS 38.133] and the UE determines the DL PRS priority as indicated by higher layer parameter *priority* subject to UE capability or as implied by UE capability, except for SSB:

- with value *'st1'* where the DL PRS is higher priority than all the DL signals and channels, or

- with value *'st2'* where the DL PRS is lower priority than PDCCH and the PDSCH scheduled by DCI formats 1\_1, 1\_2, 1\_3 or 4\_2 with the priority indicator field in the corresponding DCI format set to 1, and is higher priority than other DL signals and channels, or

- with value *'st3'* where the DL PRS is lower priority than all the DL signals and channels.

Inside one *DL-PPW-PreConfig* the UE is only expected to measure a single DL PRS positioning frequency layer.

When the UE is expected to measure the DL PRS outside the measurement gap in a configured DL PRS processing window with *type1A* and if the DL PRS is determined to be higher priority than the DL signals and channels inside the DL PRS processing window, those DL signals and channels are not expected to be measured by the UE. When the UE is expected to measure the DL PRS outside the measurement gap in a configured DL PRS processing window with *type1B* and if the DL PRS is determined to be higher priority than the DL signals and channels inside the DL PRS processing window, those DL signals and channels in the same band as the DL PRS are not expected to be measured by the UE. When the UE is expected to measure the DL PRS outside the measurement gap in a configured DL PRS processing window with *type2* if the DL PRS is determined to be higher priority than the DL signals and channels inside the DL PRS processing window, those DL signals and channels from the impacted serving cells are not expected to be measured by the UE on the overlapped symbols with the DL PRS, where impacted serving cells refer to the serving cell on which the *DL-PPW-PreConfig* is configured for a frequency range 1 band, and all the serving cells in the same band as the DL PRS for a frequency range 2 band. When the UE is expected to measure the DL PRS outside the measurement gap in a configured DL PRS processing window with *type1B* or *type2,* and if the DL PRS is determined to be higher priority than the DL signals and channels inside the DL PRS processing window, the UE behavior is described in [11, TS 38.133] for inter-band case for frequency range 2 for the DL signals/channels from a different frequency range 2 band than the frequency range 2 band of the DL PRS.

When the UE has an activated DL PRS processing window with *type1A* or *type1B* and the UE determines the presence of other DL signals and channels, except SSB, of higher priority than the DL PRS in the DL PRS processing window no later than *N2* symbols, defined in clause 6.4 for the subcarrier spacing of the DL PRS, before the first symbol of the DL PRS processing window, the UE is expected to receive the other DL signals and channels and drop all PRS within the DL PRS processing window. When the UE has an activated DL PRS processing window with *type2* and the UE determines the presence of other DL signals and channels, except SSB, of higher priority than the DL PRS on a symbol configured with the DL PRS no later than *N2* symbols, defined in clause 6.4 for the subcarrier spacing of the DL PRS, before the DL PRS symbol, the UE is expected to receive the other DL signals and channels and drop the DL PRS symbol.

When the UE has an activated DL PRS processing window with *type1A* or *type1B* and the UE determines the presence of other DL signals and channels, except SSB, of higher priority than the DL PRS in the DL PRS processing window later than *N2* symbols, defined in clause 6.4 for the subcarrier spacing of the DL PRS, before the first symbol of the DL PRS processing window, the UE is not required to receive the other DL signals and channels and may receive the DL PRS and consider the DL PRS as higher priority in the DL PRS processing window. When the UE has an activated DL PRS processing window with *type2* and the UE determines the presence of other DL signals and channels, except SSB, of higher priority than the DL PRS on a symbol configured with the DL PRS later than *N2* symbols, defined in clause 6.4 for the subcarrier spacing of the DL PRS, before the DL PRS symbols, the UE is not required to receive the other DL signals and channels and may receive the DL PRS symbol and consider the DL PRS as higher priority in that symbol.

Within a positioning frequency layer, the DL PRS resources are sorted in the decreasing order of priority for measurement to be performed by the UE, with the reference indicated by *nr-DL-PRS-ReferenceInfo* being the highest priority for measurement, and the following priority is assumed:

- Up to 64 *NR-SelectedDL-PRS-IndexPerTRP* of the DL PRS positioning frequency layer are sorted according to priority if *nr-SelectedDL-PRS-IndexListPerFreq* is provided, or up to 64 *NR-DL-PRS-AssistanceDataPerTRP* of the frequency layer are sorted according to priority; except when the UE is requested to perform aggregated measurement(s), in which case:

- A DL-PRS ID associated with DL PRS bandwidth aggregation linkage has higher priority than a DL-PRS ID not associated with DL PRS bandwidth aggregation linkage. If multiple DL-PRS ID are associated with DL PRS bandwidth aggregation linkage, they are sorted according to priority.

- Up to 2 *DL-SelectedPRS-ResourceSetIndex* per *dl-PRS-ID* of the DL PRS positioning frequency layer are sorted according to priority if *dl-SelectedPRS-ResourceSetIndexList* is provided, or up to 2 *NR-DL-PRS-ResourceSet* per *dl-PRS-ID* of the DL PRS positioning frequency layer are sorted according to priority except when the UE is requested to perform aggregated measurement(s), in which case:

- A DL PRS resource set linked for a DL PRS bandwidth aggregation has higher priority than a DL PRS resource set not linked for DL PRS bandwidth aggregation. If multiple DL PRS resource sets are linked for DL PRS bandwidth aggregation, then they are sorted according to priority.

The UE DL PRS processing capability is defined in [TS 37.355]. For the purpose of DL PRS processing capability, the duration *K* msec of DL PRS symbols within *P* msec window, is calculated by

*-* Type 1 duration calculation with UE symbol level buffering capability

*-* Type 2 duration calculation with UE slot level buffering capability

*- S* is the set of slots based on the numerology of the DL PRS of a serving cell within the *P* msec window in the positioning frequency layer that contains potential DL PRS resources considering the actual *nr-DL-PRS-ExpectedRSTD*, *nr-DL-PRS-ExpectedRSTD-Uncertainty* provided for each pair of DL PRS Resource Sets.

*-* For Type 1, is the smallest interval in msec within slot corresponding to an integer number of OFDM symbols based on the numerology of the DL PRS of a serving cell that covers the union of the potential DL PRS symbols and determines the DL PRS symbol occupancy within slot , where the interval considers the actual *nr-DL-PRS-ExpectedRSTD*, *nr-DL-PRS-ExpectedRSTD-Uncertainty* provided for each pair of DL PRS resource sets (target and reference).

*-* For Type 2, is the numerology of the DL PRS, and is the cardinality of the set .

The UE may be configured to report one or more measurement instances, each with its own timestamp, on DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, and/or UE Rx-Tx time difference measurements, in a single measurement report.

Timing Error Group(s) (TEG(s)) at UE side are defined:

*-* UE Rx TEG is associated with one or more DL measurements, which have the Rx timing error difference within a certain margin.

*-* UE RxTx TEG is associated with one or more UE Rx-Tx time difference measurements, which have the 'Rx timing errors+Tx timing errors' difference within a certain margin.

The UE may be configured to report, subject to UE capability, via high layer parameter *nr-UE-RxTEG-Request*, the association information of DL RSTD measurement(s) with UE Rx TEG(s) via higher layer parameter *nr-UE-Rx-TEG-ID* when the UE reports the DL RSTD measurement(s). The UE may report up to 4 RSTD measurements associated with different DL PRS resources per UE Rx TEG per *dl-PRS-ID*.

The UE may report a UE Rx TEG ID via higher layer parameter *nr-UE-Rx-TEG-ID* for a RSTD reference time *dl-PRS-ReferenceInfo* and a UE Rx TEG ID for each DL RSTD measurement, where the DL RSTD can be DL RSTD measurement in *NR-DL-TDOA-MeasElement* and/or *NR-DL-TDOA-AdditionalMeasurementElement*.

If the UE reports a UE Rx TEG ID with a DL RSTD measurement, the UE may report a UE Rx TEG timing error margin value, via high layer parameter *nr-UE-RxTEG-TimingErrorMargin*, for all the UE Rx TEGs within one *NR-DL-TDOASignalMeasurementInformation.*

The UE may be configured to measure and report, via high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTEGs* subject to UE capability, RSTD measurements on a DL PRS resource associated with a *dl-PRS-ID* using up to 8 different UE Rx TEGs with the same *dl-PRS-ReferenceInfo.* The higher layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTEGs* applies to all DL PRS positioning frequency layers.

The UE may be provided with association information of DL PRS resource(s) with TRP Tx TEGs via higher layer parameter *dl-prs-trp-Tx-TEG-ID* for a *dl-PRS-ID*.

The UE may be configured to report, via high layer parameter *nr-UE-RxTxTEG-Request*, subject to UE capability, the association information of UE Rx-Tx time difference measurement(s) with UE RxTx TEG(s) via higher layer parameter *nr-UE-RxTx-TEG-ID*. The UE may report up to 4 UE Rx-Tx time difference measurements associated with different DL PRS resources per UE RxTx TEG per *dl-PRS-ID*.

If the UE reports a UE RxTx TEG ID with a UE Rx-Tx time difference measurement, the UE may report a UE RxTx TEG timing error margin value, via high layer parameter *nr-UE-RxTxTEG-TimingErrorMargin*, for all the UE RxTx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation.*

The UE may be configured to report, via high layer parameter *nr-UE-RxTxTEG-Request*, subject to UE capability, the association information of UE Rx-Tx time difference measurement(s) with the UE Rx TEG(s) and UE Tx TEG(s) via the higher layer parameters of *nr-UE-Rx-TEG-ID*, and *nr-UE-Tx-TEG-Index*. The UE may report up to 4 UE Rx-Tx time difference measurements associated with different DL PRS resources per UE Rx TEG per *dl-PRS-ID*.

If the UE reports a UE Rx TEG ID with a UE Rx-Tx time difference measurement, the UE may report a UE Rx TEG timing error margin value, via high layer parameter *nr-UE-RxTEG-TimingErrorMargin*, for all the UE Rx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation*.

The UE may be configured to measure and report, via high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTEGs* subject to UE capability, UE Rx-Tx time difference measurements on a PRS resource associated with a *dl-PRS-ID* using up to 8 different UE Rx TEGs. The high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTEGs* applies to all DL PRS positioning frequency layers.

The UE may be configured to measure and report, via high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs* subject to UE capability, UE Rx-Tx time difference measurements with the same UE Tx TEG using up to 8 different UE RxTx TEGs*.* The high layer parameter *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs* applies to all DL PRS positioning frequency layers.

The UE may be configured to measure and report, via higher layer parameter [undetermined NTN related parameter] subject to UE capability, UE Rx-Tx time difference measurements on a PRS resource associated with a *dl-PRS-ID,* and report the UE Rx-Tx time difference subframe offset and the DL timing drift as described in [7, TS 38.215].

The UE in RRC\_INACTIVE mode is expected to prioritize the reception of any other DL signals and DL channels than the reception of DL PRS.

The UE in RRC\_INACTIVE mode, subject to UE capability, is expected to process DL PRS outside or inside of the initial DL BWP. For DL PRS processing outside of the initial DL BWP, the UE may be configured with the same or different subcarrier spacing and CP for DL PRS resources than those of the initial DL BWP. For DL PRS processing inside of the initial DL BWP, the UE is configured with the same subcarrier spacing and CP for DL PRS resources as those of the initial DL BWP.

For a UE configured with preconfigured Measurement gap(s) for Positioning, when the UE receives an activation command, as described in clause 6.1.3.41 of [10, TS 38.321], for a preconfigured Measurement Gap for Positioning activation/deactivation, and when the UE would transmit a PUCCH with HARQ-ACK information in slot n corresponding to the PDSCH carrying the command, the corresponding actions in [10, TS 38.321] and the UE assumptions shall be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH.

For a UE configured with DL PRS Processing Window(s), when the UE receives an activation/deactivation command, as described in clause 6.1.3.42 of [10, TS 38.321], for a DL PRS processing window activation, and when the UE would transmit a PUCCH with HARQ-ACK information in slot n corresponding to the PDSCH carrying the command, the corresponding actions in [10, TS 38.321] and the UE assumptions shall be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH. The UE is not expected to be indicated with more than 4 activated DL PRS processing windows across all active DL BWPs and is not expected to be indicated with the activated DL PRS processing windows that overlap in time.

The UE, subject to UE capability, may be requested to perform DL RSCPD and/or DL RSCP measurements on indicated DL PRS resource sets occurring within one or two time window(s) indicated by *NR-DL-PRS-MeasurementTimeWindowsConfig*. Within each window indicated by *NR-DL-PRS-MeasurementTimeWindowsConfig*, the UE expects that the indicated DL PRS resource sets across all *dl-PRS-IDs* are from one DL PRS positioning frequency layer, and that the number of indicated DL PRS resource sets associated with each *dl-PRS-ID* are the same.

The UE, subject to UE capability, may be requested to perform DL RSTD, UE Rx – Tx time difference, DL PRS-RSRP, and DL PRS-RSRPP measurement on the indicated DL PRS resource sets only within the window(s) indicated by *NR-DL-PRS-MeasurementTimeWindowsConfig*. Otherwise, UE may use the indicated DL PRS resource set(s) occurring outside the indicated time window for these measurements in addition to the indicated DL PRS resource set(s) occurring inside the indicated time window(s).

##### 5.1.6.5.1 PRS receiver frequency hopping

The reduced capability UE may be configured to measure and report, subject to UE capability, via *nr-DL-PRS-RxHoppingRequest* the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, or UE Rx-Tx time difference using receiver frequency hopping for a DL PRS resource, with a requested bandwidth of all hops that may be greater than the maximum reduced capability UE bandwidth. The reduced capability UE performing receiver frequency hopping may report via *nr-ReportDL-PRS-MeasBasedOnSingleOrMultiHopRx* one measurement associated with one received frequency hop or one measurement based on multiple hops of the DL PRS. The reduced capability UE may report whether the measurement is associated with one received frequency hop or multiple frequency hops of the DL PRS. In RRC\_CONNECTED mode, the reduced capability UE is expected to use a single instance of a configured measurement gap to receive all hops of the DL PRS using receiver frequency hopping.

##### 5.1.6.5.2 PRS for carrier phase positioning

For DL UE positioning measurement reporting in higher layer parameter *NR-DL-TDOA-SignalMeasurementInformation,* the UE may be configured to report the DL Reference Signal Carrier Phase Difference (RSCPD) [7, TS 38.215] measurement along with the DL RSTD measurement. When the UE reports RSCPD measurements, the reference *nr-DL-PRS-ReferenceInfo* is the same as the one reported, for the RSTD measurements. For DL UE positioning measurement reporting in higher layer parameter *NR-Multi-RTT-SignalMeasurementInformation*, the UE may be configured to report the DL Reference Signal Carrier Phase (RSCP) measurement [7, TS 38,215] along with the UE Rx-Tx time difference measurement. When the UE reports DL RSCPD measurement(s) along with DL RSTD measurement(s) or DL RSCP measurement(s) along with UE Rx-Tx time difference measurement(s), the DL RSCPD and/or DL RSCP measurement(s) should be measured from a single DL PRS positioning frequency layer. For a UE in RRC\_CONNECTED state, DL RSCP/RSCPD measurements are measured within the configured measurement gap.

The UE is expected to obtain each DL RSCP or DL RSCPD measurement with as defined in [11, TS 38.133]. If the UE reports a DL RSTD measurement with = 2 or 4 samples as defined in [11, TS 38.133], up to DL RSCPD measurements can be reported associated with the DL RSTD measurement. If the UE reports a UE Rx-Tx time difference measurement with = 2 or 4 samples as defined in [11, TS 38.133], up to DL RSCP measurements can be reported associated with the UE Rx-Tx time difference measurement. Each DL RSCP or DL RSCPD measurement has its own timestamp.

When the UE reports a timestamp associated with a DL RSCP measurement or a DL RSCPD measurement, subject to UE capability, it may include a symbol index in the timestamp.

If the UE reports LoS/NLoS indicator(s) via higher layer parameter *nr-los-nlos-Indicator* along with a measurement report containing DL RSCP or DL RSCPD the LoS/NLoS indicator(s) are assumed to also apply to the DL RSCP or DL RSCPD measurements.

The UE may be provided with *nr-PRU-RSCP-MeasInfo* or *nr-PRU-DL-TDOA-MeasInfo* which contains DL RSCP/RSCPD measurements together with DL RSTD, DL PRS-RSRP, and/or DL PRS-RSRPP measurement(s) associated with the RSCP/RSCPD measurements performed by a positioning reference unit (PRU) [20, TS 38.305] the timestamps associated with the measurements, and the location information of the PRU.

The UE may be configured to report quality metrics *NR-PhaseQuality*corresponding to the DL RSCP and RSCPD measurements which include the following fields [17, TS 37.355]:

*- phaseQualityValue* which provides the uncertainty of the measurement

*- phaseQualityResolution* which specifies the resolution levels used in the *phaseQualityValue* field.

The UE in RRC\_INACTIVE or RRC\_IDLE mode is expected to perform the DL RSCP or DL RSCPD measurementfrom the bandwidth of a DL PRS resource including outside of the initial downlink bandwidth part.

##### 5.1.6.5.3 PRS bandwidth aggregation for positioning measurements

When the UE is expected to perform aggregated measurements for bandwidth aggregation across DL PRS positioning frequency layers, the UE expects to be configured with linkage information, via higher layer parameter *nr-DL-PRS-AggregationInfo*, between DL PRS resource sets across DL PRS positioning frequency layers. For the linked DL PRS resource sets, the UE is expected to be configured with the same values of QCL, *dl-PRS-Periodicity-and-ResourceSetSlotOffset, dl-PRS-NumSymbols*,*dl-PRS-ResourceTimeGap, dl-PRS-ResourceRepetitionFactor, dl-PRS-ResourceSymbolOffset,* *dl-PRS-MutingBitRepetitionFactor,* *dl-PRS-SubcarrierSpacing, dl-PRS-CyclicPrefix*, comb size, power per subcarrier, *NR-MutingPattern*, and *NR-DL-PRS-SFN0-Offset,* and the UE is expected to be configured with DL PRS resources that maintain uniformly spaced DL PRS RE pattern within a symbol across aggregated DL PRS positioning frequency layers. The UE assumes that DL PRS resources across the linked DL PRS resource sets which satisfy the above conditions are linked for bandwidth aggregation, and the UE may assume phase continuity on the DL PRS resources on same symbol(s); otherwise, the UE does not assume that PRS resources from the linked DL PRS resource sets are linked for bandwidth aggregation.

The UE may be indicated by the network that aggregated DL PRS resource set(s) can be used as the reference for the aggregated DL RSTD, DL PRS-RSRP, DL PRS-RSRPP, and UE Rx-Tx time difference measurements.

The UE may be configured to measure and report, subject to UE capability, up to 4 aggregated DL RSTD measurement(s) per pair of *dl-PRS-ID,* from a different pair of aggregated DL PRS resources across two or three DL PRS positioning frequency layers*.* The UE may report up to 4 RSTD measurements associated with different aggregated DL PRS resources per UE Rx TEG per *dl-PRS-ID*.

The UE may be configured to measure and report, subject to UE capability, up to 4 aggregated UE Rx-Tx time difference measurement(s) from aggregated DL PRS resources across two or three DL PRS positioning frequency layers. The UE may report up to 4 UE Rx-Tx time difference measurements associated with different aggregated DL PRS resources per UE RxTx TEG per *dl-PRS-ID*.

The UE may be requested via higher layer parameter *nr-DL-PRS-JointMeasurementRequestedPFL-List*to perform the aggregated DL RSTD measurement(s) or the aggregated UE Rx-Tx time difference measurement(s) across two or three DL PRS positioning frequency layers.

The UE may report via higher layer parameter *nr-RSTD-BasedOnAggregatedResources* or *nr-UE-RxTxTimeDiffBasedOnAggregatedResources* in a measurement report whether the aggregated DL RSTD measurement(s) or the aggregated UE Rx-Tx time difference measurement(s) is performed. If any aggregated measurement is performed, the two or three DL PRS positioning frequency layers to be used may also be reported by reporting PRS resource set IDs.

If the UE reports a DL PRS-RSRP or a DL PRS-RSRPP with aggregated DL RSTD measurement(s) or aggregated UE Rx-Tx time difference measurement(s), the DL PRS-RSRP or the DL PRS-RSRPP correspond to the aggregated DL PRS resources across two or three DL PRS positioning frequency layers.

For PRS resources on multiple DL PRS positioning frequency layers (PFLs) linked for aggregation, the channel over which a symbol on one PFL for PRS transmission is conveyed can be inferred from the channel over which the same symbol of another PFL or the aggregated PFL is conveyed.

<omitted text>

##### 5.2.1.4.2 Report quantity configurations

A UE may be configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to either 'none', 'cri-RI-PMI-CQI ', 'cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI', 'cri-RSRP', 'cri-SINR', 'ssb-Index-RSRP', 'ssb-Index-SINR', 'cri-RI-LI-PMI-CQI', 'cri-RSRP- Index', 'ssb-Index-RSRP- Index', 'cri-SINR- Index', 'ssb-Index-SINR- Index' or 'tdcp'.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'none', then the UE shall not report any quantity for the *CSI-ReportConfig*.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-PMI-CQI', or 'cri-RI-LI-PMI-CQI', the UE shall report a preferred precoder matrix for the entire reporting band, or a preferred precoder matrix per subband, according to Clause 5.2.2.2.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-i1',

- the UE expects, for that *CSI-ReportConfig,* to be configured with higher layer parameter *codebookType* set to 'typeI-SinglePanel' and *pmi-FormatIndicator* set to 'widebandPMI'and,

- the UE shall report a PMI consisting of a single wideband indication ( in Clause 5.2.2.2.1) for the entire CSI reporting band.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-i1-CQI',

- the UE expects, for that *CSI-ReportConfig,* to be configured with higher layer parameter *codebookType* set to 'typeI-SinglePanel' and *pmi-FormatIndicator* set to 'widebandPMI'and,

- the UE shall report a PMI consisting of a single wideband indication ( in Clause 5.2.2.2.1) for the entire CSI reporting band. The CQI is calculated conditioned on the reported assuming PDSCH transmission with  precoders (corresponding to the same but different  in Clause 5.2.2.2.1), where the UE assumes that one precoder is randomly selected from the set of  precoders for each PRG on PDSCH, where the PRG size for CQI calculation is configured by the higher layer parameter *pdsch-BundleSizeForCSI*.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-CQI',

- if the UE is configured with higher layer parameter *non-PMI-PortIndication* contained in a *CSI-ReportConfig,* *r* ports are indicated in the order of layer ordering for rank *r* and each CSI-RS resource in the CSI resource setting is linked to the *CSI-ReportConfig* based on the order of the associated *NZP-CSI-RS-ResourceId* in the linked CSI resource setting for channel measurement given by higher layer parameter *resourcesForChannelMeasurement*. The configured higher layer parameter *non-PMI-PortIndication* contains a sequence  of port indices, where  are the CSI-RS port indices associated with rank ν and  where is the number of ports in the CSI-RS resource. The UE shall only report RI corresponding to the configured fields of *PortIndexFor8Ranks*. If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations with [*port-subsetIndicator*] configured in each sub-configuration, and the higher layer parameter *non-PMI-PortIndication* is separately provided for a sub-configuration, then  corresponds to the number of bits with value 1 in the bitmap [*port-subsetIndicator*] for the sub-configuration and the CSI-RS port indices are derived by mapping antenna ports corresponding to all bits with value of 1 in [*port-subsetIndicator*] as consecutive antenna ports starting at CSI-RS port index 0 in increasing order of the bit position in [*port-subsetIndicator*].

- if the UE is not configured with higher layer parameter *non-PMI-PortIndication,* the UE assumes, for each CSI-RS resource in the CSI resource setting linked to the *CSI-ReportConfig*, that the CSI-RS port indices  are associated with ranks  where  is the number of ports in the CSI-RS resource. If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations with [*port-subsetIndicator*] configured in each sub-configuration and the higher layer parameter *non-PMI-PortIndication* is not provided for a sub-configuration, then  corresponds to the number of bits with value 1 in the bitmap [*port-subsetIndicator*] for the sub-configuration and the CSI-RS port indices are derived by mapping antenna ports corresponding to all bits with value of 1 in [*port-subsetIndicator*] as consecutive antenna ports starting at CSI-RS port index 0 in increasing order of the bit position in [*port-subsetIndicator*].

- When calculating the CQI for a rank, the UE shall use the ports indicated for that rank for the selected CSI-RS resource. The precoder for the indicated ports shall be assumed to be the identity matrix scaled by .

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RSRP', 'ssb-Index-RSRP', 'cri-RSRP- Index' or 'ssb-Index-RSRP- Index',

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'disabled', the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single report *nrofReportedRS* (higher layer configured) different CRI or SSBRI for each report setting.

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'enabled', the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single reporting instance two different CRI or SSBRI for each report setting, where CSI-RS and/or SSB resources can be received simultaneously by the UE either with a single spatial domain receive filter, or with multiple simultaneous spatial domain receive filters.

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting-r17*, the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single reporting instance *nrofReportedGroups,* if configured, group(s) of two CRIs or SSBRIs selecting one CSI-RS or SSB from each of the two CSI Resource Sets for the report setting, where CSI-RS and/or SSB resources of each group can be received simultaneously by the UE.

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting-v18* set to *JointULandDL*, the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single reporting instance *nrofReportedGroups-r18,* if configured, group(s) of two CRIs or SSBRIs selecting one CSI-RS or SSB from each of the two CSI Resource Sets for the report setting, where CSI-RS and/or SSB resources of each group can be received simultaneously and applied for simultaneous transmission with spatial filters by the UE subject to UE capability.

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting-v18* set to *ULOnly,* the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single reporting instance *nrofReportedGroups-r18,* if configured, group(s) of two CRIs or SSBRIs selecting one CSI-RS or SSB from each of the two CSI Resource Sets for the report setting, where CSI-RS and/or SSB resources of each group can be applied for simultaneous transmission with spatial filters by the UE subject to UE capability.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-SINR', 'ssb-Index-SINR', 'cri-SINR- Index' or 'ssb-Index-SINR- Index',

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'disabled', the UE shall report in a single report *nrofReportedRS* (higher layer configured) different CRI or SSBRI for each report setting.

- if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'enabled', the UE shall report in a single reporting instance two different CRI or SSBRI for each report setting, where CSI-RS and/or SSB resources can be received simultaneously by the UE.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'tdcp'

- the value of is configured by higher layer parameter *Y*, and delay values, , are configured by higher layer parameter *D*, such that the UE is expected to report the amplitude of TDCP measurement, as defined in Clause 5.1 of [7, TS 38.215], for each of the configured delays. Values of can be configured subject to UE capability. The configurable delay values are , , where the value is restricted to subcarrier spacing configuration , the values other than are applicable to subcarrier spacing configurations , and where the values can be configured subject to UE capability, with .

- For , if the higher layer parameter *phase* is configured, the UE is expected to report the amplitude and phase of TDCP measurement for each of the configured delays, if supported by UE capability.

Except for a *CSI-ReportConfig* configured with *reportQuantity* set to 'cri-RI-PMI-CQI' and *codebookType* set to 'typeII-CJT-r18', 'typeII-CJT-PortSelection-r18', 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18', if the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RSRP', 'cri-RI-PMI-CQI ', 'cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI', 'cri-RI-LI-PMI-CQI', 'cri-SINR', or 'cri-SINR- Index ', and resources are configured in the corresponding resource set for channel measurement, then the UE shall derive the CSI parameters other than CRI conditioned on the reported CRI, where CRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of associated *nzp-CSI-RS-Resources* in the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement, and (*k*+1)-th entry of associated *csi-IM-Resource* in the corresponding *csi-IM-ResourceSet* (if configured) or (*k*+1)-th entry of associated *nzp-CSI-RS-Resources* in the corresponding *NZP-CSI-RS-ResourceSet* (if configured for *CSI-ReportConfig* with *reportQuantity* set to 'cri-SINR' or 'cri-SINR- Index ') for interference measurement. If CSI-RS resources are configured, each resource shall contain at most 16 CSI-RS ports. If CSI-RS resources are configured, each resource shall contain at most 8 CSI-RS ports.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-PMI-CQI', *codebookType* set to 'typeII-CJT-r18' or 'typeII-CJT-PortSelection-r18' and the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement is configured with resources, each resource can contain, at most, 32 CSI-RS ports.

Subject to UE capability, a UE configured with a *CSI-ReportConfig* with the higher layer parameter *N4* and *reportQuantity* set to 'cri-RI-PMI-CQI' is assumed to support UE-side CSI prediction. The reported PMI indicates predicted precoder matrices associated with consecutive slot intervals, each with duration of slots, where the value of is configured by higher layer parameter *N4*. If the UE is configured with an aperiodic CSI-RS resource set for channel measurement, the value, in number of slots, of the time unit is configured by higher layer parameter *d*, where is defined in Clause 5.2.1.4.1. If the UE is configured with a periodic or semi-persistent CSI-RS resource set for channel measurement, the value of is equal to the periodicity of the CSI-RS resource. The earliest of the slot intervals starts at slot , where is the uplink slot in which the CSI is reported and the slot offset is configured by higher layer parameter *delta,* where defined in Clause 5.2.2.5 and the value can be configured subject to UE capability.

- For , the UE is expected to report a predicted PMI for slot interval and the slot offset value can be configured only for . A UE can be configured with if the higher layer parameter *codebookType* is set to 'typeII-Doppler-r18', or 'typeII-Doppler-PortSelection-r18'.

- The reported CQI is associated with slot and the reported PMI.

- For , the UE is expected to report a PMI which indicates predicted precoder matrices associated with slot intervals , for . A UE can be configured with if the higher layer parameter *codebookType* is set to 'typeII-Doppler-r18'.

- The UE is configured by higher layer parameter *TDCQI* to report CQIs for each subband in the CSI reporting band, if *cqi-FormatIndicator* is set to 'subbandCQI', or CQIs for the entire CSI reporting band, if *cqi-FormatIndicator* is set to 'widebandCQI'. For , the second CQI includes a 4-bit wideband CQI index and, if subband CQI reporting is configured, a 2-bit subband CQI index, calculated independently from the first CQI, as described in Clause 5.2.2.1, and the two CQIs are reported in the same CSI report.

- If the higher layer parameter *TDCQI* is set to '1-1', and the CQI is associated with slot and the precoder matrices for slot interval .

- If the higher layer parameter *TDCQI* is set to '1-2', and the CQI is associated with slot and the precoder matrices for slot interval and with slot and the precoder matrices for slot interval .

- If the higher layer parameter *TDCQI* is set to '2', . The first CQI is associated with slot and the precoder matrices for slot interval . The second CQI is associated with slot and the precoder matrices for slot interval .

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-PMI-CQI', or 'cri-RI-LI-PMI-CQI' and the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement is configured with resources, two Resource Groups with resources in Group 1, resources in Group 2, , and Resource Pairs:

- each resource can contain, subject to UE capability, at most 32 CSI-RS ports. For two Resource Groups with resources (i=1,2), if , the resource in NZP-CSI-RS-ResourceSet shall contain at most 32 CSI-RS ports; if , each resource in NZP-CSI-RS-ResourceSet shall contain at most 16 CSI-RS ports; if , each resource in NZP-CSI-RS-ResourceSet shall contain at most 8 CSI-RS ports.

- each of the Resource Pairs is associated to a CRI value.

- The *CSI-ReportConfig* may be configured with higher layer parameter *sharedCMR*. and are the numbers of resources associated to a CRI value, other than the *N* CRIs defined above, in Group 1 and Group 2, respectively, with , such that the total number of CRI values configured for the *CSI-ReportConfig* is .

- If the higher layer parameter *csi-ReportMode* is set to 'Mode1' and the higher layer parameter *numberOfSingleTRP-CSI-Mode1* is set to , ; otherwise,

- if the higher layer parameter *csi-ReportMode* is set to 'Mode1' and the higher layer parameter *numberOfSingleTRP-CSI-Mode1* is set to , or if *csi-ReportMode* is set to 'Mode2',

- if *sharedCMR* is configured: and ; otherwise

- if *sharedCMR* is not configured, only the resources in Group 1 and Group 2 that are not referred to in any Resource Pair are associated to *M* CRI values other than the *N* CRIs defined above.

- If interference measurement is performed on CSI-IM, resources are configured in the corresponding *csi-IM-ResourceSet*. The resources for channel measurement defined above are resource-wise associated with the first CSI-IM resources by the ordering of the CSI-RS resources and CSI-IM resources in the corresponding Resource Set. The Resource Pairs for channel measurement are associated to the last CSI-IM resources by the ordering of the CSI-RS Resource Pairs and CSI-IM resources in the CSI-IM Resource Set. The UE may assume that the two CSI-RS resources for channel measurement in a Resource Pair and the associated CSI-IM resource for interference measurement are resource-wise QCLed with respect to 'typeD'.

- The UE is not expected to be configured with NZP CSI-RS for interference measurement other than the NZP CSI-RS resources for channel measurement configured in the Resource Pairs.

- The UE expects, for that *CSI-ReportConfig,* to be configured with higher layer parameter *codebookType* set to 'typeI-SinglePanel', and

- The UE shall derive the CSI parameters other than CRI(s) conditioned on the reported CRI(s), as follows:

- If the higher layer parameter *csi-ReportMode* is set to 'Mode1' and the higher layer parameter *numberOfSingleTRP-CSI-Mode1* is set to , CRI(s) are reported:

- one CRI corresponds to the configured -th entry of the associated Resource Pairs in the corresponding CSI-RS Resource Set for channel measurement, and -th entry of the corresponding CSI-IM Resource Set, if configured. The UE shall report two RIs, two PMIs, two LIs (if configured), associated to the resource in Group 1 and the resource in Group 2, respectively, of the -th Resource Pair, and one CQI; and

- if , one CRI () corresponds to the configured -th entry of the associated resources in the corresponding CSI-RS Resource Set for channel measurement, and -th entry of the corresponding CSI-IM Resource Set, if configured. The UE shall report one RI, one PMI, one LI (if configured) and one or two CQIs conditioned on CRI ; or

- if , one CRI corresponds to the configured -th entry of the associated resources in Group 1 of the corresponding CSI-RS Resource Set for channel measurement, and -th entry of the associated resources in the corresponding CSI-IM Resource Set, if configured, and one CRI corresponds to the configured -th entry of the associated resources in Group 2 of the corresponding CSI-RS Resource Set for channel measurement, and -th entry of the corresponding CSI-IM Resource Set, if configured. The UE shall report one RI, one PMI, one LI (if configured) and one or two CQIs conditioned on CRI and one RI, one PMI, one LI (if configured) and one or two CQIs conditioned on CRI .

- If the higher layer parameter *csi-ReportMode* is set to 'Mode2', one CRI is reported, which corresponds to the -th entry of the resources or Resource Pairs in the corresponding CSI-RS Resource Set for channel measurement, and -th entry of the associated resources in the corresponding CSI-IM Resource Set, if configured. The first codepoints of the CRI correspond to resources associated to Group 1 and Group 2. The last codepoints of the CRI correspond to the configured Resource Pairs. The UE shall report one RI, one PMI, one LI, if configured, and one or two CQIs conditioned on CRI if ; or two RIs, two PMIs, two LIs, if configured, associated to the resource in Group 1 and the resource in Group 2, respectively, of the -th Resource Pair, and one CQI, otherwise.

- For a reported CRI corresponding to an entry of the Resource Pairs configured in the corresponding CSI-RS Resource Set for channel measurement:

- the UE shall not report a total number of layers larger than four.

- the two RIs are reported with a joint RI index corresponding to one of the four rank combinations: .

- The *CodebookConfig* in *CSI-ReportConfig* can be configured with two RI restriction parameters *typeI-SinglePanel-ri-RestrictionSTRP* and *typeI-SinglePanel-ri-RestrictionSDM*. The parameter *typeI-SinglePanel-ri-RestrictionSTRP* applies to a reported RI when conditioned on a CRI corresponding to an entry of the CSI-RS resources defined above. The bitmap parameter *typeI-SinglePanel-ri-RestrictionSTRP* forms the bit sequence  where  is the LSB and  is the MSB. When  is zero, , PMI and RI reporting are not allowed to correspond to any precoder associated with  layers. The parameter *typeI-SinglePanel-ri-RestrictionSDM* applies to a reported joint RI index when conditioned on a CRI corresponding to an entry of the Resource Pairs and indicates one or more of the four rank combinations that are allowed to correspond to the reported PMIs and RIs. The bitmap parameter *typeI-SinglePanel-ri-RestrictionSDM* forms the bit sequence  where  is the LSB and  is the MSB. When  is zero, , PMI and RI reporting are not allowed to correspond to any precoder associated with the -th rank combination in the following order: {1,1}, {1,2}, {2,1},{2,2}.

- The *CodebookConfig* in *CSI-ReportConfig* can be configured with two Codebook Subset Restrictions. The first restriction applies to a reported PMI associated to a CSI-RS resource in Group 1. The second restriction applies to a reported PMI associated to a CSI-RS resource in Group 2.

If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations, provided by [*csi-ReportSubConfigList]*:

- The UE expects to be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'. If the UE indicates a capability for supporting mixed codebook combination in a slot with [ABC], each sub-configuration which is configured with *portSubsetIndictor* can be configured with the higher layer parameter *codebookType* set to 'typeI-SinglePanel' or 'typeI-MultiPanel'.

- Each sub-configuration can be configured with an antenna port subset using the higher layer bitmap parameter [*port-subsetIndicator*] which contains the bit sequence , where is the MSB and is the LSB, bit corresponds to antenna port , and is the number of ports *nrofPorts* configured for the CSI-RS resources(s) within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement that corresponds to the *CSI-ReportConfig*. A bit value 0 in [*port-subsetIndicator*] indicates that the corresponding antenna port is disabled for the sub-configuration, whereas bit value 1 indicates that the antenna port is enabled and belongs to the antenna port subset for the sub-configuration. For the derivation of PMI, antenna ports corresponding to all bits with value of 1 in [*port-subsetIndicator*] are mapped to consecutive antenna ports starting at CSI-RS antenna port 3000 in increasing order of the bit position in [*port-subsetIndicator*].

- If a sub-configuration is configured with an antenna port subset, then the sub-configuration can be configured with a [RI restriction parameter] and, if the number of antenna ports of the subset greater than 2, with [*n1-n2* parameter] if the higher layer parameter *codebookType* is set to 'typeI-SinglePanel' or with [*ng*-*n1-n2* parameter] if the higher layer parameter *codebookType* is set to 'typeI-MultiPanel', and, if the corresponding number of antenna ports of the subset is 2, with *twoTX-CodebookSubsetRestriction*, where the parameters [RI restriction], [*n1-n2],* [*ng*-*n1-n2],* *twoTX-CodebookSubsetRestriction* are as described in Clauses 5.2.2.2.1 and 5.2.2.2.2. If a sub-configuration is configured with an antenna port subset, and if higher layer parameter *reportQuantity* is set to 'cri-RI-i1-CQI', and if the higher layer parameter *codebookType* is set to 'typeI-SinglePanel', then the sub-configuration can be configured with higher layer parameter *typeI*-*SinglePanel-codebookSubsetRestriction-i2*, where *typeI*-*SinglePanel-codebookSubsetRestriction-i2* is as described in Clause 5.2.2.2.1.

- If a sub-configuration is configured with an antenna port subset, and if the *CSI-ReportConfig* that contains a mix of sub-configuration(s) each corresponding to 'typeI-SinglePanel' some other sub-configuration(s) each corresponding to 'typeI-MultiPanel', then the sub-configuration(s) which is configured with *portSubsetIndictor* can be configured with the higher layer parameter *codebookMode.*

- A sub-configuration can be configured with a power offset provided by [*powerOffse*t].

- A sub-configuration can be configured with a list of NZP CSI-RS resources, provided by [*nzp-CSI-RS-resourceList*], which indicates one or more NZP CSI-RS resources, within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement which corresponds to the *CSI-ReportConfig.* If there is no sub-configuration configured with a power offset provided by *[powerOffset],* the list of NZP CSI-RS resources has no intersection with a list of NZP CSI-RS resources configured for any other sub-configuration(s) within the *CSI-ReportConfig,* otherwise, the list of NZP CSI-RS resources is identical to or has no intersection with a list of NZP CSI-RS resources configured for any other sub-configuration(s) within the *CSI-ReportConfig*.

- If a sub-configuration is configured with a list of NZP CSI-RS resources with more than one resource, the UE shall derive the CSI parameters other than CRI conditioned on the reported CRI, where the CRI *k* (*k* ≥ 0) for the sub-configuration corresponds to the configured (*k*+1)-th entry of associated *NZP-CSI-RS-Resource* in the list of NZP CSI-RS resources.

- If a sub-configurations is not configured with [*nzp-CSI-RS-resourceList*] then the sub-configuration shall be associated with all the NZP CSI-RS resources within a *NZP-CSI-RS-ResourceSet* contained in the *CSI-ResourceConfig* for channel measurement which corresponds to the *CSI-ReportConfig.*

- the UE reports CSI(s) for one or more sub-configurations according to Clauses 5.2.1.5.1, 5.2.1.5.2, 5.2.3 and 5.2.4, and according to the higher layer parameter *reportQuantity* configured for that *CSI-ReportConfig*.

- The UE does not expect the higher layer parameter *reportQuantity* to be set to 'cri-RSRP', 'cri-SINR', 'cri-SINR- Index', 'cri-RSRP-Index', 'none', 'ssb-Index-RSRP', 'ssb-Index-SINR', 'ssb-Index-RSRP- Index', 'ssb-Index-SINR- Index', or 'tdcp'.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'ssb-Index-RSRP' or 'ssb-Index-RSRP- Index', the UE shall report SSBRI, where SSBRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of the associated *csi-SSB-ResourceList* in the corresponding *CSI-SSB-ResourceSet.*

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'ssb-Index-SINR' or 'ssb-Index-SINR- Index', the UE shall derive L1-SINR conditioned on the reported SSBRI, where SSBRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of the associated *csi-SSB-ResourceList* in the corresponding *CSI-SSB-ResourceSet* for channel measurement, and (*k*+1)-th entry of associated *csi-IM-Resource* in the corresponding *csi-IM-ResourceSet* (if configured) or (*k*+1)-th entry of associated *nzp-CSI-RS-Resources* in the corresponding *NZP-CSI-RS-ResourceSet* (if configured) for interference measurement.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-PMI-CQI', ' cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI' or 'cri-RI-LI-PMI-CQI', then the UE is not expected to be configured with more than 8 CSI-RS resources in a CSI-RS resource set contained within a resource setting that is linked to the *CSI-ReportConfig*, except when the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *N4*, *reportQuantity* set to 'cri-RI-PMI-CQI' and the corresponding CSI-RS resource set for channel measurement is aperiodic with resources.

If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-LI-PMI-CQI', UE does not expect the *CSI-ReportConfig* to be configured with higher layer parameter *codebookType* set to '*typeII-r16*' or '*typeII-PortSelection-r16*', '*typeII-PortSelection-r17'*, 'typeII-CJT-r18', 'typeII-CJT-PortSelection-r18', 'typeII-Doppler-r18' or 'typeII-Doppler-PortSelection-r18'.

If the UE is configured with a *CSI-ReportConfig* with higher layer parameter *reportQuantity* set to 'cri-RSRP', 'cri-SINR', 'none', 'cri-RSRP- Index' or 'cri-SINR- Index and the *CSI-ReportConfig* is linked to a resource setting configured with the higher layer parameter *resourceType* set to 'aperiodic', then the UE is not expected to be configured with more than 16 CSI-RS resources in a CSI-RS resource set contained within the resource setting.

The LI indicates which column of the precoder matrix of the reported PMI corresponds to the strongest layer of the codeword corresponding to the largest reported wideband CQI. If two wideband CQIs are reported and have equal value, the LI corresponds to strongest layer of the first codeword. If the UE is configured with a *CSI-ReportConfig* with *reportQuantity* set to 'cri-RI-LI-PMI-CQI' and the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement is configured with two Resource Groups and Resource Pairs, and the UE reports a CRI associated to a Resource Pair, and a rank combination , the first LI indicates which column of the precoder matrix of the first reported PMI corresponds to the strongest of the first layers of the codeword and the second LI indicates which column of the precoder matrix of the second reported PMI corresponds to the strongest of the last layers of the codeword.

For operation with shared spectrum channel access in FR1, or in FR2-2 when the UE is provided *ChannelAccessMode2-r17* = '*enabled*', if the UE is configured with a *CSI-ReportConfig* with higher layer parameter *reportQuantity* set to 'cri-RI-PMI-CQI ', 'cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI' or 'cri-RI-LI-PMI-CQI', the UE shall derive:

- the CSI parameters without averaging two or more instances of any periodic or semi-persistent *nzp-CSI-RS-Resources* in the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement or for interference measurement located in different DL transmissions,

- the instances of the *nzp-CSI-RS-Resources* are not in the same channel occupancy duration indicated by DCI format 2\_0, if the UE is provided at least one of *SlotFormatIndicator* or co*-DurationList*; or

- the instances of the *nzp-CSI-RS-Resources* occur within a set of consecutive symbols which are not all occupied by PDSCH(s) and/or aperiodic CSI-RS(s) indicated by DCI formats, if any, and the corresponding PDCCH(s), if the UE is neither provided with *CO-DurationsPerCell* nor *SlotFormatIndicator*, but is provided with *csi-RS-ValidationWithDCI*

- the interference measurements for computing CSI value based on periodic/semi-persistent CSI-IM measured only in OFDM symbol(s) that fulfill the same conditions under which the UE is expected to receive periodic/semi-persistent CSI-RS as described in Clause 11.1 and Clause 11.1.1 of [6, TS 38.213].

If the UE is configured with the higher layer parameter *SSB-MTC-AdditionalPCI*, the UE is allowed to report in a single reporting instance up to four SSBRIs for each report setting, where SSB resources are associated with PCI indices referring to the PCI of the serving cell and PCI(s) different from the PCI of the serving cell within the set of PCIs configured.

If a UE is configured with a *LTM-CSI-ReportConfig*,

- if the UE is configured with *spCellInclusion*, the UE shall report in a single reporting instance *nrOfReportedRS-PerCell* different SSBRIfor the current SpCell and each of the *nrOfReportedCells -1* candidate cells.Otherwise, the UE shall report in a single reporting instance *nrOfReportedRS-PerCell* different SSBRI for each of the *nrOfReportedCells* candidate cells,

- where SSBRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of the associated *ltm-CSI-SSB-ResourceList* in the corresponding *LTM-CSI-SSB-ResourceSet*,

- if *spCellInclusion* is configured, SSB resources in *ltm-CSI-SSB-ResourceList* associated with the current SpCell are the entries where PCI given by *ltm-CandidatePCI* and frequency information given by *ssbFrequency* of the associated candidate cell (given in [*ltm-CandidateIdList*]) is equal to the PCI and center frequency of cell-defining SSB of the current SpCell.

If the UE is configured with a *CSI-ReportConfig* that contains a list of sub-configurations provided by *csi-ReportSubConfigList*, the UE can only be configured with NZP CSI-RS for interference measurement if each sub-configuration is configured with [*powerOffse*t] and not configured with [*port-subsetIndicator*].

<omitted text>

##### 5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology

For CSI-RS resource sets associated with Resource Settings configured with the higher layer parameter *resourceType* set to 'aperiodic', 'periodic', or 'semi-persistent', trigger states for Reporting Setting(s) (configured with the higher layer parameter *reportConfigType* set to 'aperiodic') and/or Resource Setting for channel and/or interference measurement on one or more component carriers are configured using the higher layer parameter *CSI-AperiodicTriggerStateList*. For a reporting setting for which the *CSI-ReportConfig* contains a list of sub-configurations provided by the higher layer parameter [*csi-ReportSubConfigList*], one or more trigger states can be configured with each indicating one or more of the sub-configurations. For aperiodic CSI report triggering, a single set of CSI triggering states are higher layer configured, wherein the CSI triggering states can be associated with any candidate DL BWP. A UE is not expected to receive more than one DCI with non-zero *CSI request* field per slot per cell. A UE is not expected to receive DCI with non-zero *CSI request* field within a cell group in a slot overlapping with any slot receiving DCI with non-zero *CSI request* field in the same cell group. A UE is not expected to be configured with different *TCI-StateId*'s for the same aperiodic CSI-RS resource ID configured in multiple aperiodic CSI-RS resource sets with the same triggering offset in the same aperiodic trigger state. A UE is not expected to receive more than one aperiodic CSI report request for transmission in a given slot per cell. A UE is not expected to receive an aperiodic CSI report request for transmission in a slot overlapping with any slot having an aperiodic CSI report transmission in the same cell group. If a UE does not indicate its capability of *csi-TriggerStateNon-ActiveBWP* the UE is not expected to be triggered with a CSI report for a non-active DL BWP. Otherwise, when a UE is triggered with a CSI report for a DL BWP that is non-active when expecting to receive the most recent occasion, no later than the CSI reference resource, of the associated NZP CSI-RS, the UE is not expected to report the CSI for the non-active DL BWP and the CSI report associated with that BWP is omitted. When a UE is triggered with aperiodic NZP CSI-RS in a DL BWP that is non-active when expecting to receive the NZP CSI-RS, the UE is not expected to measure the aperiodic CSI-RS. In the carrier of the serving cell expecting to receive that associated NZP CSI-RS, if the active DL BWP when receiving the NZP CSI-RS is different from the active DL BWP when receiving the triggering DCI,

- the last symbol of the PDCCH span of the DCI carrying the BWP switching shall be no later than the last symbol of the PDCCH span of the DCI carrying the CSI trigger, irrespective of whether they are in the same carrier of a serving cell or not and irrespective of whether they are in the same SCS or not;

- the UE is not expected to have any other BWP switching in that carrier after the last symbol of the PDCCH span covering the DCI carrying the CSI trigger and before the first symbol of the triggered NZP CSI-RS or CSI-IM.

- when the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], the span that involves the PDCCH candidate that ends later in time is used.

A trigger state is initiated using the *CSI request* field in DCI.

- When all the bits of *CSI request* field in DCI are set to zero, no CSI is requested.

- When the number of configured CSI triggering states in *CSI-AperiodicTriggerStateList* is greater than , where  is the number of bits in the DCI *CSI request* field, the UE receives a subselection indication, as described in clause 6.1.3.13 of [10, TS 38.321], used to map up to  trigger states to the codepoints of the *CSI request* field in DCI.  is configured by the higher layer parameter *reportTriggerSize* where . When the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the subselection indication, the corresponding action in [10, TS 38.321] and UE assumption on the mapping of the selected CSI trigger state(s) to the codepoint(s) of DCI CSI request field shall be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH and is the subcarrier spacing configuration for with a value of 0 for frequency range 1, and is provided by *K-Mac* or if *K-Mac* is not provided..

- When the number of CSI triggering states in *CSI-AperiodicTriggerStateList* is less than or equal to , the *CSI request* field in DCI directly indicates the triggering state.

- For each aperiodic CSI-RS resource in a CSI-RS resource set associated with each CSI triggering state, the UE is indicated the quasi co-location configuration of quasi co-location RS source(s) and quasi co-location type(s), as described in clause 5.1.5, through higher layer signaling of *qcl-info* which contains a list of references to *TCI-State's* for the aperiodic CSI-RS resources associated with the CSI triggering state. If a *State* referred toin the list is configured with a reference to an RS configured with *qcl-Type* set to 'typeD', that RS may be an SS/PBCH block located in the same or different CC/DL BWP or a CSI-RS resource configured as periodic or semi-persistent located in the same or different CC/DL BWP.

- If the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in a *NZP-CSI-RS-ResourceSet* configured without higher layer parameter *trs-Info* is smaller than the UE reported threshold *beamSwitchTiming,* as defined in [13, TS 38.306], when the reported value is one of the values of {14, 28, 48} and *enableBeamSwitchTiming* is not provided, or is smaller than 48 when the UE provides *beamSwitchTiming-r16*, *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameter *repetition,* or is smaller than the UE reported threshold *beamSwitchTiming-r16,* when *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'on'.

- If a UE is configured with *enableDefaultTCI-StatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*

- if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], aperiodic CSI-RS triggered by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and *enableBeamSwitchTiming* is not provided, aperiodic CSI-RS triggered by a PDCCH associated with the same *coresetPoolIndex* as the PDCCH triggering the aperiodic CSI-RS and scheduled with offset larger than or equal to 48 when the reported value of *beamSwitchTiming-r16* is one of the values {224, 336} and *enableBeamSwitchTiming* is provided, periodic CSI-RS, semi-persistent CSI-RS;

- else, the UE applies the QCL parameter(s) of the CORESET associated with a monitored search space with the lowest *controlResourceSetId* among CORESETs, which are configured with the same value of *coresetPoolIndex* as the PDCCH triggering that aperiodic CSI-RS, in the latest slot in which one or more CORESETs are associated with the same value of *coresetPoolIndex* as the PDCCH triggering that aperiodic CSI-RS

- else if a UE is configured with *enableTwoDefaultTCI-States* and at least one TCI codepoint is mapped to two TCI states

- if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], aperiodic CSI-RS scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and *enableBeamSwitchTiming* is not provided, aperiodic CSI-RS scheduled with offset larger than or equal to 48 when the reported value of *beamSwitchTiming-r16* is one of the values {224, 336} and *enableBeamSwitchTiming* is provided, periodic CSI-RS, semi-persistent CSI-RS. If there is a PDSCH indicated with two TCI states in the same symbols as the CSI-RS, the UE applies the first TCI state of the two TCI states when receiving the aperiodic CSI-RS.

- else, the UE applies the first one of two TCI states corresponding to the lowest TCI codepoint among those mapped to two TCI states and applicable to the PDSCH within the active BWP of the cell in which the CSI-RS is to be received when receiving the aperiodic CSI-RS.

- else if a UE is configured with *sfnSchemePdcch* set to *'*sfnSchemeA' or 'sfnSchemeB', it is not configured with *enableTwoDefaultTCI-States,* and the two TCI states are activated for the CORESET by the activation command as described in clause 6.1.3.44 of [10, TS 38.321]

- if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with an offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], periodic CSI-RS, semi-persistent CSI-RS, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and when *enableBeamSwitchTiming* is not provided or the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *trs-Info* , aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters *repetition* and *trs-Info* scheduled with offset larger than or equal to 48 when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'on' scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided;

- else, the UE applies the first one of TCI states indicated for the CORESET with the lowest CORESET ID in the latest slot within the active BWP of the cell in which the CSI-RS is to be received when receiving the aperiodic CSI-RS, if two TCI states are activated for the CORESET. Otherwise, the UE applies the single activated TCI state of the CORESET with the lowest CORESET ID in the latest slot within the active BWP of the cell in which the CSI-RS is to be received, when receiving the aperiodic CSI-RS

- else if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], periodic CSI-RS, semi-persistent CSI-RS, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and when *enableBeamSwitchTiming* is not provided or the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *trs-Info* , aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters *repetition* and *trs-Info* scheduled with offset larger than or equal to 48 when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'on' scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided;

- else if the UE is not provided *dl-OrJointTCI-StateList*, and if at least one CORESET is configured for the BWP in which the aperiodic CSI-RS is received, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption used for the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored;

- else if the UE is provided *dl-OrJointTCI-StateList* and if the indicated TCI state is associated with a PCI different from the serving cell, regardless of configuration of *followUnifiedTCI-State*, and if at least one CORESET is configured for the BWP in which the aperiodic CSI-RS is received, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption used for the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored. In the CA case, if the 'QCL-TypeD' of the aperiodic CSI-RSs from respective CCs in a band are different in a slot, the QCL-TypeD assumption of the CSI-RS in the CC with lowest CC ID in the band is applied to all the aperiodic CSI-RSs in the CCs in the band;

- else if the UE is provided *dl-OrJointTCI-StateList* and the indicated TCI state is associated with the PCI of the serving cell, regardless of configuration of *followUnifiedTCI-State*, the indicated TCI state is applied to the aperiodic CSI-RS;

- else if the UE is configured with *enableDefaultBeamForCCS* and when receiving the aperiodic CSI-RS, the UE applies the QCL assumption of the lowest-ID activated TCI state applicable to the PDSCH within the active BWP of the cell in which the CSI-RS is to be received.

- If the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in a *NZP-CSI-RS-ResourceSet* is equal to or greater than the UE reported threshold *beamSwitchTiming* when the reported value is one of the values of {14,28,48} and *enableBeamSwitchTiming* is not provided and the *NZP-CSI-RS-ResourceSet* is not configured with higher layer parameter *trs-Info*, or is equal to or greater than the UE reported threshold *beamSwitchTiming* when the reported value is one of the values of {14,28,48} and the *NZP-CSI-RS-ResourceSet* is configured with higher layer parameter *trs-Info*, or is equal to or greater than 48 when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters *repetition* and *trs-Info*, or is equal to or greater than the UE reported threshold *beamSwitchTiming-r16,* when *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'on', the UE is expected to apply the QCL assumptions in the indicated TCI states for the aperiodic CSI-RS resources in the CSI triggering state indicated by the CSI trigger field in DCI.

- The UE is not expected to receive aperiodic CSI-RS and PDSCH/aperiodic CSI-RS associated with different values of *coresetPoolIndex* in overlapped symbol(s). The UE is not expected to receive aperiodic CSI-RS and semi-persistent/periodic CSI-RS with different 'QCL-type D' in overlapped symbol(s).

- If *dl-OrJointTCI-StateList-r17* is provided, the UE may assume that a CSI-RS resource in an aperiodic CSI-RS resource set configured without *trs-Info* is quasi co-located with the RS(s) in the indicated TCI state.

- A non-zero codepoint of the CSI request field in the DCI is mapped to a CSI triggering state according to the order of the associated positions of the up to trigger states in *CSI-AperiodicTriggerStateList* with codepoint '1' mapped to the triggering state in the first position.

For a UE configured with the higher layer parameter *CSI-AperiodicTriggerStateList*, if a Resource Setting linked to a *CSI-ReportConfig* has multiple aperiodic resource sets, only one of the aperiodic CSI-RS resource sets from the Resource Setting is associated with the trigger state, and the UE is higher layer configured per trigger state per Resource Setting to select the one CSI-IM/NZP CSI-RS resource set from the Resource Setting.

When aperiodic CSI-RS is used with aperiodic reporting, the CSI-RS offset is configured per resource set by the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16* or *aperiodicTriggeringOffset-r17*. The CSI-RS triggering offset has the values of {0, 1, 2, 3, 4, 5, 6, …, 15, 16, 24} slots for or {0, 4, 8, 12, …, 60, 64, 96} slots for and , where is the subcarrier spacing configurations for CSI-RS. If the UE is not configured with *minimumSchedulingOffsetK0* for any DL BWP and *minimumSchedulingOffsetK2* for any UL BWP and if all the associated trigger states do not have the higher layer parameter *qcl-Type* set to 'typeD' in the corresponding TCI states, the CSI-RS triggering offset is fixed to zero. The aperiodic triggering offset of the CSI-IM follows offset of the associated NZP CSI-RS for channel measurement. The aperiodic CSI-RS is transmitted in a slot , , if UE is configured with ca-SlotOffset for at least one of the triggered and triggering cell, and in slot , otherwise, and where

*- n* is the slot containing the triggering DCI, *X* is the CSI-RS triggering offset according to the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16* or *aperiodicTriggeringOffset-r17*,

*-* and are the and the  which are determined by higher-layer configured *ca-SlotOffset* for the cell receiving the PDCCH, and are the and the  which are determined by higher-layer configured *ca-SlotOffset* for the cell transmitting the CSI-RS respectively, as defined in [4, TS 38.211] clause 4.5.

The UE does not expect that aperiodic CSI-RS is transmitted before the OFDM symbol(s) carrying its triggering DCI. When the minimum scheduling offset restriction is applied, UE is not expected to be triggered by CSI triggering state indicated by the CSI request field in DCI in which CSI-RS triggering offset is smaller than the currently applicable minimum scheduling offset restriction *K*0min.

If interference measurement is performed on aperiodic NZP CSI-RS, a UE is not expected to be configured with a different aperiodic triggering offset of the NZP CSI-RS for interference measurement from the associated NZP CSI-RS for channel measurement.

If the UE is configured with a single carrier for uplink, the UE is not expected to transmit more than one aperiodic CSI report triggered by different DCIs on overlapping OFDM symbols.

When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources, the PDCCH candidate that ends later in time is used, and the UE does not expect that the aperiodic CSI-RS is transmitted before the first symbol of the PDCCH candidate that starts later in time.

When a UE is configured with *dl-OrJointTCI-StateList* and is having two indicated TCI states, a higher layer configuration can be provided to an aperiodic CSI-RS resource set or a CSI-RS resource in an aperiodic CSI-RS resource set to inform that the UE shall apply the first or the second indicated TCI-State to the aperiodic CSI-RS resource set or to the CSI-RS resource in the aperiodic CSI-RS resource set, if the higher layer configuration is provided and if the offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in the aperiodic CSI-RS resource set is equal to or larger than a threshold.

-If the UE is configured by higher layer parameter PDCCH-Config that contains two different values of CORESETPoolIndex in different ControlResourceSets, the first and the second indicated TCI-States correspond to the indicated TCI-States specific to coresetPoolIndex value 0 and value 1, respectively.

When a UE is configured with *dl-OrJointTCI-StateList* and is having two indicated TCI states and if the offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in the aperiodic CSI-RS resource set is smaller than a threshold:

-If there is no DL signal in the same symbols as the aperiodic CSI-RS

-if the UE is in frequency range 1, or the UE reports its capability of [two default beams for S-DCI based MTRP] in frequency range 2, the UE shall apply the first or the second indicated joint/DL TCI state to the aperiodic CSI-RS according to the higher layer configuration(s) provided to the aperiodic CSI-RS resource or to the aperiodic CSI-RS resource set

-otherwise, the UE shall apply the first indicated joint/DL TCI state to the aperiodic CSI-RS

-else if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with offset larger than or equal to the threshold *timeDurationForQCL*, as defined in [13, TS 38.306], periodic CSI-RS, semi-persistent CSI-RS, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48}∙2max(0,μCSIRS-3) and when *enableBeamSwitchTiming* is not provided or the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *trs-Info*, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configured with the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters *repetition* and *trs-Info* scheduled with offset larger than or equal to 48∙2max(0,μCSIRS-3) when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configured with the higher layer parameter *repetition* set to 'on' scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided. If there is a PDSCH applying two indicated joint/DL TCI states in the same symbols as the AP CSI-RS, the UE applies the first or the second indicated joint/DL TCI state to the AP CSI-RS according to the higher layer configuration(s) provided to the AP CSI-RS resource or to the aperiodic CSI-RS resource set.

When a UE is configured with *dl-OrJointTCI-StateList*, is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets,* is having two indicated TCI states where the first and the second indicated TCI states correspond to the indicated TCI states specific to *coresetPoolIndex* value 0 and value 1 and if the offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in the aperiodic CSI-RS resource set is smaller than a threshold:

-If there is no other DL signal in the same symbols as the aperiodic CSI-RS

-if the UE is in frequency range 1, or the UE reports its capability of [default beam per *coresetPoolIndex* for M-DCI based MTRP] in frequency range 2, the UE shall apply the first or the second indicated TCI state to the aperiodic CSI-RS according to the higher layer configuration(s) provided to the aperiodic CSI-RS resource or aperiodic CSI-RS resource set

-otherwise, the UE shall apply the indicated TCI state specific to *coresetPoolIndex* value 0 to the aperiodic CSI-RS resource set

-else if there is any other DL signal with an indicated TCI state in the same symbols as the aperiodidc CSI-RS,

- if the UE is in frequency range 1, or the UE reports its capability of [default beam per *coresetPoolIndex* for M-DCI based MTRP] in frequency range 2, and there are two other DL signals applying the first and the second indicated TCI states, respectively, in the same symbols as the aperiodic CSI-RS, the UE shall apply the first or the second indicated TCI state to the aperiodic CSI-RS according to the higher layer configuration(s) provided to the aperiodic CSI-RS resource or aperiodic CSI-RS resource set

- otherwisethe UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with offset larger than or equal to the threshold *timeDurationForQCL*, as defined in [13, TS 38.306], periodic CSI-RS, semi-persistent CSI-RS, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48}∙2max(0,μCSIRS-3) and when *enableBeamSwitchTiming* is not provided or the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *trs-Info*, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configured with the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters repetition and *trs-Info* scheduled with offset larger than or equal to 48∙2max(0,μCSIRS-3) when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configured with the higher layer parameter *repetition* set to 'on' scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided.

<omitted text>

### 5.2.5 Priority rules for CSI reports

For two overlapping PUSCHs, the priority rules in this clause are applied for physical channels with same priority index according to clause 9 in [6, TS 38.213] if a UE is not configured with *sTx-2Panel* or a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSet* in the active DL BWP and the UE is configured with *sTx-2Panel* and the two overlapping PUSCHs are associated with same value of *coresetPoolIndex*.

CSI reports are associated with a priority value where

-  for aperiodic CSI reports to be carried on PUSCH  for semi-persistent CSI reports to be carried on PUSCH,  for semi-persistent CSI reports to be carried on PUCCH and  for periodic CSI reports to be carried on PUCCH;

-  for CSI reports carrying L1-RSRP or L1-SINR and  for CSI reports not carrying L1-RSRP or L1-SINR;

- *c* is the serving cell index and is the value of the higher layer parameter *maxNrofServingCells*;

- for a CSI report configured with *LTM-CSI-ReportConfig*, *c* is the serving cell index value where the report configuration is configured.

- *s* is the *reportConfigID* andis the value of the higher layer parameter *maxNrofCSI-ReportConfigurations.*

- for a CSI report configured with *LTM-CSI-ReportConfig*, *s* is the *LTM-CSI-ReportConfigID* and *Ms* is the value of the higher layer parameter *maxNrofLTM-CSI-ReportConfigurations*

A first CSI report is said to have priority over second CSI report if the associated  value is lower for the first report than for the second report.

Two CSI reports are said to collide if the time occupancy of the physical channels scheduled to carry the CSI reports overlap in at least one OFDM symbol and are transmitted on the same carrier. When a UE is configured to transmit two colliding CSI reports,

- if *y* values are different between the two CSI reports, the following rules apply except for the case when one of the *y* value is 2 and the other *y* value is 3 (for CSI reports transmitted on PUSCH, as described in Clause 5.2.3; for CSI reports transmitted on PUCCH, as described in Clause 5.2.4):

- The CSI report with higher value shall not be sent by the UE.

- otherwise, the two CSI reports are multiplexed or either is dropped based on the priority values, as described in Clause 9.2.5.2 in [6, TS 38.213].

A CSI report configured with *LTM-CSI-ReportConfig* has a higher priority over all CSI report(s) configured with *CSI-ReportConfig* irrespective of value in case of collision with CSI report(s) configured with *CSI-ReportConfig.*

If a semi-persistent CSI report to be carried on PUSCH overlaps in time with PUSCH data transmission in one or more symbols on the same carrier, and if the earliest symbol of these PUSCH channels starts no earlier than N2+d2,1 symbols after the last symbol of the DCI scheduling the PUSCH where d2,1 is the maximum of the d2,1 associated with the PUSCH carrying semi-persistent CSI report and the PUSCH with data transmission, the CSI report shall not be transmitted by the UE. Otherwise, if the timeline requirement is not satisfied this is an error case.

If a UE would transmit a first PUSCH that includes semi-persistent CSI reports and a second PUSCH that includes an UL-SCH on the same carrier, and the first PUSCH transmission would overlap in time with the second PUSCH transmission, the UE does not transmit the first PUSCH and transmits the second PUSCH. The UE expects that the first and second PUSCH transmissions satisfy the above timing conditions for PUSCH transmissions that overlap in time when at least one of the first or second PUSCH transmissions is in response to a DCI format detection by the UE.

<omitted text>

## 5.5 UE PDSCH reception preparation time with different subcarrier spacings for PDCCH and PDSCH in different cells

This clause applies only if the PDCCH carrying the scheduling DCI is received on one carrier with one OFDM subcarrier spacing (µPDCCH), and the PDSCH scheduled to be received by the DCI is on another carrier with another OFDM subcarrier spacing (µPDSCH).

If the µPDCCH < µPDSCH, the UE is expected to receive the scheduled PDSCH, if the first symbol in the PDSCH allocation, including the DM-RS, as defined by the slot offset *K0* and the start and length indicator *SLIV* of the scheduling DCI starts no earlier than the first symbol of the slot of the PDSCH reception starting at least *Npdsch* PDCCH symbols after the end of the PDCCH scheduling the PDSCH, not taking into account the effect of receive timing difference between the scheduling cell and the scheduled cell.

If the µPDCCH > µPDSCH, the UE is expected to receive the scheduled PDSCH, if the first symbol in the PDSCH allocation, including the DM-RS, as defined by the slot offset *K0* and the start and length indicator *SLIV* of the scheduling DCI starts no earlier than *Npdsch* PDCCH symbols after the end of the PDCCH scheduling the PDSCH, not taking into account the effect of receive timing difference between the scheduling cell and the scheduled cell.

When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining *Npdsch*, the PDCCH candidate that ends later in time is used.

Table 5.5-1: *Npdsch* as a function of the subcarrier spacing of the scheduling PDCCH

|  |  |
| --- | --- |
| ***µPDCCH*** | ***Npdsch* [symbols]** |
| 0 | 4 |
| 1 | 5 |
| 2 | 10 |
| 3 | 14 |
| 5 | 56 |
| 6 | 112 |

<omitted text>

## 6.1 UE procedure for transmitting the physical uplink shared channel

PUSCH transmission(s) can be dynamically scheduled by an UL grant in a DCI, or the transmission can correspond to a configured grant Type 1 or Type 2. The configured grant Type 1 PUSCH transmission is semi-statically configured to operate upon the reception of higher layer parameter of *configuredGrantConfig* including *rrc-ConfiguredUplinkGrant* without the detection of an UL grant in a DCI. The configured grant Type 2 PUSCH transmission is semi-persistently scheduled by an UL grant in a valid activation DCI according to clause 10.2 of [6, TS 38.213] after the reception of higher layer parameter *configuredGrantConfig* not including *rrc-ConfiguredUplinkGrant*. If *configuredGrantConfigToAddModList* is configured, more than one configured grant configuration of configured grant Type 1 and/or configured grant Type 2 may be active at the same time on an active BWP of a serving cell.

The UE can be configured with a list of up to 64 *TCI-UL-State* configurations within the higher layer parameter *BWP-UplinkDedicated.* Each *TCI-UL-State* configuration contains a parameter for configuring one reference signal, if applicable, for determining UL TX spatial filter for dynamic-grant and configured-grant based PUSCH and PUCCH resource in a CC, and SRS.

If a UE is configured by higher layer parameter *PDCCH-Config* that contains *ControlResourceSets* with two different values of *coresetPoolIndex* for the active BWP of a serving cell, or if a UE is configured with *SSB-MTC-AddtionalPCI* and with *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*, and if the UE is configured with [*twoTAGs*] and is configured with *dl-OrJointTCI-StateList* or *TCI-UL-State* for a serving cell, each *TCI-State* or *TCI-UL-State* is associated with a [*TAG-ID*]for determining timing adjustment for a corresponding UL transmission as described in Clause 4.2 of [6, TS 38.213]. The UE does not expect that *TCI-states* or *TCI-UL-States* associated with one *coresetPoolIndex* to correspond to two TAGs.

For the PUSCH transmission corresponding to a Type 1 configured grant or a Type 2 configured grant activated by DCI format 0\_0 or 0\_1, the parameters applied for the transmission are provided by *configuredGrantConfig* except for *dataScramblingIdentityPUSCH*, *txConfig*, *codebookSubset*, *maxRank*, *maxRank-n8,* *scaling* of *UCI-OnPUSCH,* which are provided by *pusch-Config*. A configured grant PUSCH can be transmitted with at most 4 layers. For the PUSCH transmission corresponding to a Type 2 configured grant activated by DCI format 0\_2, the parameters applied for the transmission are provided by *configuredGrantConfig* except for *dataScramblingIdentityPUSCH*, *txConfig*, *codebookSubsetDCI-0-2*, *maxRankDCI-0-2*, *scaling* of *UCI-OnPUSCH*, *resourceAllocationType1GranularityDCI-0-2* provided by *pusch-Config*.If the UE is provided with *transformPrecoder* in *configuredGrantConfig*, the UE applies the higher layer parameter *tp-pi2BPSK*, if provided in *pusch-Config*, according to the procedure described in clause 6.1.4 for the PUSCH transmission corresponding to a configured grant.

When the UE is configured *dl-OrJointTCI-StateList* or *ul-TCI-StateList*, the UE shall perform PUSCH transmission corresponding to a Type 1 configured grant or a Type 2 configured grant or a dynamic grant according to the spatial relation, if applicable, with a reference to the RS for determining UL Tx spatial filter. The RS is determined based on an RS configured with *qcl-Type* set to 'typeD' of the indicated *TCI-State* or an RS in the indicated *TCI-UL-State*. The reference RS in the indicated *TCI-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, or a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info.* The reference RS in the indicated *TCI-UL-State* can be a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition*, a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info*, an SRS resource in an SRS resource set with the higher layer parameter *usage* set to 'beamManagement', or SS/PBCH block associated with the same or different PCI from the PCI of the serving cell. When *nrofSlotsInCG-Period* is configured for Type 1 configured grant or Type 2 configured grant, HARQ process ID for the first configured PUSCH grant and each subsequent valid configured PUSCH grant within a *periodicity* of the configuration is determined as in clause 5.4.1 of [10, TS 38.321], where a valid configured PUSCH grant is the one not colliding with the DL symbol(s) indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, and not colliding with a symbol(s) of an SS/PBCH block with index provided by *ssb-PositionsInBurst* as described in clause 11.1 of [6, TS 38.213].

When a UE is configured with *dl-OrJointTCI-StateList* or *TCI-UL-State* and is having two indicated TCI-States or TCI-UL-States,

- a UE having a PUSCH transmission scheduled or activated by DCI format 0\_0 should apply the first indicated TCI state to the PUSCH transmission,

- a UE configured with a PUSCH transmission corresponding to a Type 1 configured grant is expected to be configured with the higher layer parameter *applyIndicatedTCIState* indicating the *first*, the *second* or *both* of the indicated TCI states to be applied for the PUSCH transmission. If 'both' TCI states are indicated, the UE should apply the first indicated TCI state to the PUSCH transmission occasion(s) or the PUSCH antenna port(s) associated with the first SRS resource set for CB/NCB transmission, and the second indicated TCI state to the PUSCH transmission occasion(s) or the PUSCH antenna port(s) associated with the second SRS resource set for CB/NCB transmission; otherwise the UE should apply either the 'first' or 'second' indicated TCI state to all PUSCH transmission occasions.

- If the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets* in the active DL BWP, the first and the second indicated TCI states correspond to the indicated TCI-States or TCI-UL-States specific to coresetPoolIndex value 0 and value 1, respectively, and *applyIndicatedTCIState* does not indicate *both* of the indicated TCI states to be applied for the PUSCH transmission.

For the PUSCH retransmission scheduled by a PDCCH with CRC scrambled by CS-RNTI with NDI=1, the parameters in *pusch-Config* are applied for the PUSCH transmission except for *p0-NominalWithoutGrant, p0-PUSCH-Alpha, powerControlLoopToUse,* *pathlossReferenceIndex* described in clause 7.1 of [6, TS 38.213], *mcs-Table, mcs-TableTransformPrecoder* described in clause 6.1.4.1 and *transformPrecoder* described in clause 6.1.3.

For a UE configured with two uplinks in a serving cell, PUSCH retransmission for a TB on the serving cell is not expected to be on a different uplink than the uplink used for the PUSCH initial transmission of that TB.

A UE shall upon detection of a PDCCH with a configured DCI format 0\_0, 0\_1, 0\_2 or 0\_3 transmit the corresponding PUSCH as indicated by that DCI unless the UE does not generate a transport block as described in [10, TS38.321]. Upon detection of a DCI format 0\_1 or 0\_2 with '*UL-SCH indicator*' set to '0' and with a non-zero '*CSI request*' where the associated *reportQuantity* in *CSI-ReportConfig* set to '*none*' for all CSI report(s) triggered by '*CSI request*' in this DCI format 0\_1 or 0\_2, the UE ignores all fields in this DCI except the '*CSI request*' and the UE shall not transmit the corresponding PUSCH as indicated by this DCI format 0\_1 or 0\_2. Upon detection of a DCI format 0\_3 with '*UL-SCH indicator*' set to '0' and with a non-zero '*CSI request*' where the associated *reportQuantity* in *CSI-ReportConfig* set to '*none*' for all CSI report(s) triggered by '*CSI request*' in this DCI format 0\_3, the UE ignores all fields for the scheduled cell with the smallest serving cell index in this DCI except the '*CSI request*' and the UE shall not transmit the corresponding PUSCH on the serving cell with the smallest serving cell index as indicated by this DCI format 0\_3.

When the UE is scheduled with multiple PUSCHs on a serving cell by a DCI, HARQ process ID indicated by this DCI applies to the first PUSCH not overlapping with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*, HARQ process ID is then incremented by 1 for each subsequent PUSCH(s) in the scheduled order, with modulo operation of *nrofHARQ-ProcessesForPUSCH* applied if *nrofHARQ-ProcessesForPUSCH* is provided, or with modulo operation of *nrofHARQ-ProcessesForPUSCH-r17* applied if *nrofHARQ-ProcessesForPUSCH-r17* is provided, or with modulo operation of 16 applied, otherwise. HARQ process ID is not incremented for PUSCH(s) not transmitted if at least one of the symbols indicated by the indexed row of the used resource allocation table in the slot overlaps with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*. For any HARQ process ID(s) in a given scheduled cell, the UE is not expected to transmit a PUSCH that overlaps in time with another PUSCH. Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH ending in symbol *i* on a scheduling cell,, the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH that ends later than symbol *i* of the scheduling cell. When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the PDCCH ending in symbol *i*, the PDCCH candidate that ends later in time is used. The UE is not expected to be scheduled to transmit another PUSCH by a DCI format 0\_0 with CRC scrambled by TC-RNTI, for a given HARQ process with the DCI received before the end of the expected transmission of the last PUSCH for that HARQ process if the latter is scheduled by a DCI format 0\_0 with CRC scrambled by TC-RNTI or by an UL grant in RA Response. The UE is not expected to be scheduled to transmit another PUSCH by DCI format 0\_0, 0\_1, 0\_2 or 0\_3 scrambled by C-RNTI, CS-RNTI or MCS-C-RNTI for a given HARQ process with the DCI received before the end of the expected transmission of the last PUSCH for that HARQ process if the latter is scheduled by a DCI with CRC scrambled by C-RNTI, CS-RNTI or MCS-C-RNTI.

If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH associated with a value of *coresetPoolIndex* ending in symbol *i*, the UE can be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH associated with a different value of *coresetPoolIndex* that ends later than symbol *i*.

When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook' or 'nonCodebook' and higher layer parameter *enableSTx2PofmDCI* is configured and *PDCCH-Config* contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active DL BWP of a serving cell,

- two PUSCHs that are fully/partially overlapping in time domain and are fully/partially/non-overlapping in frequency domain can be dynamically scheduled by UL grant(s) in DCI(s) and/or scheduled by configured grant(s) Type 1 or Type 2,

- if dynamically scheduled by UL grant(s) in DCI(s) or activated by DCI(s) for configured grant Type 2, the DCI field *SRS Resource Set Indicator* is not present in each of PDCCH

- two PUSCHs are associated to different values of *coresetPoolIndex* where for configured grant Type 1, the association is based on higher layer parameter *srs-ResourceSetId* in *rrc-ConfiguredUplinkGrant* that indicates either the first or the second SRS resource set with usage 'codebook' or 'nonCodeBook' in *srs-ResourceSetToAddModList*

- the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets

- the UE expects *maxNrofPorts* in *PTRS-UplinkConfig* to be configured as one if UL PT-RS is configured.

When a UE is configured with *dl-OrJointTCI-StateList* or *TCI-UL-State* and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook' or 'noncodebook', and the higher layer parameter *multiPanelSchemeSDM* or *multiPanelSchemeSFN* is configured, and the higher layer parameter *rrc-ConfiguredUplinkGrant* does not contain *srs-ResourceIndicator2* or *precodingAndNumberOfLayers2*, the PUSCH transmission occasion(s) is associated with the first SRS resource set if the first indicated *TCI-States* or *TCI-UL-States* applies and is associated with the second SRS resource set if the second indicated *TCI-States* or *TCI-UL-States* applies.

When a UE is configured with *dl-OrJointTCI-StateList* or *TCI-UL-State* and is having two indicated TCI states, and only one SRS resource set is configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook' or 'noncodebook', the PUSCH transmission occasion(s) scheduled or activated by DCI format 0\_1 or 0\_2 is associated with the first indicated *TCI-States* or *TCI-UL-States* if applies or is associated with the second indicated *TCI-States* or *TCI-UL-States* if applies, as indicated by the higher layer parameter *applyIndicatedTCIState* configured by *PUSCH-Config.*

When a UE is configured with higher layer parameter *sTx-2Panel* and *PDCCH-Config* contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active DL BWP of a serving cell,

- the UE is expected to be configured with two SRS resource sets with usage 'codebook' or 'nonCodeBook' in *srs-ResourceSetToAddModList*

- if the UE is configured to monitor DCI format 0\_2 and there is only one SRS resource set~~s~~ configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with usage 'codebook' or 'nonCodeBook', the UE monitors only CORESETs associated with *coresetPoolIndex* value 0*.*

A UE is not expected to be scheduled by a PDCCH ending in symbol to transmit a PUSCH on a given serving cell overlapping in time with a transmission occasion, where the UE is allowed to transmit a PUSCH with configured grant according to [10, TS38.321], starting in a symbol on the same serving cell if the end of symbol is not at least symbols before the beginning of symbol , if

- the UE is not provided *prioLowDG-HighCG* or *prioHighDG-LowCG*, or the UE is provided *prioLowDG-HighCG* or *prioHighDG-LowCG* and the two PUSCHs have the same priority index as described in Clause 9 of [6, TS 38.213] and

- the UE is not provided *enableSTx2PofmDCI,* or is provided *enableSTx2PofmDCI* and the two PUSCHs are associated with the same *coresetPoolIndex* value.

The value in symbols is determined according to the UE processing capability defined in Clause 6.4, and and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH with configured grant and the subcarrier spacing of the PDCCH scheduling the PUSCH.

If a UE receives an ACK for a given HARQ process in CG-DFI in a PDCCH ending in symbol *i* to terminate a transport block repetition in a PUSCH transmission with a configured grant on a given serving cell with the same HARQ process after symbol *i*, the UE is expected to terminate the repetition of the transport block in a PUSCH transmission starting from a symbol *j* if the gap between the end of PDCCH of symbol *i* and the start of the PUSCH transmission in symbol *j* is equal to or more than *N2* symbols. The value *N2* in symbols is determined according to the UE processing capability defined in Clause 6.4, and *N2* and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH and the subcarrier spacing of the PDCCH indicating CG-DFI. A UE is not expected to be scheduled by a PDCCH ending in symbol to transmit a PUSCH on a given serving cell for a given HARQ process, if there is a transmission occasion where the UE is allowed to transmit a PUSCH with configured grant according to [10, TS38.321] with the same HARQ process on the same serving cell starting in a symbol after symbol , and if the gap between the end of PDCCH and the beginning of symbol is less than symbols. The value in symbols is determined according to the UE processing capability defined in clause 6.4, and and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH with configured grant and the subcarrier spacing of the PDCCH scheduling the PUSCH.

For PUSCH scheduled by DCI format 0\_0 on a cell, the UE shall transmit PUSCH according to the spatial relation, if applicable, corresponding to the dedicated PUCCH resource with the lowest ID within the active UL BWP of the cell, as described in Clause 9.2.1 of [6, TS 38.213]. If the dedicated PUCCH resource with the lowest ID within the active UL BWP of the cell corresponds to two spatial relations, the UE shall transmit the PUSCH according to the spatial relation with the lower ID.

For PUSCH scheduled by DCI format 0\_0 on a cell and if the higher layer parameter *enableDefaultBeamPL-ForPUSCH0-0* is set 'enabled', the UE is not configured with PUCCH resources on the active UL BWP and the UE is in RRC connected mode, the UE shall transmit PUSCH according to the spatial relation, if applicable, with a reference to the RS configured with *qcl-Type* set to 'typeD' corresponding to the QCL assumption of the CORESET with the lowest ID on the active DL BWP of the cell. If the CORESET is indicated with two TCI states, *sfnSchemePdcch* is configured and the UE supports *sfn-DefaultUL-BeamSetup-r17*, the UE shall use the first TCI state as the QCL assumption.

For PUSCH scheduled by DCI format 0\_0 on a cell and if the higher layer parameter *enableDefaultBeamPL-ForPUSCH0-0* is set 'enabled', the UE is configured with PUCCH resources on the active UL BWP where all the PUCCH resource(s) are not configured with any spatial relation and the UE is in RRC connected mode, the UE shall transmit PUSCH according to the spatial relation, if applicable, with a reference to the RS configured with *qcl-Type* set to 'typeD' corresponding to the QCL assumption of the CORESET with the lowest ID on the active DL BWP of the cell in case CORESET(s) are configured on the cell. If the CORESET is indicated with two TCI states, *sfnSchemePdcch* is configured and the UE supports *sfn-DefaultUL-BeamSetup-r17*, the UE shall use the first TCI state as the QCL assumption.

For uplink, 16 HARQ processes per cell are supported by the UE, or subject to UE capability, a maximum of 32 HARQ processes per cell as defined in [13, TS 38.306]. The number of processes the UE may assume will at most be used for the uplink is configured to the UE for each cell separately by higher layer parameter *nrofHARQ-ProcessesForPUSCH*, or *nrofHARQ-ProcessesForPUSCH-r17,* and when no configuration is provided the UE may assume a default number of 16 processes.

<omitted text>

#### 6.1.1.1 Codebook based UL transmission

For codebook based transmission, PUSCH can be scheduled by DCI format 0\_0, DCI format 0\_1, DCI format 0\_2, DCI format 0\_3 or semi-statically configured to operate according to Clause 6.1.2.3. If this PUSCH is scheduled by DCI format 0\_1, DCI format 0\_2, or semi-statically configured to operate according to Clause 6.1.2.3, the UE determines its PUSCH transmission precoder(s) based on SRI(s), TPMI(s) and the transmission rank, where the SRI(s), TPMI(s) and the transmission rank are given by DCI fields of one or two SRS resource indicators and one or two Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2 or given by *srs-ResourceIndicator* and *precodingAndNumberOfLayers* according to clause 6.1.2.3 or given by *srs-ResourceIndicator, srs-ResourceIndicator2,* *precodingAndNumberOfLayers, and precodingAndNumberOfLayers2* according to clause 6.1.2.3. If this PUSCH is scheduled by DCI format 0\_3, the UE determines its PUSCH transmission precoder based on SRI, TPMI and the transmission rank, where the SRI, TPMI and the transmission rank are given by DCI fields of one SRS resource indicator and one Precoding information and number of layers in clause 7.3.1.1.4 of [5, TS 38.212] for DCI format 0\_3. The *SRS-ResourceSet(s)* applicable for PUSCH scheduled by DCI format 0\_1 and DCI format 0\_2 are defined by the entries of the higher layer parameter *srs-ResourceSetToAddModList* and *srs-ResourceSetToAddModListDCI-0-2* in *SRS-config*, respectively. Only one or two SRS resource sets can be configured in *srs-ResourceSetToAddModList* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', and only one or two SRS resource sets can be configured in *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'.

When only one SRS resource set is configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', SRI and TPMI are given by the DCI fields of one SRS resource indicator and one Precoding information and number of layers in clauses 7.3.1.1.2, 7.3.1.1.3 and 7.3.1.1.4 of [5, TS 38.212] for DCI format 0\_1, 0\_2 and 0\_3 or given by *srs-ResourceIndicator* and *precodingAndNumberOfLayers* according to clause 6.1.2.3. A UE does not expect two SRS resource sets are configured in *srs-ResourceSetToAddModList* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook' for a serving cell, when the serving cell is included in *schedulingCellListDCI-0-3-r18* for a set of serving cells provided by *mc-DCI-SetOfCellsToAddModList-r18*. The TPMI is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource selected by the SRI when multiple SRS resources are configured, or if a single SRS resource is configured TPMI is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource. The transmission precoder is selected from the uplink codebook that has a number of antenna ports equal to higher layer parameter *nrofSRS-Ports* or *nrofSRS-Ports-n8* in *SRS-Confi*g, as defined in Clause 6.3.1.5 of [4, TS 38.211]. When the UE is configured with the higher layer parameter *txConfig* set to 'codebook', the UE is configured with at least one SRS resource. The indicated SRI in slot *n* is associated with the most recent transmission of SRS resource identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI.

When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', one or two SRI(s), and one or two TPMI(s) are given by the DCI fields of two SRS resource indicator and two Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2. The UE applies the indicated SRI(s) and TPMI(s) to one or more PUSCH repetitions according to the associated SRS resource set of a PUSCH repetition according to clause 6.1.2.1. Each TPMI, based on indicated codepoint of *SRS Resource Set* *indicator*, is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource selected by the corresponding SRI when multiple SRS resources are configured for the applicable SRS resource set, or if a single SRS resource is configured for the applicable SRS resource set TPMI is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource. For one or two TPMI(s), the transmission precoder is selected from the uplink codebook that has a number of antenna ports equal to the higher layer parameter *nrofSRS-Ports* in SRS-Config for the indicated SRI(s), as defined in Clause 6.3.1.5 of [4, TS 38.211]. When two SRIs are indicated, the UE shall expect the *nrofSRS-Ports* for the two indicated SRS resources to be the same. When the UE is configured with the higher layer parameter *txConfig* set to 'codebook', the UE is configured with at least one SRS resource. Each of the indicated one or two SRI(s) in slot *n* is associated with the most recent transmission of SRS resource of associated SRS resource set identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets.

When the higher layer parameter *multipanelScheme* is set to 'SDMScheme' and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', two SRI(s), and two TPMI(s) are given by the DCI fields of two SRS resource indicator and two Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2 or given by *srs-ResourceIndicator, srs-ResourceIndicator2,* *precodingAndNumberOfLayers, and precodingAndNumberOfLayers2* in *configuredGrantConfig*:

- When codepoint "10" of *SRS Resource Set* *indicator* is indicated or when *srs-ResourceIndicator2 and* precodingAndNumberOfLayers2 are provided*,* the first TPMI is used to indicate the precoder to be applied over layers {0…v1-1}, where v1 is the number of layers indicated by the first TPMI, that corresponds to the SRS resource selected by the corresponding SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set, and the second TPMI is used to indicate the precoder to be applied over layers {v1…. v2+v1-1}, where v2 is the number of layers indicated by the second TPMI, that corresponds to the SRS resource selected by the corresponding SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set, v1 ≤ *maxRankSdm* or *maxRankSdmDCI-0-2* andv2 ≤ *maxRankSdm* or *maxRankSdmDCI-0-2* and *maxRankSdm* or *maxRankSdmDCI-0-2* are defining the maximum number of layers applied over the first and the second SRS resource sets, separately.

- When codepoint "00" or "01" of *SRS Resource Set* *indicator* is indicated*,* the second SRI and second TPMI are reserved, the first TPMI is used to indicate the precoder to be applied over layers {0…v-1}, where v ≤ *maxRank,* where *maxRank* is defining the maximum number of layers.

- Codepoint "11" of *SRS Resource Set indicator* is reserved.

- For one or two TPMI(s), the transmission precoder is selected from the uplink codebook that has a number of antenna ports equal to the higher layer parameter *nrofSRS-Ports* in *SRS-Config* for the indicated SRI(s), as defined in Clause 6.3.1.5 of [4, TS 38.211]. When two TPMIs are indicated, the UE shall expect that the precoder indicated by the first TPMI and the precoder indicated by the second TPMI are mapped to different PUSCH antenna ports.

- When two SRIs are indicated, the UE shall expect that the number of SRS antenna ports associated with two indicated SRIs would be the same. When the UE is configured with the higher layer parameter *txConfig* set to 'codebook', the UE is configured with at least one SRS resource. Each of the indicated one or two SRI(s) in slot *n* is associated with the most recent transmission of SRS resource of associated SRS resource set identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets.

When higher layer parameter *multipanelScheme* set to 'SFNscheme' and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', two SRI(s), and two TPMI(s) are given by the DCI fields of two SRS resource indicator and two Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2 or given by *srs-ResourceIndicator, srs-ResourceIndicator2,* *precodingAndNumberOfLayers, and precodingAndNumberOfLayers2* in *configuredGrantConfig*:

- When codepoint "10" of *SRS Resource Set* *indicator* is indicated or when *srs-ResourceIndicator2 and* precodingAndNumberOfLayers2 are provided*,* the first TPMI is used to indicate precoder to be applied over layers {0…v-1} and the second TPMI is used to indicate the precoder to be applied over layers {0…v-1}, where v ≤ *maxRankSfn* or *maxRankSfnDCI-0-2* and *maxRankSfn* or *maxRankSfnDCI-0-2* defining the maximum number of layers applied over the first SRS resource set and over the second SRS resource set separately.

- When codepoint "00" or "01" of *SRS Resource Set* *indicator* is indicated*,* the second SRI and second TPMI are reserved, the first TPMI is used to indicate precoder to be applied over layers {0…v-1}, where v ≤ *maxRank* and where *maxRank* is defining the maximum number of layers applied over the first SRS resource set or the seoncd SRS resource.

- Codepoint "11" of *SRS Resource Set indicator* is reserved.

- For one or two TPMI(s), the transmission precoder is selected from the uplink codebook that has a number of antenna ports equal to *nrofSRS-Ports* in *SRS-Config* for the indicated SRI(s), as defined in Clause 6.3.1.5 of [4, TS 38.211]. When two TPMIs are indicated, the UE shall expect that the precoder indicated by the first TPMI and the precoder indicated by the second TPMI are mapped to different PUSCH antenna ports.

- When two TPMIs are indicated, the UE shall expect that the number of SRS antenna ports associated with two indicated SRIs to be the same. When the UE is configured with the higher layer parameter *txConfig* set to 'codebook', the UE is configured with at least one SRS resource. Each of the indicated one or two SRI(s) in slot *n* is associated with the most recent transmission of SRS resource of associated SRS resource set identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets.

When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the most recent transmission of SRS resource identified by the SRI, the PDCCH candidate that starts earlier in time is used.

For codebook based transmission with two or four antenna ports, the UE determines its codebook subsets based on TPMI(s) and upon the reception of higher layer parameter *codebookSubset* in *pusch-Config* for PUSCH associated with DCI format 0\_1 or 0\_3 and *codebookSubsetDCI-0-2* in *pusch-Config* for PUSCH associated with DCI format 0\_2 which may be configured with *'*fullyAndPartialAndNonCoherent*'*, or *'*partialAndNonCoherent*'*, or 'nonCoherent' depending on the UE capability for two or four antenna ports.

For codebook based transmission with eight antenna ports, the UE determines its codebook based upon the reception of higher layer parameter[s] *CodebookTypeUL* in *pusch-Config* for PUSCH associated with DCI format 0\_1 and 0\_2, depending on the UE capability. According to the configured *CodebookTypeUL*, coherent UL MIMO operation applies within antenna port groups as defined in Table 6.3.1.5-8 of [4, TS 38.211]. According to the configured *CodebookType*, requirements for coherent UL MIMO in clause 6.4D.4 of [8, TS 38.101-1] and [21, TS 38.101-2] apply within an antenna port group.

When higher layer parameter ul-FullPowerTransmission is set to 'fullpowerMode2'and the higher layer parameter codebookSubset or the higher layer parameter codebookSubsetDCI-0-2 is set to 'partialAndNonCoherent', and when the SRS-resourceSet with usage set to "codebook" includes at least one SRS resource with 4 ports and one SRS resource with 2 ports, the codebookSubset associated with the 2-port SRS resource is 'nonCoherent'.

When higher layer parameter *ul-FullPowerTransmission* is set to 'fullpowerMode2*'* and the higher layer parameter *CodebookTypeUL* is set to *'*codebook2' or *'*codebook3', and the *SRS-resourceSet* with *usage* set to 'codebook' includes one SRS resource with 8 ports, and at least one SRS resource with 2 ports or 4 ports, subject to UE capability,

- when *CodebookTypeUL* is set to *'*codebook2', the *codebookSubset* associated with the 2-port SRS resource is 'nonCoherent'.

- when *CodebookTypeUL* is set to *'*codebook2', the *codebookSubset* associated with the 4-port SRS resource can be configured as 'partialAndNonCoherent' or 'nonCoherent', subject to UE capability.

- when *CodebookTypeUL* is set to *'*codebook3', the *codebookSubset* associated with 4 ports SRS resources is 'nonCoherent'.

The maximum transmission rank may be configured by the higher layer parameter *maxRank* *or maxRank-n8* in *pusch-Config* for PUSCH scheduled with DCI format 0\_1 or 0\_3 and *maxRankDCI-0-2* for PUSCH scheduled with DCI format 0\_2*.*

A UE reporting its UE capability of 'partialAndNonCoherent' transmission shall not expect to be configured by either *codebookSubset* or codebookSubsetDCI-0-2 with 'fullyAndPartialAndNonCoherent*'* for two or four antenna ports.

A UE reporting its UE capability of 'nonCoherent' transmission shall not expect to be configured by either *codebookSubset* or codebookSubsetDCI-0-2 with *'*fullyAndPartialAndNonCoherent*'* or with *'*partialAndNonCoherent' for two or four antenna ports.

A UE does not expect to be configured by *CodebookTypeUL* with a value of *CodebookTypeUL* that does not correspond to one of the values of *UL\_8TX\_Ng* reported in its capability.

A UE shall not expect to be configured with the higher layer parameter *codebookSubset* or the higher layer parameter codebookSubsetDCI-0-2 set to *'*partialAndNonCoherent' when higher layer parameter *nrofSRS-Ports* in an *SRS-ResourceSet* with *usage* set to 'codebook' indicates that the maximum number of the configured SRS antenna ports in the *SRS-ResourceSet* is two.

For codebook based transmission, only one SRS resource can be indicated based on the SRI from within the SRS resource set. Except when higher layer parameter *ul-FullPowerTransmission* is set to 'fullpowerMode2', the maximum number of configured SRS resources for codebook based transmission is 2. If aperiodic SRS is configured for a UE, the SRS request field in DCI triggers the transmission of aperiodic SRS resources.

A UE shall not expect to be configured with higher layer parameter *ul-FullPowerTransmission* set to 'fullpowerMode1*'* and *codebookSubset* or *codebookSubsetDCI-0-2* set to *'*fullAndPartialAndNonCoherent*'* simultaneously.

A UE shall not expect to be configured with higher layer parameter *ul-FullPowerTransmission* set to 'fullpowerMode1' and *CodebookTypeUL* set to 'codebook1' simultaneously.

The UE shall transmit PUSCH using the same antenna port(s) as the SRS port(s) in the SRS resource(s) indicated by the DCI format 0\_1, 0\_2 or 0\_3 or by *configuredGrantConfig* according to clause 6.1.2.3.

The DM-RS antenna ports  in Clause 6.4.1.1.3 of [4, TS38.211] are determined according to the ordering of DM-RS port(s) given by Tables 7.3.1.1.2-6 to 7.3.1.1.2-23 in Clause 7.3.1.1.2 of [5, TS 38.212].

Except when higher layer parameter *ul-FullPowerTransmission* is set to 'fullpowerMode2', when multiple SRS resources are configured by *SRS-ResourceSet* with *usage* set to 'codebook', the UE shall expect that higher layer parameters *nrofSRS-Ports* in *SRS-Resource* in *SRS-ResourceSet* shall be configured with the same value for all these SRS resources.

When higher layer parameter *ul-FullPowerTransmission* is set to 'fullpowerMode2',

- the UE can be configured with one SRS resource or multiple SRS resources with same or different number of SRS ports within an SRS resource set with *usage* set to 'codebook'.

- up to 2 different spatial relations can be configured for all SRS resources in the SRS resource set with *usage* set to 'codebook' when multiple SRS resources are configured in the SRS resource set.

- subject to UE capability, a maximum of 2 or 4 SRS resources are supported in an SRS resource set with *usage* set to 'codebook'.

#### 6.1.1.2 Non-Codebook based UL transmission

For non-codebook based transmission, PUSCH can be scheduled by DCI format 0\_0, DCI format 0\_1, DCI format 0\_2, DCI format 0\_3 or semi-statically configured to operate according to Clause 6.1.2.3. If this PUSCH is scheduled by DCI format 0\_1, DCI format 0\_2, DCI format 0\_3 or semi-statically configured to operate according to Clause 6.1.2.3, the UE can determine its PUSCH precoder(s) and transmission rank based on the SRI(s) when multiple SRS resources are configured, where the SRI(s) is given by one or two SRS resource indicator(s) in DCI according to clause 7.3.1.1.2 and 7.3.1.1.3 of [5, 38.212] for DCI format 0\_1 and DCI format 0\_2, or the SRI is given by one SRS resource indicator in DCI according to clause 7.3.1.1.4 of [5, 38.212] for DCI format 0\_3, or the SRI is given by *srs-ResourceIndicator* according to clause 6.1.2.3, or SRIs given by *srs-ResourceIndicator* and *srs-ResourceIndicator2* according to clause 6.1.2.3.. The *SRS-ResourceSet(s)* applicable for PUSCH scheduled by DCI format 0\_1 and DCI format 0\_2 are defined by the entries of the higher layer parameter *srs-ResourceSetToAddModList* and *srs-ResourceSetToAddModListDCI-0-2* in *SRS-config*, respectively. The UE shall use one or multiple SRS resources for SRS transmission, where, in a SRS resource set, the maximum number of SRS resources which can be configured to the UE for simultaneous transmission in the same symbol and the maximum number of SRS resources are UE capabilities. The SRS resources transmitted simultaneously occupy the same RBs. For a given CC, multiple SRS resources in a set with usage “nonCodebook” are not expected to be partially overlapped in time. Only one SRS port for each SRS resource is configured. Only one or two SRS resource sets can be configured in *srs-ResourceSetToAddModList* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook', and only one or two SRS resource sets can be configured in *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook'. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook', SRIs are given by the DCI fields of two SRS resource indicators in clauses 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2 and the UE applies the indicated SRI(s) to one or more PUSCH repetitions according to the associated SRS resource set of a PUSCH repetition according to clause 6.1.2.1. A UE does not expect two SRS resource sets are configured in *srs-ResourceSetToAddModList* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook' for a serving cell, when the serving cell is included in *schedulingCellListDCI-0-3-r18* for a set of serving cells provided by *mc-DCI-SetOfCellsToAddModList-r18*. The maximum number of SRS resources per SRS resource set that can be configured for non-codebook based uplink transmission is 1, 2, 4 or 8 depending on UE capability. Each of the indicated SRIs in slot *n* is associated with the most recent transmission of SRS resource(s) of associated SRS resource set identified by the SRI, where the SRS transmission is prior to the PDCCH carrying the SRI. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook', the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets.

When the higher layer parameter *multipanelScheme* is set to 'SDMScheme' and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook', SRIs are given by the DCI fields of two SRS resource indicators in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2 or given by *srs-ResourceIndicator, srs-ResourceIndicator2* in *configuredGrantConfig*:

- When codepoint "10" of *SRS Resource Set* *indicator* is indicated*,* or when *srs-ResourceIndicator2* is provided, the first SRI is used to indicate resource(s) to be associated with layer(s) {0…v1-1}, where v1 being the number of layers indicated by the first SRI, and the second SRI is used to indicate resource(s) to be associated with layer(s) {v1…. v2+v1-1}, where v2 being the number of layers indicated by the second SRI, v1 ≤ *Lmax* andv2 ≤ *Lmax* where *Lmax* is defined inclauses 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212]. The UE shall expect that SRS resource(s) indicated by the first SRI and SRS resource(s) indicated by the second SRI are corresponding to different PUSCH antenna ports.

- When codepoint "00" or "01" of *SRS Resource Set* *indicator* is indicated*,* the second SRI is reserved, the first SRI is used to indicate resource(s) to be associated with layers {0…v-1}, v ≤ *Lmax*.

- Codepoint "11" of *SRS Resource Set indicator* is reserved.

When the higher layer parameter *multipanelScheme* is set to 'SFNscheme' and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook', two SRI(s) are given by the DCI fields of two SRS resource indicators in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2 or given by *srs-ResourceIndicator and srs-ResourceIndicator2* in *configuredGrantConfig*:

- When codepoint "10" of *SRS Resource Set* *indicator* is indicated*,* or when *srs-ResourceIndicator2* is provided, the first SRI is used to indicate resource(s) to be associated with layer(s) {0…v-1} and the second SRI is used to indicate resource(s) to be associated with layer(s) {0…v-1}, where v ≤ *Lmax* and where *Lmax* is defined in clauses 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212]. The UE shall expect that SRS resource(s) indicated by the first SRI and SRS resource(s) indicated by the second SRI are corresponding to different PUSCH antenna ports.

- When codepoint "00" or "01" of *SRS Resource Set* *indicator* is indicated*,* the second SRI is reserved, the first SRI is used to indicate resources(s) to be associated with layers {0…v-1}, where v ≤ *Lmax*. When two SRIs are indicated, the UE shall expect that the number of SRS antenna ports associated with two indicated SRIs to be the same.

- Codepoint "11" of *SRS Resource Set indicator* is reserved.

When the UE is configured with the higher layer parameter *txConfig* set to 'Noncodebook', the UE is configured with at least one SRS resource. Each of the indicated one or two SRI(s) in slot *n* is associated with the most recent transmission of SRS resource of associated SRS resource set identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'Noncodebook', the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets.

When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the most recent transmission of SRS resource(s) identified by the SRI, the PDCCH candidate that starts earlier in time is used.

For non-codebook based transmission, the UE can calculate the precoder used for the transmission of SRS based on measurement of an associated NZP CSI-RS resource. A UE can be configured with only one NZP CSI-RS resource for each of the SRS resource set(s) with higher layer parameter usage in *SRS-ResourceSet* set to 'nonCodebook' if configured.

- If aperiodic SRS resource set is configured, the associated NZP-CSI-RS is indicated via SRS request field in DCI format 0\_1 and 1\_1, DCI format 0\_2 (if SRS request field is present) and DCI format 1\_2 (if SRS request field is present), as well as DCI format 0\_3 and 1\_3, where *AperiodicSRS-ResourceTrigger* and *AperiodicSRS-ResourceTriggerList* (indicating the association between aperiodic SRS triggering state(s) and SRS resource sets), triggered SRS resource(s) *srs-ResourceSetId*, *csi-RS* (indicating the associated *NZP-CSI-RS-ResourceId*) are higher layer configured in *SRS-ResourceSet*. The *SRS-ResourceSet(s)* associated with the SRS request by DCI format 0\_1, 0\_3, 1\_1 and 1\_3 are defined by the entries of the higher layer parameter *srs-ResourceSetToAddModList* and the *SRS-ResourceSet(s)* associated with the SRS request by DCI format 0\_2 and 1\_2 are defined by the entries of the higher layer parameter *srs-ResourceSetToAddModListDCI-0-2*. A UE is not expected to update the SRS precoding information if the gap from the last symbol of the reception of the aperiodic NZP-CSI-RS resource and the first symbol of the aperiodic SRS transmission is less than 42 OFDM symbols, where the SCS configuration *μ* is the smallest SCS configuration between the NZP-CSI-RS resource and the SRS transmission.

- If the UE configured with aperiodic SRS associated with aperiodic NZP CSI-RS resource, the presence of the associated CSI-RS is indicated by the SRS request field if the value of the SRS request field is not '00' as in Table 7.3.1.1.2-24 of [5, TS 38.212] and if the scheduling DCI is not used for cross carrier or cross bandwidth part scheduling. If UE is configured with *minimumSchedulingOffsetK0* in the active DL BWP and the currently applicable minimum scheduling offset restriction *K0,min* is larger than 0, the UE does not expected to receive the scheduling DCI with the SRS request field value other than '00'. The CSI-RS is located in the same slot as the SRS request field. If the UE configured with aperiodic SRS associated with aperiodic NZP CSI-RS resource, any of the TCI states configured in the scheduled CC shall not be configured with *qcl-Type* set to 'typeD'.

- If periodic or semi-persistent SRS resource set is configured, the *NZP-CSI-RS-ResourceId* for measurement is indicated via higher layer parameter *associatedCSI-RS* in *SRS-ResourceSet*.

The UE shall perform one-to-one mapping from the indicated SRI(s) to the indicated DM-RS ports(s) and their corresponding PUSCH layers {0 … ν-1} given by DCI format 0\_1, 0\_2 or 0\_3 or by *configuredGrantConfig* according to clause 6.1.2.3 in increasing order.

The UE shall transmit PUSCH using the same antenna ports as the SRS port(s) in the SRS resource(s) indicated by SRI(s) given by DCI format 0\_1 or 0\_2 or by *configuredGrantConfig* according to clause 6.1.2.3, where the SRS port in (*i*+1)-th SRS resource in the SRS resource set is indexed as .

The DM-RS antenna ports  in Clause 6.4.1.1.3 of [4, TS 38.211] are determined according to the ordering of DM-RS port(s) given by Tables 7.3.1.1.2-6 to 7.3.1.1.2-23 in Clause 7.3.1.1.2 of [5, TS 38.212].

For non-codebook based transmission, the UE does not expect to be configured with both *spatialRelationInfo* for SRS resource and *associatedCSI-RS* in *SRS-ResourceSet* for SRS resource set.

For non-codebook based transmission, the UE can be scheduled with DCI format 0\_1 or 0\_2 when at least one SRS resource is configured in *SRS-ResourceSet* with *usage* set to 'nonCodebook'.

<omitted text>

### 6.1.6 Uplink switching

The UE may omit uplink transmission during the uplink switching gap if the conditions defined in this clause are met and the UE is configured with *uplinkTxSwitching* or *uplinkTxSwitchingMoreBands*. The switching gap is indicated by UE capability *uplinkTxSwitchingPeriod2T2T* if *uplinkTxSwitching-2T-Mode* is configured, and *uplinkTxSwitchingPeriod* otherwise in clauses 6.1.6.1, 6.1.6.2.0, 6.1.6.3, and is determined based on higher layer parameter *switchingPeriodConfigForBandPair* in clause 6.1.6.2.2 for uplink switching with 3 or 4 uplink bands if *uplinkTxSwitchingMoreBands* is configured:

- If a UE indicated a capability for uplink switching with *BandCombination-UplinkTxSwitch* for a band combination, and if it is for that band combination

- Configured with a MCG using E-UTRA radio access and with a SCG using NR radio access (EN-DC), or

- Configured with uplink carrier aggregation, or

- Configured in a serving cell with two uplink carriers with higher layer parameter *supplementaryUplink*.

The conditions under which the switching gap may be present are defined for each of the cases in clauses 6.1.6.1, 6.1.6.2, and 6.1.6.3 respectively.

If an uplink switching is triggered for an uplink transmission starting at *T0*, after *T0-Toffset*, the UE is not expected to cancel the uplink switching, or to trigger any other new uplink switching occurring before *T0* for any other uplink transmission that is scheduled after *T0-Toffset*, where *Toffset* is

- determined based on the switching gap defined for a single Tx switching in [8, TS 38.101-1] when the Tx switching involves more than two bands, and there are at least two UL transmissions after switching on two switch-to bands that trigger the uplink switching, which are at least partially overlapped in time domain,

- the UE processing procedure time defined for the uplink transmission triggering the switch given in clause 5.3, clause 5.4, clause 6.2.1, clause 6.4 and in clause 9 of [6, TS 38.213], otherwise.

The UE does not expect to perform more than one uplink switching in a slot with *µUL* = max(*µUL, 1, µUL, 2*), where the *µUL, 1* corresponds to the subcarrier spacing of the active UL BWP of one uplink carrier before the switching gap and the *µUL, 2* corresponds to the subcarrier spacing of the active UL BWP of the other uplink carrier after the switching gap.

For uplink switching configured with 3 or 4 uplink bands

- If two contiguous intra-band uplink carriers are configured to a UE, the UE may assume that the active UL BWPs of the two carriers are configured with the same subcarrier spacing.

- The UE does not expect to perform more than one uplink switching in a reference slot with *µUL*, where the *µUL* corresponds to the maximum subcarrier spacing of the active UL BWPs of all the configured uplink carriers.

- If 500 µs is determined by the UE capability *uplinkTxSwitchingMinimumSeparationTime*, when within any two consecutive reference slots corresponding to numerology *µUL*,

- the UE first performs one uplink switch and later performs another uplink switch and

- at least three bands are involved in the transmissions before the first switch, between the first switch and the second switch, and after the second switch,

the separation time between the start of all transmission(s) after the first switch and the start of all transmission(s) after the second switch is not expected to be less than 500 µs. If other than 500 µs is determined by the UE capability *uplinkTxSwitchingMinimumSeparationTime*, no additional restrictions apply.

- If an uplink switching is triggered for uplink transmission(s) with a gap between the start of the first uplink transmission(s) and the end of the last preceding uplink transmission(s) that is smaller than the determined switching gap , the UE determines the band of the switching period location, defined in [8, TS 38.101-1] based on the priority of the bands configured by *uplinkTxSwitchingBandList*. Among the bands either in switch-from or switch-to bands but not both, the switch is located on either,

- the switch-from band(s) if the highest priority band is a switch-to band, or

- the switch-to band(s) if the highest priority band is a switch-from band.

<omitted text>

##### 6.1.6.2.2 Uplink switching with 3 or 4 uplink bands

For a UE indicating a capability for uplink switching with *BandCombination-UplinkTxSwitch* for a band combination, and if it is for that band combination configured with uplink carrier aggregation with 3 or 4 bands, the behaviour in subclause 6.1.6.2.0 applies when the two bands involved in the uplink switching belong to different uplink serving cells with the parameters *uplinkTxSwitching*, *uplinkTxSwitchingOption* and *uplinkTxSwitching-2T-Mode* beingreplaced by *UplinkTxSwitchingMoreBands, switchingOptionConfigForBandPair* and *switching2T-Mode,* respectively, and the behaviour in subclause 6.1.6.3 with the parameter *uplinkTxSwitching-2T-Mode* beingreplaced by *UplinkTxSwitchingMoreBands* applies when the two bands involved in the uplink switching belong to one uplink serving cell, with the following exceptions:

- If more than two bands are involved in the determination of one uplink switching and if on any two of the bands the UE is configured with *switchingOptionConfigForBandPair* set to 'dualUL',

- When the UE is to transmit a 2-port transmission on one uplink carrier on the 1st band and if the preceding uplink transmission was a 1-port transmission on a carrier on the 2nd and/or 3rd band and the UE is under the operation state in which 1-port transmission can be supported in the 2nd and 3rd band, then the UE is not expected to transmit for the duration of *N*Tx1-Tx2 on any of the carriers, where *N*Tx1-Tx2 is the switching gap defined in [8, TS 38.101-1].

- When the UE is to transmit a 1-port transmission on one uplink carrier on the 1st band and the 2nd band, and if the preceding uplink transmission was a 1-port or 2-port transmission on a carrier on the 3rd band and the UE is under the operation state in which 2-port transmission can be supported on the 3rd band, then the UE is not expected to transmit for the duration of *N*Tx1-Tx2 on any of the carriers, where *N*Tx1-Tx2 is the switching gap defined in [8, TS3 8.101-1].

- When the UE is to transmit a 1-port transmission on one uplink carrier on the 1st band and the 2nd band, and if the preceding uplink transmission was a 1-port transmission on a carrier on the 1st band and/or the 3rd band and the UE is under the operation state in which 1-port transmission can be supported in the 1st and 3rd band, if UE indicates *maintainedUL-Trans* for the 1st band for band pair{the 2nd band, the 3rd band} then the UE is not expected to transmit for the duration of *N*Tx1-Tx2 on any of the carriers on the 2nd band and the 3rd band, otherwise then the UE is not expected to transmit for the duration of *N*Tx1-Tx2 on any of the carriers , where *N*Tx1-Tx2 is the switching gap defined in [8, TS 38.101-1].

- When the UE is to transmit a 1-port transmission on one uplink carrier on the 1st band and the 2nd band, and if the preceding uplink transmission was a 1-port transmission on a carrier on the 3rd band and/or the 4th band and the UE is under the operation state in which 1-port transmission can be supported in the 3rd and 4th band, then the UE is not expected to transmit for the duration of *N*Tx1-Tx2 on any of the carriers, where *N*Tx1-Tx2 is theswitching gap defined in [8, TS 38.101-1].

- The UE is not expected to be scheduled or configured to transmit on more than two uplink bands at any given time.

- If the UE indicated a *uplinkTxSwitchingOptionForBandPair* set to ‘DualUL’, or ‘Both’ for a band pair in the band combination, the UE can be configured with *switchingOptionConfigForBandPair* set to 'dualUL' for that band pair.

- If the UE indicated a *uplinkTxSwitchingOptionForBandPair* set to ‘SwitchedUL’, or ‘Both’ for a band pair in the band combination, the UE can be configured with *switchingOptionConfigForBandPair* set to 'switchedUL' for that band pair.

- If the UE is configured with *uplinkTxSwitching-DualUL-TxState* set to 'oneT', when the UE is under the operation state in which 1-port transmission can be supported on one carrier on the 1st band and the 2nd band followed by no transmission on any carrier on these two bands and 1-port transmission on the other carrier on the 3rd band the UE shall consider this as if 1-port transmission was transmitted on the 3rd band and the band associated with the 3rd band as configured by *associatedBand*, otherwise the UE shall consider this as if 2-port transmission took place on the transmitting carrier. Even if all cells in a band are deactivated, that does not invalidate the associated band configuration that is indicating the band as associated band for the other band(s) for the definition in clause 6.1.6.

- If the UE is configured with *uplinkTxSwitching-DualUL-TxState* set to 'oneT', if a band in the band combination is not configured as dualUL for any band pair it belongs to, when the UE is to transmit a 1-port transmission on a carrier on the band the UE shall consider this as if 2-port transmission took place on the transmitting carrier.

<omitted text>

#### 6.2.1.3 UE sounding procedure between component carriers

For a carrier of a serving cell *c1* with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission, denote as the corresponding carrier of a serving cell whose UL transmissions are temporarily suspended as signalled by higher layer parameter *srs-SwitchFromServCellIndex* and *srs-SwitchFromCarrier*. Define the set as the set of carriers of serving cells that each carrier meets one of the following conditions:

- is in the same band and same TAG as;

- is a carrier of inter-band CA with and is indicated through the capability signalling *srs-SwitchingAffectedBandsListNR-r17* to be affected by the SRS switch from to ;

where .

A UE can be configured with SRS resource(s) on a carrier *c1* with slot formats comprised of DL and UL symbols and not configured for PUSCH/PUCCH transmission. For carrier *c1*, the UE is configured with higher layer parameter *srs-SwitchFromServCellIndex* and *srs-SwitchFromCarrier* the switching from carrier *c2* which is configured for PUSCH/PUCCH transmission. During SRS transmission on carrier *c1* (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR*), the UE temporarily suspends the uplink transmission on carriers in the set *S(c2)*.

For an SRS transmission starting in symbol of carrier and a conflicting transmission in any carrier starting in symbol, the UE shall apply the prioritization / dropping rules in the remainder of this clause taking into account:

- DCI(s) for which the time interval between the last symbol of PDCCH and is at leastsymbols and an additional time duration , and the time interval between the last symbol of PDCCH and is at least symbols*;* and

- semi-persistent CSI reports or SRS considered active at least symbols and an additional time duration before , and considered active at least symbols before .

where , and the time interval unit of OFDM symbol is counted based on the smaller subcarrier spacing across any carrier within the set , and their corresponding scheduling cells.

The following prioritization rules shall be applied in case of collision between a transmission of SRS over carrier and transmission of a physical signal/channel over a carrier of a serving cell in set

- the UE shall not transmit SRS whenever SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell and PUSCH/PUCCH transmission carrying HARQ-ACK/positive SR/RI/CRI/SSBRI and/or PRACH on a carrier of a serving cell in set happen to overlap in the same symbol

- the UE shall not transmit a periodic/semi-persistent SRS whenever periodic/semi-persistent SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell and PUSCH transmission carrying aperiodic CSI on a carrier of a serving cell in set happen to overlap in the same symbol

- the UE shall drop PUCCH/PUSCH transmission carrying periodic/semi-persistent CSI comprising only CQI/PMI/L1-RSRP/L1-SINR, and/or SRS transmission on a carrier of a serving cell in set configured for PUSCH/PUCCH transmission whenever the transmission and SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol

- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR on a carrier of a serving cell in set whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133]) as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol.

For an aperiodic SRS triggered in DCI format 2\_3 and if the UE is configured with higher layer parameter *srs-TPC-PDCCH-Group* set to 'typeA', and given by *SRS-CarrierSwitching,* without PUSCH/PUCCH transmission, the UE in each serving cell transmits the configured one or two SRS resource set(s) from *srs-ResourceSetToAddModList* with higher layer parameter *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* in *SRS-ResourceSet* set to 'aperiodic'.

For an aperiodic SRS triggered in DCI format 2\_3 and if the UE is configured with higher layer parameter *srs-TPC-PDCCH-Group* set to 'typeB' without PUSCH/PUCCH transmission, the UE in each serving cell transmits the configured one or two SRS resource set(s) from *srs-ResourceSetToAddModList* with higher layer parameter *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* in *SRS-ResourceSet* set to 'aperiodic'.

For an aperiodic SRS triggered in DCI format 1\_1 or 1\_2, if the UE is configured by *SRS-CarrierSwitching*, it transmits SRS on one serving cell not configured for PUSCH/PUCCH transmission scheduled by the DCI and the UE in the serving cell transmits the configured one or two SRS resource set(s) with higher layer parameter usage set to 'antennaSwitching' and higher layer parameter *resourceType* in *SRS-ResourceSet* set to 'aperiodic'.

For an aperiodic SRS triggered in DCI format 1\_3, if the UE is configured by *SRS-CarrierSwitching*, for an SRS transmission in a scheduled cell not configured for PUSCH/PUCCH transmission, the UE transmits the configured one or two SRS resource set(s) with higher layer parameter *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* in *SRS-ResourceSet* set to 'aperiodic'.

If the UE is not configured for PUSCH/PUCCH transmission on carrier *c1* with slot formats comprised of DL and UL symbols, and if the UE is not capable of simultaneous reception and transmission on carrier *c1*and serving cell *c2*, the UE is not expected to be configured or indicated with SRS resource(s) such that SRS transmission on carrier *c1* (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR*) would collide with the REs corresponding to the SS/PBCH blocks configured for the UE or the slots belonging to a control resource set indicated by *MIB* or *SIB1* on serving cell *c2*.

For *n*-th (*n ≥* 1) aperiodic SRS transmission on a cell *c*, upon detection of a positive SRS request on a grant, the UE shall commence this SRS transmission on the configured symbol and slot provided

- it is no earlier than the summation of

- the maximum time duration between the two durations spanned by N OFDM symbols of the numerology of cell *c* and the cell carrying the grant respectively, and

- the UL or DL RF retuning time [11, TS 38.133] as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR,*

- it does not collide with any previous SRS transmissions, or interruption due to UL or DL RF retuning time, except if the previous SRS transmission is in the same cell *c* and the UE reports *stayOnTargetCC-SRS-CarrierSwitch* for the corresponding band combination.

otherwise, *n*-th SRS transmission is dropped, where N is the reported capability as the minimum time interval in unit of symbols, between the DCI triggering and aperiodic SRS transmission.

In case of inter-band carrier aggregation, a UE can simultaneously transmit SRS and PUCCH/PUSCH across component carriers in different bands subject to the UE's capability.

In case of inter-band carrier aggregation, a UE can simultaneously transmit PRACH and SRS across component carriers in different bands subject to UE's capability.

If the UE is not configured for PUSCH/PUCCH transmission for at least one serving cell configured with slot formats comprised of DL and UL symbols, and if the UE is not capable of simultaneous reception and transmission on serving cell *c1*and serving cells(*c2*), and if a UE

- is configured with multiple serving cells and is provided with *directionalCollisionHandling-r16* = 'enabled' for a set of serving cell(s) among the configured multiple serving cells including serving cell *c1*and s(*c2*), and

- indicates support of *half-DuplexTDD-CA-SameSCS-r16* capability, and

- is not configured to monitor PDCCH for detection of DCI format 2\_0 on any of the multiple serving cells,

the UE shall apply first the prioritization/dropping rules described above for sounding procedure between component carriers and then apply the procedures for directional collision handling in clause 11.1 of [6, TS 38.213].

#### 6.2.1.4 UE sounding procedure for positioning purposes

When the SRS is configured by the higher layer parameter *SRS-PosResource* and if the higher layer parameter *spatialRelationInfoPos* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Resource* or *SRS-PosResource*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell. If the UE is configured for transmission of *SRS-PosResource* in RRC\_INACTIVE mode, the configured *spatialRelationInfoPos* is also applicable.

The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.

If the UE is not configured with the higher layer parameter *spatialRelationInfoPos* the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter *SRS-PosResource* across multiple SRS resources or it may use a different spatial domain transmission filter across multiple SRS resources.

In RRC\_CONNECTED mode, the UE is only expected to transmit an SRS configured by the higher layer parameter *SRS-PosResource* within the active UL BWP of the UE.

When the configuration of SRS is done by the higher layer parameter *SRS-PosResource*, the UE can only be provided with a single RS source in *spatialRelationInfoPos* per SRS resource for positioning.

For operation on the same carrier, if an SRS configured by the higher parameter *SRS-PosResource* collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.

Unless specified otherwise, the UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission.

Timing Error Group (TEG) at UE side is defined:

- UE Tx TEG is associated with the transmissions of one or more UL SRS resources for the positioning purpose, which have the Tx timing error difference within a certain margin.

The UE may be configured to report, via high layer parameter *nr-UE-RxTxTEG-Request* or *ue-TxTEG-RequestUL-TDOA-Config*, subject to UE capability, association information of the already transmitted SRS resource(s) configured by the higher layer parameter *SRS-PosResource* with UE Tx TEG(s) via higher layer parameter *nr-SRS-TxTEG-Set* or *ue-TxTEG-AssociationList*.

The UE may report, via high layer parameter *ue-TxTEG-TimingErrorMarginValue*, the UE Tx TEG timing error margin value of all the UE Tx TEGs within one *UEPositioningAssistanceInfo*.

If the UE reports a UE Tx TEG ID with a UE Rx-Tx time difference measurement, as defined in clause 5.1.6.5, the UE shall report the association information of the already transmitted SRS resources configured by the higher layer parameter *SRS-PosResource* with the UE Tx TEG ID.

If the UE is configured with SRS resources configured by the higher layer parameter *SRS-PosResource* in multiple CCs, the UE should report the *carrierFreq or servCellId* of the SRS resources when it reports the UE Tx TEG associations.

If the UE reports a UE RxTx TEG ID with a UE Rx-Tx time difference measurement, the UE may report a UE Tx TEG ID.

If the UE reports a UE Tx TEG ID with a UE Rx-Tx time difference measurement, the UE may report a UE Tx TEG timing error margin value, via high layer parameter *nr-UE-TxTEG-TimingErrorMargin*, for all the UE Tx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation*.

Subject to UE capability, the UE may be configured with an SRS resource for positioning associated with the initial UL BWP, and the SRS resource is transmitted inside the initial UL BWP during RRC\_INACTIVE mode with the same CP and subcarrier spacing as configured for the initial UL BWP. Subject to UE capability, the UE may be configured with an SRS resource for positioning outside the initial BWP including frequency location and bandwidth, subcarrier spacing, and CP length for transmission of the SRS in RRC\_INACTIVE mode. If an SRS symbol for positioning outside the initial BWP in RRC\_INACTIVE mode including the switching time, indicated in higher layer parameter *switchingTimeSRS-TX-OtherTX*, in unpaired spectrum, subject to UE capability, collides in time domain with other DL signals or channels or UL signals or channels, the colliding SRS symbol for positioning is dropped. If an SRS symbol for positioning outside the initial BWP in RRC\_INACTIVE mode including the switching time, indicated in higher layer parameter *switchingTimeSRS-TX-OtherTX*, in paired spectrum or SUL band, subject to UE capability, collides in time domain with UL signals or channels on the same carrier, the colliding SRS symbol for positioning is dropped. The SRS resource for positioning outside the initial BWP in RRC\_INACTIVE mode is configured in the same band and CC as the initial UL BWP.

If the UE in RRC\_INACTIVE mode is not provided *SRS-PosRRC-InactiveValidityAreaConfig* and determines that the UE is not able to accurately measure the configured DL RS in *SRS-SpatialRelationInfoPos* for a SRS resource for positioning where the DL RS is semi-persistent or periodic, the UE stops transmission of the SRS resource for positioning.

The UE is not expected to simultaneously transmit SRS resources configured by the higher layer parameter *SRS-PosResource* on NUL and SUL band in RRC\_INACTIVE mode.

The UE may be configured with SRS, via *SRS-PosRRC-InactiveValidityAreaConfig*, subject to UE capability, valid in multiple cells within a validity area for RRC\_INACTIVE mode. For the configured SRS via *SRS-PosRRC-InactiveValidityAreaConfig*, if the UE in RRC\_INACTIVE mode determines that the UE is not able to accurately measure the configured DL RS in *SRS-SpatialRelationInfoPos* for a SRS resource for positioning where the DL RS is semi-persistent or periodic, the UE would not perform SRS transmission of the SRS resource for positioning. If the UE determines that the configured DL RS in *SRS-SpatialRelationInfoPos* for a SRS resource for positioning is being accurately measured, the UE is expected to perform the SRS transmission.

##### 6.2.1.4.1 SRS frequency hopping for positioning

The reduced capability UE may be configured via *SRS-PosTx-Hopping*, subject to UE capability, to perform transmit frequency hopping separate from the UL BWP configuration and outside of the UL BWP, where the UE may be configured with subcarrier spacing, CP and bandwidth that are different from the UL active BWP. The reduced capability UE transmit frequency hopping is configured within one SRS resource for positioning, that may be configured with a bandwidth larger than the maximum bandwidth of the reduced capability UE, in RRC\_CONNECTED or RRC\_INACTIVE mode. The reduced capability UE transmit frequency hopping, may be configured with overlapping or non-overlapping frequency hops in the frequency domain. When the reduced capability UE is configured to perform transmit frequency hopping:

- it expects to be configured with the following parameters:

- starting PRB of the first hop in time domain in *freqDomainShift*

- starting slot offset for the first hop in *SRS-PeriodicityAndOffset*, starting slot offset for each hop following the first hop in *slotOffset* for aperiodic SRS and in *periodicityAndOffset* for periodic and semi-persistent SRS, and starting symbol for each hop in *startPosition*

- number of symbols in each hop in *nrofSymbols*

- hop bandwidth in *c-SRS*

- number of overlapping resource block(s) between hops, if present, in *overlapValue*

- number of hops in *numberOfHops*.

- it does not expect to be configured with the sum of *startPosition* and *nrofSymbol*s for a hop that exceeds a slot duration.

- it expects to be configured with the same periodicity of each hop of an SRS resource with the transmit frequency hopping.

The reduced capability UE may be configured, via *srs-PosUplinkTransmissionWindowConfig*, subject to UE capability, with an UL time window where the UE is not expected to transmit other signals/channels and is only expected to transmit the SRS for positioning using frequency hopping. The UE is not expected to be configured with one [cycle] of the transmit frequency hopping, including the switching time from/to active BWP required ahead of the first hop and after the last hop, that is partially overlapped with the time window.

For aperiodic positioning SRS with Tx frequency hopping, the minimal time interval between the last symbol of the PDCCH triggering the aperiodic SRS transmission and the first symbol of SRS resource is *N2* symbols and an additional time duration corresponding to the switching time from the active uplink BWP.

The reduced capability UE is expected to switch back to the active BWP if the time between two consecutive hops exceeds twice the switching time from/to the active BWP.

In RRC\_CONNECTED mode, for a transmission of a hop for an SRS resource for positioning with frequency hopping starting in symbol and a colliding PUSCH or PUCCH transmissionstarting in symbol , the UE shall apply the dropping rules taking into account:

- DCI(s) for which the time interval between the last symbol of PDCCH and the SRS symbol is at least symbols and additional time duration , where is the switching time to/from the active BWP.

- DCI(s) for which the time interval between the last symbol of PDCCH and the colliding PUSCH/PUCCH symbol is at least  symbols, where calculation of is based on the smallest SCS between the SCS configured for positioning SRS with the frequency hopping, the SCS of the PUSCH/PUCCH, and the SCS of the PDCCH.

- semi-persistent CSI reports or SRS considered active at least symbols and an additional time duration before , and considered active at least symbols before .

If the SRS symbol(s), including the switching time to and from the active bandwidth part, of the transmit frequency hopping collides with PUSCH or PUCCH, and if the UE determines the SRS to be dropped, the colliding SRS symbol(s) are dropped.

When the reduced capability UE is configured by the higher layer parameter *SRS-PosTx-Hopping*, including a switching time to and from the active bandwidth part, the UE shall use the same priority rules as defined in Clause 6.2.1.

For operation in the same carrier, the reduced capability UE is not expected to be configured on overlapping symbols with an SRS resource of the transmit frequency hopping configured by the higher layer parameter *SRS-PosTx-Hopping* including the switching time to or from the active bandwidth part and an SRS resource with *resourceType* of both SRS resources as 'periodic'.

For operation in the same carrier, the reduced capability UE is not expected to be activated or triggered to transmit SRS on overlapping symbols with a SRS resource of the transmit frequency hopping configured by the higher layer parameter *SRS-PosTx-Hopping* including the switching time to or from the active bandwidth part and a SRS resource with *resourceType* of both SRS resources as 'semi-persistent' or 'aperiodic'.

##### 6.2.1.4.2 SRS bandwidth aggregation for positioning measurements

The UE is expected to be configured with linkage information *SRS-PosResourceSetLinkedForAggBWList* on SRS resource sets for positioning across two or three CCs which are linked for bandwidth aggregation. For the linked SRS resource sets, the UE is expected to be configured with the same values of *startPosition, nrofSymbols,* *periodicityAndOffset, slotOffset, alpha, p0,* *spatialRelationInfoPos, resourceType*, subcarrier spacing, CP, and comb size, and the UE is expected to maintain phase continuity for the SRS transmission on the same symbol(s). The UE assumes that SRS resources across the linked SRS resource sets which satisfy the above conditions are linked for bandwidth aggregation, otherwise, the UE does not assume that SRS resources of the linked SRS resource sets are linked for bandwidth aggregation.

If the UE is configured with *dci-TriggeringPosResourceSetLink*, and if the UE receives a DCI 0\_1, 0\_2, 1\_1, or 1\_2 triggering an aperiodic SRS resource set for positioning linked for bandwidth aggregation in a CC, subject to UE capability, UE transmits SRS of the linked SRS resource sets across all CCs.

A UE in RRC\_INACTIVE mode is expected to be configured with frequency information via *freqInfo* in *SRS-PosResourceSetLinkedForAggBW* for additional component carrier(s) with respective SRS configuration(s) for bandwidth aggregation.

When an SRS resource configured in a CC without PUSCH or PUCCH is linked for bandwidth aggregation with an SRS resource configured in an active UL BWP of another CC in the same band, there is a guard period during which the UE is not expected to transmit or receive other signals or channels in this band, or any other affected band(s), subject to UE capability.

For the linked SRS resource sets for bandwidth aggregation across CCs, if an SRS configured by the higher layer parameter *SRS-PosResource*, along with the guard period when applicable, collides with other signals or channels on a symbol and if the SRS in that symbol is dropped, SRS transmission of the linked SRS resource sets across all CCs is dropped on that symbol.

If the UE receives an activation or deactivation command of semi-persistent SRS resource set(s) for positioning in up to three aggregated carriers or SRS resource set(s) for positioning in up to two aggregated carriers as specified in [10, TS 38.321] and when the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the activation or deactivation command, the corresponding actions in [10, TS 38.321] and the UE assumptions on SRS transmission or cessation corresponding to the SRS resource set(s) shall be applied starting from the first slot that is after slot where µ is the SCS configuration for the PUCCH.

For positioning SRS resources on multiple carriers linked for aggregation, the channel over which a symbol on one carrier for SRS transmission is conveyed can be inferred from the channel over which the same symbol of another carrier or the aggregated carrier is conveyed.

<omitted text>

# 7 UE procedures for transmitting and receiving on a carrier with intra-cell guard bands

For operation with shared spectrum channel access for FR1, when the UE is configured with any of *IntraCellGuardBandsPerSCS* for UL carrier and for DL carrier and *sl-IntraCellGuardBandsSL-List* for SL carrier with SCS configuration , the UE is provided with intra-cell guard bands on a carrier with , each defined by start CRB and size in number of CRBs, and , provided by higher layer parameters *startCRB* and *nrofCRBs*, respectively, where . The subscript *x* is set to DL, UL, or SL for the downlink, uplink, or sidelink, respectively. Where there is no risk of confusion, the subscript *x* can be dropped. The intra-cell guard bands separate RB sets, each defined by start and end CRB, and , respectively. The UE does not expect that *nrofCRBs* is configured with non-zero value smaller than the applicable intra-cell guard bands as specified in [8, TS 38.101-1] corresponding to and carrier size . The UE determines the start and end CRB indices for as

and

The RB set with index consists of resource blocks where . When the UE is not configured with *IntraCellGuardBandsPerSCS* for UL carrier and for DL carrier with SCS configuration , or is not configured with *sl-IntraCellGuardBandsSL-List* for SL carrier with SCS configuration , the UE determines the CRB indices for the intra-cell guard band(s), if any, and corresponding RB set(s) according to the nominal intra-cell guard band and RB set pattern as specified in [8, TS 38.101-1] corresponding to and carrier size . For any one or more of DL, UL, SL, if the nominal intra-cell guard band and RB set pattern as specified in [8, TS 38.101-1] contains no intra-cell guard bands, the number of RB sets for the carrier is .

For a carrier with , the UE expects and where for a BWP *i* configured by *initialDownlinkBWP* or *BWP-Downlink* for the DL BWP, or *initialUplinkBWP* or *BWP-Uplink* for the UL BWP, or configured by *SL-BWP-Config* for the SL BWP. Within the BWP *i*, RB sets are numbered in increasing order from 0 to where is the number of RB sets contained in the BWP *i* and RB set 0 within the BWP *i* corresponds to RB set in the carrier and RB set within the BWP *i* corresponds to RB set in the carrier.

When a UE is provided with *nrofCRBs =* 0 for all intra-cell guard band(s) on a carrier with , the UE is indicated that no intra-cell guard-bands are configured for the carrier and expects . For , the UE expects the number of RBs within a RB set is between 100 and 110. For , the UE expects the number of RBs within a RB set is between 50 and 55 except for at most one RB set which may contain 56 RBs.

# 8 Physical sidelink shared channel related procedures

A UE can be configured by higher layers with one or more sidelink resource pools. A sidelink resource pool can be for transmission of PSSCH, as described in Clause 8.1, and/or SL PRS, as described in Clause 8.2.4, or for reception of PSSCH, as described in Clause 8.3, and/or SL PRS, as described in Clause 8.4.4, and can be associated with either sidelink resource allocation mode 1 or sidelink resource allocation mode 2.

A sidelink resource pool which can be used for transmission of both SL PRS and PSSCH will be referred to as shared SL PRS resource pool.

A sidelink resource pool which can be used for transmission of SL PRS and cannot be used for transmission of PSSCH will be referred to as dedicated SL PRS resource pool.

In the frequency domain,

- If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is not provided, or it is set to 'contiguousRB', a sidelink resource pool consists of *sl-NumSubchannel* contiguous sub-channels. A sub-channel consists of *sl-SubchannelSize* contiguous PRBs, where *sl-NumSubchannel* and *sl-SubchannelSize* are higher layer parameters.

- If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', in the frequency domain, each RB set of a sidelink resource pool consists of integer number of sub-channels, where each sub-channel consists of *sl-NumInterlacePerSubchannel* interlaces having contiguous interlace indices.

For operation with shared spectrum channel access for frequency range 1, a sidelink resource pool can be (pre-)configured to include integer number of RB sets, and the lowest RB of the sidelink resource pool is aligned with the lowest RB of lowest RB set in the resource pool, and the highest RB of the sidelink resource pool is aligned with the highest RB of highest RB set in the resource pool. A UE can be configured with intra-cell guard bands according to the higher layer parameter *sl-IntraCellGuardBandsSL-List*. The configured intra-cell guard band PRBs between any two adjacent RB sets can be used only for PSSCH transmission, if and only if, the UE has successfully performed channel access procedure in both adjacent RB sets, and the UE uses both of these RB sets for PSSCH transmission. If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to ‘contiguousRB', and if more than 1 sub-channel is used for PSSCH transmission, when the highest sub-channel of PSSCH overlaps with a single RB set and the highest PRB in the highest sub-channel overlaps with intra-cell guard band PRBs, the UE can transmit PSSCH on the PRBs belonging to the allocated sub-channel(s) except for the intra-cell guard band PRBs within the highest sub-channel.

The set of slots that may belong to a sidelink resource pool is denoted by where

-

- the slot index is relative to slot#0 of the radio frame corresponding to SFN 0 of the serving cell or DFN 0,

- the set includes all the slots except the following slots,

- slots in which S-SS/PSBCH block (S-SSB) or additional transmission occasion for S-SSB is configured,

- slots in each of which at least one of *Y-th*, *(Y+1)-th*, …, *(Y+X-1)-th* OFDM symbols are not semi-statically configured as UL as per the higher layer parameter *tdd-UL-DL-ConfigurationCommon* of the serving cell if providedor *sl-TDD-Configuration* if provided or *sl-TDD-Config* of the received PSBCH if provided, where *Y* and *X* are set by the higher layer parameters *sl-StartSymbol* and *sl-LengthSymbols*, respectively.

- The reserved slots which are determined by the following steps.

1) the remaining slots excluding slots and slots from the set of all the slots are denoted by arranged in increasing order of slot index.

2) a slot belongs to the reserved slots if , here and where denotes the length of bitmap configured by higher layers.

- The slots in the set are arranged in increasing order of slot index.

The UE determines the set of logical slots assigned to a sidelink resource pool as follows:

- a bitmap associated with the resource pool is used where the length of the bitmap is configured by higher layers.

- a slot belongs to the set if where .

- The slots in the set are re-indexed such that the subscripts *i* of the remaining slots are successive {0, 1, …, where is the number of the slots remaining in the set.

The UE determines the set of resource blocks assigned to a sidelink resource pool as follows:

- The resource block pool consists of PRBs.

- If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is not provided, or is set to 'contiguousRB', the sub-channel *m* for consists of a set of contiguous resource blocks with the physical resource block number for , where , and *numSubchannel* are given by higher layer parameters *sl-StartRB-Subchannel*, *sl-SubchannelSize* and *sl-NumSubchannel*, respectively.

- If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', the sub-channel *m* for consists of a set of *sl-NumInterlacePerSubchannel* contiguous interlaces, where each interlace consists of at least 10 resource blocks as defined in clause 4.4.4.6 of [4, TS 38.211], *numSubchannel* is equal to the number of interlaces within one RB set divided by *sl-NumInterlacePerSubchannel*, and *sl-NumInterlacePerSubchannel* is given by higher layer parameter *sl-NumInterlacePerSubchannel*. The sub-channel *m* is indexed per RB set and is periodically indexed across multiple RB sets within the resource pool. The sub-channel with the same index is mapped to the set of *sl-NumInterlacePerSubchannel* interlace(s) with the same index(s) in different RB sets. The sub-channel#0 is mapped to interlaces 0 to *sl-NumInterlacePerSubchannel-1,* the subchannel #1 is mapped to interlaces *sl-NumInterlacePerSubchannel* to *sl-NumInterlacePerSubchannel\*2-1*, and so on.

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is not provided, or is set to ‘contiguousRB’, a UE is not expected to use the last PRBs in the resource pool, except when the resource pool is a dedicated SL PRS resource pool.

In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink, the UE expects to be (pre-)configured with 15 kHz SCS or 30 kHz SCS for a SL BWP, for NR sidelink transmissions in 30kHz SCS, the UE expects that the start of the first symbol of the earlier overlapping NR SL slot is aligned with the start of the first symbol of the overlapping LTE SL subframe.

## 8.1 UE procedure for transmitting the physical sidelink shared channel

Each PSSCH transmission is associated with an PSCCH transmission.

That PSCCH transmission carries the 1st stage of the SCI associated with the PSSCH transmission; the 2nd stage of the associated SCI is carried within the resource of the PSSCH.

If the UE transmits SCI format 1-A on PSCCH according to a PSCCH resource configuration in slot *n* and PSCCH resource *m*, then for the associated PSSCH transmission in the same slot

- one transport block is transmitted with up to two layers;

- The number of layers (ʋ) is determined according to the '*Number of DMRS port'* field in the SCI;

- The set of consecutive symbols within the slot for transmission of the PSSCH is determined according to clause 8.1.2.1;

- The set of contiguous or interlaced resource blocks for transmission of the PSSCH is determined according to clause 8.1.2.2;

Transform precoding is not supported for PSSCH transmission.

Only wideband precoding is supported for PSSCH transmission.

The DM-RS antenna ports cid:image011.png@01D5F222.20AEBCB0 in Clause 8.4.1.1.2 of [4, TS38.211] are determined according to the ordering of DM-RS port(s) given by Tables 8.3.1.1-3 in Clause 8.3.1.1 of [5, TS 38.212].

The UE shall set the contents of the SCI format 2-A as follows:

- the UE shall set value of the *'HARQ process number'* field as indicated by higher layers.

- the UE shall set value of the '*NDI*' field as indicated by higher layers.

- the UE shall set value of the '*Redundancy version*' field as indicated by higher layers.

- the UE shall set value of the '*Source ID*' field as indicated by higher layers.

- the UE shall set value of the '*Destination ID*' field as indicated by higher layers.

- the UE shall set value of the '*HARQ feedback enabled/disabled indicator*' field as indicated by higher layers.

- the UE shall set value of the '*Cast type indicator*' field as indicated by higher layers.

- the UE shall set value of the '*CSI request*' field as indicated by higher layers.

- the UE shall set value of the '*CAPC*' field, if present, as indicated by higher layers.

- the UE shall set value of the '*COT sharing cast type*' field, if present, as indicated by higher layers.

- the UE shall set value of the '*COT sharing Additional ID'* field, if present, as indicated by higher layers.

- the UE shall set value of the '*Remaining COT duration'* field, if present, as indicated by higher layers.

The UE shall set the contents of the SCI formats 2-B as follows:

- the UE shall set value of the '*HARQ process number*' field as indicated by higher layers.

- the UE shall set value of the '*NDI*' field as indicated by higher layers.

- the UE shall set value of the '*Redundancy version*' field as indicated by higher layers.

- the UE shall set value of the '*Source ID*' field as indicated by higher layers.

- the UE shall set value of the '*Destination ID*' field as indicated by higher layers.

- the UE shall set value of the '*HARQ feedback enabled/disabled indicator*' field as indicated by higher layers.

- the UE shall set value of the '*Zone ID*' field as indicated by higher layers.

- the UE shall set the '*Communication range requirement*' field as indicated by higher layers.

The UE shall set the contents of the SCI format 2-C as follows:

- the UE shall set value of the *'HARQ process number'* field as indicated by higher layers.

- the UE shall set value of the '*NDI*' field as indicated by higher layers.

- the UE shall set value of the '*Redundancy version*' field as indicated by higher layers.

- the UE shall set value of the '*Source ID*' field as indicated by higher layers.

- the UE shall set value of the '*Destination ID*' field as indicated by higher layers.

- the UE shall set value of the '*HARQ feedback enabled/disabled indicator*' field as indicated by higher layers.

- the UE shall set value of the '*CSI request*' field as indicated by higher layers.

- the UE shall set value of '*Providing/Requesting indicator*' field as indicated by higher layers.

- if '*Providing/Requesting indicator*' indicates SCI format 2-C is used to convey an explicit request for inter-UE coordination information:

- the UE shall set value of the '*Priority*' field as indicated by higher layers.

- the UE shall set value of the '*Number of subchannels*' field as indicated by higher layers.

- the UE shall set value of the '*Number of RB sets*' field as indicated by higher layers if the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured to 'interlaceRB'.

- the UE shall set value of the '*Resource reservation period*' field as indicated by higher layers.

- the UE shall set value of the '*Resource selection window location*' field as indicated by higher layers.

- the UE shall set value of the '*Resource set type*' field as indicated by higher layers if higher layer parameter *sl-DetermineResourceType* is configured to 'UE-B's request'; otherwise this field is omitted.

- if '*Providing/Requesting indicator*' indicates SCI format 2-C is used to convey inter-UE coordination information:

- the UE shall set value of the '*Resource set type*' field as indicated by higher layers.

- the UE shall set value of the '*Resource combination(s)*' field (clause 8.1.5A) as indicated by higher layers.

- the UE shall set value of the *'Lowest subchannel indices'* as indicated by higher layers

- the UE shall set value of the *'Lowest RB set indices'* as indicated by higher layers if the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* in *SL-BWP-Config* is configured to 'interlaceRB'.

- the UE shall set value of the '*First resource location*' as indicated by higher layers

- the UE shall set value of the '*Reference slot location*' as indicated by higher layers

The UE shall set the contents of the SCI format 2-D as follows:

- the UE shall set value of the *'SL PRS resource ID'* field as indicated by higher layers.

- the UE shall set value of the *'SL PRS request'* field as indicated by higher layers.

- the UE shall set value of the *'Embedded SCI format'* field as indicated by higher layers.

- if *'Embedded SCI format'* indicates that SCI format 2-A is embedded within this SCI format 2-D then the UE shall include in the *'[Embedded SCI format payload]'* field the fields of SCI format 2-A, set as specified above.

- if *'Embedded SCI format'* indicates that SCI format 2-B is embedded within this SCI format 2-D then the UE shall include in the *'[Embedded SCI format payload]'* field the fields of SCI format 2-B, set as specified above.

<omitted text>

#### 8.1.2.1 Resource allocation in time domain

The UE shall transmit the PSSCH in the same slot as the associated PSCCH.

The minimum resource allocation unit in the time domain is a slot.

The UE shall transmit the PSSCH in consecutive symbols within the slot, subject to the following restrictions:

- The UE shall not transmit PSSCH in symbols which are not configured for sidelink. A symbol is configured for sidelink, according to higher layer parameters *sl-StartSymbol* and *sl-LengthSymbols*, where *sl-StartSymbol* is the symbol index of the first symbol of *sl-LengthSymbols* consecutive symbols configured for sidelink.

- Within the slot, PSSCH resource allocation starts at symbol *sl-StartSymbol+1,* except when *sl-StartingSymbolFirst* and *sl-StartingSymbolSecond* are provided for a SL-BWP*.* If *sl-StartingSymbolFirst* and *sl-StartingSymbolSecond* are provided for the SL-BWP, there are 2 candidate starting symbols, given by *sl-StartingSymbolFirst* and *sl-StartingSymbolSecond* respectively, for PSSCH transmission for slots without PSFCH symbols; and there is one starting symbol, given by *sl-StartingSymbolFirst,* for PSSCH transmission for slots with PSFCH symbols. PSSCH resource allocation starts at the next symbol after each candidate starting symbol. In a slot, the UE may use the second candidate starting symbol, provided by *sl-StartingSymbolSecond*, only if it fails to access the channel prior to the first candidate starting symbol provided by *sl-StartingSymbolFirst.*

- The UE shall not transmit PSSCH in symbols which are configured for use by PSFCH, if PSFCH is configured in this slot.

- The UE shall not transmit PSSCH in the last symbol configured for sidelink.

- The UE shall not transmit PSSCH in the symbol immediately preceding the symbols which are configured for use by PSFCH, if PSFCH is configured in this slot.

- For operation with shared spectrum channel access in frequency range 1, for the first SL transmission with PSSCH/PSCCH by a UE to initiate a channel occupancy for a slot, if no resource reservation is transmitted or detected for the slot and any one of the RB set(s) of the intended PSCCH/PSSCH transmission, and if UE is configured with multiple CPE starting positions provided by *sl-CPE-StartingPositions* in *sl-CPE-StartingPositioningPSCCH-PSSCH-InitiateCOTList,* the UE determines a duration of a cyclic prefix extension *Text* to be applied according to [4, TS 38.211] where the index *i* for 𝐶𝑖 and [4, TS 38.211] is chosen randomly from a set of values configured per priority of the PSCCH/PSSCH by the higher layer parameter *sl-CPE-StartingPositions* in *sl-CPE-StartingPositioningPSCCH-PSSCH-InitiateCOTList*. Otherwise, the UE uses a configured default cyclic prefix extension *Text* indicated by *sl-CPE-StartingPositioningPSCCH-PSSCH-InitiateCOTDefault*.

- For operation with shared spectrum channel access in frequency range 1, for the first SL transmission with PSSCH/PSCCH by a UE within a channel occupancy*,* the UE transmitting in the channel occupancy determines the duration of a cyclic prefix extension *Text* according to higher layer parameter *sl-CPE-StartingPositionsPSCCH-PSSCH-WithinCOT-Default*, unless the UE is configured with multiple CPE starting positions for transmitting within a shared channel occupancy by *sl-CPE-StartingPositions* in *sl-CPE-StartingPositionsPSCCH-PSSCH-WithinCOT-List,* in which case the UE determines the duration of a cyclic prefix extension *Text* to be applied according to [4, TS 38.211] where the index *i* for 𝐶𝑖 and [4, TS 38.211] is chosen randomly from a set of values configured per priority of the PSCCH/PSSCH by the higher layer parameter *sl-CPE-StartingPositions* in *sl-CPE-StartingPositionsPSCCH-PSSCH-WithinCOT-List,* if no resource reservation is transmitted or detected for the slot and the RB set(s) of the intended PSCCH/PSSCH transmission, otherwise, the UE uses the configured default cyclic prefix extension *Text* indicated by *sl-CPE-StartingPositionsPSCCH-PSSCH-WithinCOT-Default.*

- For operation with shared spectrum channel access in frequency range 1, for a PSSCH/PSCCH transmission by a UE that follows another SL transmission by the same UE in a channel occupancy, the UE determines the duration of a cyclic prefix extension *Text* as follows:

- When gap between the PSSCH/PSCCH transmission and the previous SL transmission is 1 symbol, the index *i* for is set to '1'.

- When gap between the PSSCH/PSCCH transmission and the previous SL transmission is 2 symbols, the index *i* for is set to '3' for µ=1 and to '2' for µ=2.

In sidelink resource allocation mode 1:

- For sidelink dynamic grant, the PSSCH transmission is scheduled by a DCI format 3\_0.

- For sidelink configured grant type 2, the configured grant is activated by a DCI format 3\_0.

- For sidelink dynamic grant and sidelink configured grant type 2:

- The "Time gap" field value *m* of the DCI format 3\_0 provides an index *m* + 1 into a slot offset table. That table is given by higher layer parameter *sl-DCI-ToSL-Trans* and the table value at index *m* + 1 will be referred to as slot offset .

- The slot of the first sidelink transmission scheduled by the DCI is the first SL slot of the corresponding resource pool that starts not earlier than , where is the starting time of the downlink slot carrying the corresponding DCI, is the timing advance value corresponding to the TAG of the serving cell on which the DCI is received and is the slot offset between the slot of the DCI and the first sidelink transmission scheduled by DCI and is the SL slot duration.

- The "Configuration index" field of the DCI format 3\_0, if provided and not reserved, indicates the index of the sidelink configured type 2.

- For sidelink configured grant type 1:

- The slot of the first sidelink transmissions follows the higher layer configuration according to [10, TS 38.321].

#### 8.1.2.2 Resource allocation in frequency domain

The resource allocation unit in the frequency domain is the sub-channel.

The sub-channel assignment for sidelink transmission is determined using the "Frequency resource assignment" field in the associated SCI.

The lowest sub-channel for sidelink transmission is the sub-channel on which the lowest PRB of the associated PSCCH is transmitted.

If a PSSCH scheduled by a PSCCH would overlap with resources containing the PSCCH, the resources corresponding to a union of the PSCCH that scheduled the PSSCH and associated PSCCH DM-RS are not available for the PSSCH.

When PSSCH is transmitted on multiple RB sets, the corresponding PSCCH is located on the sub-channel with the lowest index of the RB set with the lowest index within the multiple RB sets.

For operation with shared spectrum channel access for frequency range 1, if the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB:,

- the lowest index of the RB set allocation to the initial PSSCH transmission is indicated via the field "Lowest index of the RB set allocation to the initial transmission" of the DCI format 3\_0.

- the starting RB set index of the initial PSSCH transmission of the sidelink configured grant Type 1 is indicated via the higher layer parameter *sl-StartRBsetCG-Type1*.

<omitted text>

#### 8.1.3.2 Transport block size determination

For the PSSCH assigned by SCI, if Table 5.1.3.1-2 is used and *,* or a table other than Table 5.1.3.1-2 is usedand *,* the UE shall first determine the TBS as specified below:

The UE shall first determine the number of REs (*NRE*) within the slot.

- A UE first determines the number of REs allocated for PSSCH within a PRB () by , where

- is the number of subcarriers in a physical resource block,

- = *sl-LengthSymbols* -2, where *sl-LengthSymbols* is the number of sidelink symbols within the slot provided by higher layers. If *sl-startingSymbolFirst* and *sl-startingSymbolSecond* are provided for the SL-BWP, the number of sidelink symbols assumed in transport block size determination is determined by a reference number of symbols, *sl-numRefSymbolLength*, provided by higher layers, such that *sl-numRefSymbolLength* replaces *sl-LengthSymbols* in calculation of .

- = 3 if '*PSFCH overhead indication'* field of SCI format 1-A indicates "1", and = 0 otherwise, if higher layer parameter *sl-PSFCH-Period* is 2 or 4. If higher layer parameter *sl-PSFCH-Period* is 0, . If higher layer parameter *sl-PSFCH-Period* is 1, .

- is the number of OFDM symbols used for SL PRS in the slot as indicated by the ‘*SL PRS resource ID*’ in SCI format 2-D if the 2nd-stage SCI is SCI format 2-D, and , otherwise.,

- is the overhead given by higher layer parameter *sl-X-Overhead*,

- is given by Table 8.1.3.2-1 according to higher layer parameter *sl-PSSCH-DMRS-TimePatternList.*

Table 8.1.3.2-1: according to higher layer parameter *sl-PSSCH-DMRS-TimePatternList*

|  |  |
| --- | --- |
| *sl-PSSCH-DMRS-TimePatternList* |  |
| {2} | 12 |
| {3} | 18 |
| {4} | 24 |
| {2,3} | 15 |
| {2,4} | 18 |
| {3,4} | 21 |
| {2,3,4} | 18 |

- A UE determines the total number of REs allocated for PSSCH () by , where

- *nPRB* is the total number of allocated PRBs for the PSSCH. If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', a reference number of PRBs (*nref*) per interlace within 1 RB set, *sl-nNmRefPRBOfInterlace*, is provided by higher layers for determination of total number of PRBs for PSSCH, that is *nPRB = nref \* ninter,subCH \* nsubCH \* nRB-set,* where *ninter,subCH* is given by the higher layer parameter *sl-NumInterlacePerSubchannel, nsubCH* is the number of occupied sub-channels within one RB set for the PSSCH, and *nRB-set* is the number of occupied RB sets for the PSSCH. If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to ‘contiguousRB’, *nPRB =*  *\* nsubCH ,* where is provided by higher layer parameter *sl-SubchannelSize*, and *nsubCH* is the number of occupied sub-channels for the PSSCH.

- is the total number of REs occupied by the PSCCH and PSCCH DM-RS.

- is the number of coded modulation symbols generated for 2nd-stage SCI transmission (prior to duplication for the 2nd layer, if present) according to Clause 8.4.4 of [5, TS 38.212], with the assumption of .

The UE determines TBS according to Steps 2), 3), and 4) in clause 5.1.3.2.

A UE is not expected to receive an SCI indicating if Table 5.1.3.1-2 is used, or otherwise.

### 8.1.4 UE procedure for determining the subset of resources to be reported to higher layers in PSSCH resource selection in sidelink resource allocation mode 2

In resource allocation mode 2, the higher layer can request the UE to determine a subset of resources from which the higher layer will select resources for PSSCH/PSCCH transmission for a carrier. To trigger this procedure, in slot *n* for this carrier*,* the higher layer provides the following parameters for this PSSCH/PSCCH transmission:

- the resource pool from which the resources are to be reported;

- L1 priority, ;

- the remaining packet delay budget;

- number of sub-channels, : If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is not provided, the number of sub-channels to be used for the PSSCH/PSCCH transmission in a slot is . If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'contiguousRB', corresponds to the number of sub-channels within all used RB sets to be used for the PSCCH/PSSCH transmission in a slot. If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', corresponds to the number of sub-channels to be used for the PSSCH/PSCCH transmission in a slot in each RB set,

- If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', the number of used RB sets for one PSCCH/PSSCH transmission, LRBset.

- optionally, the number of consecutive slots for multi-consecutive slots transmission, .

- optionally, the resource reservation interval, , in units of msec.

- if the higher layer requests the UE to determine a subset of resources from which the higher layer will select resources for PSSCH/PSCCH transmission as part of re-evaluation or pre-emption procedure, the higher layer provides a set of resources which may be subject to re-evaluation and a set of resources which may be subject to pre-emption.

- it is up to UE implementation to determine the subset of resources as requested by higher layers before or after the slot - , where is the slot with the smallest slot index among and , and is equal to , whereis defined in slots in Table 8.1.4-2 whereis the SCS configuration of the SL BWP.

- Each of the resource(s) in and/or corresponds to consecutive slots if is provided with a value larger than 1.

- Optionally, the indication of resource selection mechanism.

- Optionally, *rbSetsWithConsecutiveLBTFailure*, which indicates the RB sets where consistent LBT failure has been indicated.

The following higher layer parameters affect this procedure:

*- sl-SelectionWindowList*:internal parameter is set to the corresponding value from higher layer parameter *sl-SelectionWindowList* for the given value of .

*- sl-Thres-RSRP-List*: this higher layer parameter provides an RSRP threshold for each combination , where is the value of the priority field in a received SCI format 1-A and is the priority of the transmission of the UE selecting resources; for a given invocation of this procedure, .

*- sl-RS-ForSensing* selects if the UE uses the PSSCH-RSRP or PSCCH-RSRP measurement, as defined in clause 8.4.2.1.

*- sl-ResourceReservePeriodList*

*- sl-SensingWindow*: internal parameter is defined as the number of slots corresponding to *sl-SensingWindow* msec

*- sl-TxPercentageList*: internal parameter for a given is defined as *sl-TxPercentageList ()* converted from percentage to ratio

- *sl-PreemptionEnable*: if *sl-PreemptionEnable* is provided, and if it is not equal to 'enabled', internal parameter is set to the higher layer provided parameter *sl-PreemptionEnable.*

- Optionally, minimum number of *Y* slots as (*sl*-*MinNumCandidateSlotsPeriodic*), which indicates the minimum number of *Y* slots that are included in the candidate resources corresponding to periodic-based partial sensing and contiguous partial sensing for resource (re)selection triggered by periodic transmission ().

- Optionally, minimum number of slots as (*sl*-*MinNumCandidateSlotsAperiodic*), which indicates the minimum number of slots that are included in the candidate resources corresponding to periodic-based partial sensing and/or contiguous partial sensing results (if available) for resource (re)selection triggered by aperiodic transmission ().

- Optionally, sensing occasion as *sl-PBPS-OccasionReservePeriodList,* which indicates the subset of periodicity values from *sl-ResourceReservePeriodList* used to determine periodic sensing occasions in periodic-based partial sensing. If not configured, all periodicity values from *sl-ResourceReservePeriodList* are used to determine periodic sensing occasions in periodic-based partial sensing.

- Optionally, additional sensing occasions as *sl-Additional-PBPS-Occasion*, which indicates that UE additionally monitors periodic sensing occasions that correspond to a set of values. The possible values of the set at least includes the most recent sensing occasion before the first slot of the candidate slots subject to processing time restriction as specified below for a given reservation periodicity and the last periodic sensing occasion prior to the most recent one for the given reservation periodicity. If not (pre-)configured, the UE monitors the most recent sensing occasion before the first slot of the candidate slots subject to processing time restriction as specified below for the given periodicity used to determine periodic sensing occasions in periodic-based partial sensing.

- Optionally, indication of the size in logical slots of contiguous partial sensing window for periodic transmissions as defined by the parameter *sl-CPS-WindowPeriodic*.

Optionally, indication of the size in logical slots of contiguous partial sensing window for aperiodic transmissions as defined by the parameter *sl-CPS-WindowAperiodic.*

- Optionally, indication of whether UE is required to perform SL reception of PSCCH and RSRP measurement for partial sensing on slots in SL DRX inactive time as *sl-PartialSensingInactiveTime.*

In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink, that is coexistence over time and frequency resources that are shared between NR sidelink and LTE sidelink:

- *sl-NRPSSCH-EUTRA-ThresRSRP-List*: this higher layer parameter provides an RSRP threshold for each combination , where is the value of the priority field in a received LTE SCI format 1, and is the priority of the transmission of the UE selecting resources; for a given invocation of this procedure, .

- *sl-NRPSFCH-EUTRA-ThresRSRP-List*: this higher layer parameter, if provided, provides an RSRP threshold for each combination , where is the value of the priority field in a received LTE SCI format 1, and is the priority of the transmission of the UE selecting resources; for a given invocation of this procedure, .

The resource reservation interval, , if provided, is converted from units of msec to units of logical slots, resulting in according to clause 8.1.7.

When the resource pool is (pre-)configured with *sl-AllowedResourceSelectionConfig* including full sensing, and full sensing is configured in the UE by higher layers, the UE performs full sensing.

When periodic reservation for another TB (sl-MultiReserveResource) is enabled for the resource pool, the resource pool is (pre-)configured with *sl-AllowedResourceSelectionConfig* including partial sensing, and partial sensing is configured by higher layer, the UE performs periodic-based partial sensing, unless other conditions state otherwise in the specification.

When a UE is triggered by higher layer to report resources for resource (re-)selection in a mode 2 Tx pool, the resource pool is (pre-)configured with *sl-AllowedResourceSelectionConfig* including partial sensing, and partial sensing is configured by higher layer, the UE performs contiguous partial sensing, unless stated otherwise in the specification.

Notation:

denotes the set of slots which belongs to the sidelink resource pool and is defined in Clause 8.

For dynamic co-channel coexistence of LTE sidelink and NR sidelink, denotes the set of subframes that may belong to an LTE sidelink resource pool as defined in clause 14.1.5 of [19, TS36.213].

The following steps are used:

1) If a number of consecutive slots is provided with a value larger than 1, the candidate multi-slot resource definition is applied. Otherwise, the candidate single-slot resource definition is applied.

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'contiguousRB', a candidate multi-slot resource is defined as a set of contiguous sub-channels starting from sub-channel in consecutive slots starting from slot , when the set of slots that are consecutive in physical slots.

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', a candidate multi-slot resourceis defined as a set of contiguous sub-channels starting from sub-channel in consecutive slots starting from slot in contiguous RB sets starting from RB set z, when the set of slots that are consecutive in physical slots. A candidate single-slot resource is defined as a set of contiguous sub-channels starting from sub-channel in slot in contiguous RB sets starting from RB set z.

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is not provided or if the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to ‘contiguousRB’, a candidate single-slot resource for transmission is defined as a set of contiguous sub-channels with sub-channel *x+j* in slot where .

The UE shall assume that any set of contiguous sub-channels or contiguous sub-channels in contiguous RB sets included in the corresponding resource pool within the time interval correspond to one candidate single-slot resource or the UE shall assume that any set of contiguous sub-channels or contiguous sub-channels in contiguous RB sets in consecutive slots included in the corresponding resource pool within the time interval correspond to one candidate multi-slot resource for UE performing full sensing. The UE shall assume that any set of contiguous sub-channels or contiguous sub-channels in contiguous RB sets included in the corresponding resource pool in a set of *Y* candidate slots within the time interval correspond to one candidate single-slot resource or the UE shall assume that any set of contiguous sub-channels or contiguous sub-channels in contiguous RB sets in consecutive slots included in the corresponding resource pool in a set of *Y* candidate slots within the time interval correspond to one candidate multi-slot resource for UE performing periodic-based partial sensing together with contiguous partial sensing and resource (re)selection triggered by periodic transmission (), or in a set of *Y'* candidate slots within the time interval correspond to one candidate single-slot resource or one candidate multi-slot resource for UE performing at least contiguous partial sensing and resource (re)selection triggered by aperiodic transmission (), where

- selection of is up to UE implementation under , where is defined in slots in Table 8.1.4-2 where is the SCS configuration of the SL BWP;

- if is shorter than the remaining packet delay budget (in slots) then is up to UE implementation subject to remaining packet delay budget (in slots); otherwise is set to the remaining packet delay budget (in slots).

- is selected by UE where .

- is selected by UE where . When the UE performs at least contiguous partial sensing and if , the UE selects a set of candidate slots with corresponding PBPS and/or CPS results (if available). If the number of candidate slots is smaller than , it is up to UE implementation to include other candidate slots.

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'contiguousRB', the UE shall exclude candidate single-slot or candidate multi-slot resources with the sub-channel with the smallest index including resource blocks of the intra-cell guardband PRBs, configured by higher layer parameter, *sl-IntraCellGuardBandsSL-List*, or determined according to the nominal intra-cell guard band and RB set pattern as specified in [8, TS 38.101-1] when higher layer parameter, *sl-IntraCellGuardBandsSL-List*, is not configured.

If *rbSetsWithConsecutiveLBTFailure* is provided, the UE shall exclude candidate single-slot resources or candidate multi-slot resources, whose associated one or more RB set(s) is included in the *rbSetsWithConsecutiveLBTFailure* parameter.

The total number of remaining candidate single-slot resources or candidate multi-slot resources is denoted by .

2) The sensing window is defined by the range of slots [), when the UE performs full sensing, where is defined above and is defined in slots in Table 8.1.4-1 where is the SCS configuration of the SL BWP. The UE shall monitor slots which belongs to a sidelink resource pool within the sensing window except for those in which its own transmissions occur. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots.

When the UE performs periodic-based partial sensing, the UE shall monitor slots at , where is a slot of the selected candidate slots and is converted to units of logical slot according to clause 8.1.7. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots.

The value of corresponds to *sl-PBPS-OccasionReservePeriodList* if (pre-)configured, otherwise, the values correspond to all periodicity from *sl-ResourceReservePeriodList.*

The UE monitors sensing occasion(s) determined by *sl-Additional-PBPS-Occasion*, as previously described, and not earlier than . For a given periodicity , the values of *k* correspond to the most recent sensing occasion earlier than if *sl-Additional-PBPS-Occasion* is not (pre-)configured, and additionally includes the value of *k* corresponding to the last periodic sensing occasion prior to the most recent one if *sl-Additional-PBPS-Occasion* is (pre-)configured. is the first slot of the selected *Y* candidate slots of PBPS.

When the UE performs periodic-based partial sensing and contiguous partial sensing with periodic reservation for another TB (*sl-MultiReserveResource*) enabled and , the contiguous partial sensing window is defined by the range of slots . *n*+*T*A is *M* consecutive logical slots earlier than slot , and *n*+*T*B is slots earlier than , where is the first slot of the selected *Y* candidate slots of PBPS, and , are in units of physical time/slots. The value of *M* is (pre-)configured with the *sl-CPS-WindowPeriodic*. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots. If *sl-CPS-WindowPeriodic* is not (pre-)configured, *M* equals to 31.

When the UE performs at least contiguous partial sensing and if , the contiguous partial sensing window is defined by the range of slots . and are both selected such that the UE has sensing results starting at least *M* consecutive logical slots before and ending at slots earlier than , where is the first slot of the selected candidate slots. The value of *M* is (pre-)configured with the *sl-CPS-WindowAperiodic*. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots. If *sl-CPS-WindowAperiodic* is not (pre-)configured, *M* equals to 31. When the minimum *M* slots for CPS cannot be guaranteed and when , it is up to UE implementation to either continue with step 3) or perform random selection.

Whether the UE is required to performs SL reception of PSCCH and RSRP measurement for partial sensing on slots in SL DRX inactive time is enabled/disabled by higher layer parameter *sl-PartialSensingInactiveTime.* When it is enabled, if UE performs periodic-based partial sensing on the slots in SL DRX inactive time for a given periodicity corresponding to , UE monitors only the default periodic sensing occasions (most recent sensing occasion) from the slots; if UE performs contiguous partial sensing on the slots in SL DRX inactive time, UE monitors a minimum of *M* slots from the slots.

2LTE1) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE uses information determined by the E-UTRA radio access within the range of LTE subframes [], where is an LTE subframe no later than LTE subframe is the LTE subframe , is the LTE subframe which overlaps slot *n*, is 1100 msec and is up to UE implementation under ; is 4+T msec, where T ≤ 4 msec. The UE shall perform the procedures in 5LTE1, 5LTE3 and 6LTE based on the information for these LTE subframes which is known to the NR radio access at the latest *T* msec prior to slot *n*.

2LTE2) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall perform the procedures in 5LTE2 based on the information determined by the E-UTRA radio access, which is known by the NR radio access at the latest *T* msec prior to slot *n*.

3) The internal parameter is set to the corresponding value of RSRP threshold indicated by the *i*-th field in *sl-Thres-RSRP-List*, where .

3LTE) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink:

- The internal parameter is set to the corresponding value of RSRP threshold indicated by the *i*-th field in *sl-NRPSSCH-EUTRA-ThresRSRP-List*, where .

- The internal parameter is set to the corresponding value of RSRP threshold indicated by the *i*-th field in *sl-NRPSFCH-EUTRA-ThresRSRP-List*, if provided, where . If *sl-NRPSFCH-EUTRA-ThresRSRP-List* is not provided then each element of is set to minus Infinity dBm.

4) The set is initialized to the set of all the remaining candidate single-slot resources or candidate multi-slot resources identified in step 1.

5) The UE shall exclude any candidate single-slot resource or , or candidate multi-slot resource or from the set if it meets all the following conditions:

- the UE has not monitored slot in Step 2.

- for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.

5LTE1) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall exclude any candidate single-slot resource from the set if all the following conditions are met:

- the resource pool overlaps with an LTE sidelink resource pool;

- the UE has not monitored LTE subframe .

- for any periodicity value allowed by the LTE higher layer parameter *restrictResourceReservationPeriod* and a hypothetical LTE SCI format 1 received in LTE subframe with '*Resource reservation'* field set to that periodicity value and indicating all subchannels of the LTE sidelink resource pool in this LTE subframe, condition c in step 6LTE would be met.

5LTE2) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall exclude any candidate single-slot resource from the set if all the following conditions are met:

- the UE has a selected sidelink grant for LTE V2X sidelink according to [19, TS 36.321] .

- the selected sidelink grant for LTE V2X sidelink determines the set of LTE resource blocks and LTE subframes which overlaps in time with for *j=*0, 1, …, ;

- the priority value associated with the selected sidelink grant for LTE V2X sidelink is lower than ; It is up to UE implementation whether or not to apply this exclusion step if the priority value associated with selected sidelink grant for LTE V2X sidelink is higher than or equal to .

5LTE3) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall exclude any candidate single-slot resource from the set if all the following conditions are met:

a) the resource pool is configured with PSFCH resources;

b) an LTE SCI format 1 is received in LTE subframe , and the '*Resource reservation'* field and '*Priority*' field in the received LTE SCI format 1 indicate the values and , respectively according to Clause 14.2.1 in [19, TS 36.213], where LTE subframes are indexed according to Clause 14.1.5 in [19, TS 36.213];

c) the LTE PSSCH-RSRP measurement according to the received LTE SCI format 1 is higher than

d) the SCI format received in LTE subframe or the same SCI format which is assumed to be received in LTE subframe(s) determines according to clause 14.1.1.4C or clause 14.2.4 in [19, TS 36.213] the set of LTE subframes which overlaps with PSFCH slots associated with for *q*=1, 2, …, *Q* and *j=*0, 1, …, where the PSFCH association is according to [6, TS 38.213]. and *Q* are determined as in condition c) of step 6LTE.

5a) If the number of candidate single-slot resources or , or the number of candidate multi-slot resource or remaining in the set is smaller than , the set is initialized to the set of all the candidate single-slot resources or candidate multi-slot resources as in step 4.

6) The UE shall exclude any candidate single-slot resource or , or candidate multi-slot resource or from the set if it meets all the following conditions:

a) the UE receives an SCI format 1-A in slot , and '*Resource reservation period'* field, if present, and '*Priority*' field in the received SCI format 1-A indicate the values and , respectively according to Clause 16.4 in [6, TS 38.213];

b) the RSRP measurement performed, according to clause 8.4.2.1 for the received SCI format 1-A, is higher than

c) the SCI format received in slot or the same SCI format which, if and only if the '*Resource reservation period*' field is present in the received SCI format 1-A, is assumed to be received in slot(s) determines according to clause 8.1.5 the set of resource blocks and slots which overlaps with or for *q*=1, 2, …, *Q* and *j=*0, 1, …, . Here, is converted to units of logical slots according to clause 8.1.7, if and , where if the UE is configured with full sensing by its higher layer, if slot *n* belongs to the set , otherwise slot is the first slot after slot *n* belonging to the set ; If UE is configured with partial sensing by its higher layer, if slot belongs to the set , otherwise, slot is the first slot after slot belonging to the set . Otherwise . If the UE is configured with full sensing by its higher layer, is set to selection window size *T2* converted to units of msec. If UE is configured with partial sensing by its higher layer, shall be converted to milliseconds, where slot is the last slot of the or candidate slots. The slot is the first slot of the selected/remaining set of or candidate slots.

6LTE) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall exclude any candidate single-slot resource from the set if all the following conditions are met:

a) an LTE SCI format 1 is received in LTE subframe , and the '*Resource reservation'* field and '*Priority*' field in the received LTE SCI format 1 indicate the values and , respectively according to Clause 14.2.1 in [19, TS 36.213], where LTE subframes are indexed according to Clause 14.1.5 in [19, TS 36.213];

b) the LTE PSSCH-RSRP measurement according to the received LTE SCI format 1 is higher than

c) the SCI format received in LTE subframe or the same SCI format which is assumed to be received in LTE subframe(s) determines according to clause 14.1.1.4C or clause 14.2.4 in [19, TS 36.213] the set of LTE resource blocks and LTE subframes which overlaps with for *q*=1, 2, …, *Q* and *j=*0, 1, …, . Here, is with determined according to Table 14.1.1-1 in [19, TS 36.213], if and , where if subframe belongs to the set , otherwise subframe is the first subframe after subframe belonging to the set ; Otherwise . is set to selection window size *T2* converted to units of msec.

6a) This step is executed only if the procedure in clause 8.1.4A is triggered.

6b) This step is executed only if the procedure in clause 8.1.4C is triggered.

7) If the number of candidate single-slot resources or candidate multi-slot resources remaining in the set is smaller than , then and , if set, is increased by 3 dB for each priority value and the procedure continues with step 4.

7a) If sidelink DRX active time of RX UE is provided by the higher layer and there is no candidate single-slot or multi-slot resource remained within the sidelink DRX active time in the set , the UE based on its implementation additionally selects and includes at least one candidate single-slot resource or at least one candidate multi-slot resource within the sidelink DRX active time in the set .

The UE shall report set to higher layers.

If a resource from the set is not a member of , then the UE shall report re-evaluation of the resource to higher layers.

If a resource from the set meets the conditions below then the UE shall report pre-emption of the resource to higher layers.

- is not a member of , and

- meets the conditions for exclusion in step 6, with set to the final threshold after executing steps 1)-7), i.e. including all necessary increments for reaching , or for exclusion in step 6LTE, with set to the final threshold after executing steps 1-7, i.e. including all necessary increments for reaching , or for exclusion in step 5LTE3, and

- the associated priority satisfies one of the following conditions:

- *sl-PreemptionEnable* is provided and is equal to 'enabled' and

- *sl-PreemptionEnable* is provided and is not equal to 'enabled', and and

Table 8.1.4-1: depending on sub-carrier spacing

|  |  |
| --- | --- |
|  | **[slots]** |
| 0 | 1 |
| 1 | 1 |
| 2 | 2 |
| 3 | 4 |

Table 8.1.4-2: depending on sub-carrier spacing

|  |  |
| --- | --- |
|  | **[slots]** |
| 0 | 3 |
| 1 | 5 |
| 2 | 9 |
| 3 | 17 |

When the UE performs periodic-based partial sensing and contiguous partial sensing, and when the UE is triggered to perform re-evaluation and/or pre-emption checking, and if ,

- During the *q*th reservation period (*q*=0,1,2,…, *Cresel*-1), candidate resource set (*SA*) is initialized to the remaining *Y* candidate slots starting from slot and ending at the last slot of the *Y* candidate slots, where the slot indices of the remaining *Y* candidate slots are equal to , where is a slot index of *Y* candidate slots used in the initial resource (re)selection.

- is the first candidate slot starting from slot *n+T3*.

- The UE performs PBPS for the remaining *Y* candidate slots according to except for those in which its own transmissions occur, whereis a slot belonging to the remaining *Y* candidate slots, and *k* and *Preserve* are the same as resource (re)selection, where the values of *k* correspond to the most recent sensing occasion earlier than if *sl-Additional-PBPS-Occasion* is not (pre-)configured, and additionally includes the value of *k* corresponding to the last periodic sensing occasion prior to the most recent one if *sl-Additional-PBPS-Occasion* is (pre-)configured.

- The UE performs CPS starting from *M* logical slots earlier than to slots earlier than except for those in which its own transmissions occur.

- By default, *M* is 31 unless (pre-)configured with another value by *sl-CPS-WindowPeriodic*.

When the UE is triggered to perform re-evaluation and/or pre-emption checking, performs at least contiguous partial sensing, and if ,

- Candidate resource set (*SA*) is initialized to the remaining *Y'* candidate slots starting from slot and ending at the last slot of the *Y'* candidate slots, where is the first candidate slot starting from slot *n+T3*.

- It is up to UE implementation that UE may perform PBPS for periodic sensing occasions after the resource (re)selection when higher layer parameter *sl-MultiReserveResource* is enabled.

- UE performs CPS starting from at least *M* consecutive logical slots earlier than to slots earlier than except for those in which its own transmissions occur.

- For minimum size *M* of the contiguous partial sensing window , by default, *M* is 31 unless (pre-)configured with another value, by *sl-CPS-WindowAperiodic*.

When the minimum *M* slots for CPS cannot be guaranteed, UE senses in all available slots starting from the resource (re)selection trigger slot of the same TB to slots earlier than . The UE re-evaluation and pre-emption checking is based on all available sensing results after .

<omitted text>

### 8.1.4A UE procedure for determining a set of preferred or non-preferred resources for another UE's transmission

When this procedure is triggered, the following parameters are provided by the higher layer:

- the resource pool from which the preferred or non-preferred resources are to be determined;

- the resource selection window within which the preferred or non-preferred resources are to be determined;

- the resource set type (either preferred or non-preferred resource set);

- if the resource set type indicates preferred set, then the higher layer additionally provides the following parameters:

- L1 priority, ;

- the number of sub-channels to be used for the PSSCH/PSCCH transmission in a slot, ;

- If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', the number of used RB sets for one PSCCH/PSSCH transmission, *LRBset*;

- the resource reservation period, , if present.

The value of is determined by the UE according to clause 8.1.5.

When this procedure is triggered by another UE's explicit request, the fields in the request are interpreted as follows:

- The field 'Resource selection window location' is the concatenation of the starting time location and the ending time location of the resource selection window. The starting and ending time locations of the resource selection window are each encoded in the same way as the reference slot as described in clause 8.1.5A.

- The field 'Resource reservation period' is encoded in the same way as the field of the same name in SCI format 1-A.

When determining a preferred resource set, the UE applies the procedure described in clause 8.1.4 with the above parameters and the following modifications:

- Step 6a) The UE excludes candidate single-slot resource(s) belonging to slot(s) where the UE does not expect to perform SL reception of a TB due to half-duplex operation, if all the following conditions are met:

- the UE is a destination UE of the TB for whose transmission the preferred resource set is being determined;

- the higher layer parameter *sl-Condition1-A-2* is not set to 'Disabled'.

When determining a non-preferred resource set, the UE considers any resource(s) within the resource selection window, if indicated by a received explicit request, and satisfying at least one of the following conditions as non-preferred resource(s):

- resource(s) indicated by a received SCI format 1-A, satisfying at least one of the following criteria:

- the RSRP measurement performed, according to clause 8.4.2.1, for the received SCI format 1-A, is higher than where is the value of the priority field in the received SCI format 1-A. The internal parameter is set to the corresponding value of RSRP threshold indicated by the *k*-th field in *sl-ThresholdRSRP-Condition1-B-1-Option1List*, where .

- the UE is a destination UE of a TB associated with the received SCI format 1-A and the RSRP measurement performed, according to clause 8.4.2.1 for the received SCI format 1-A, is lower than where is the value of the priority field in the received SCI format 1-A. The internal parameter is set to the corresponding value of RSRP threshold indicated by the *k*-th field in *sl-ThresholdRSRP-Condition1-B-1-Option2List*, where .

- resources(s) in slot(s) in which the UE does not expect to perform SL reception due to half duplex operation, if the UE is a destination UE of a TB for whose transmission the non-preferred resource set is being determined.

<omitted text>

### 8.1.5 UE procedure for determining slots and resource blocks for PSSCH transmission associated with an SCI format 1-A

The set of slots and resource blocks for PSSCH transmission is determined by the resource used for the PSCCH transmission containing the associated SCI format 1-A, and fields '*Frequency resource assignment*', '*Time resource assignment*' of the associated SCI format 1-A as described below.

'*Time resource assignment*' carries logical slot offset indication of N = 1 or 2 actual resources when *sl-MaxNumPerReserve* is 2, and N = 1 or 2 or 3 actual resources when *sl-MaxNumPerReserve* is 3, in a form of time RIV (TRIV) field which is determined as follows:

if

elseif

else

if

else

end if

end if

where the first resource is in the slot where SCI format 1-A was received, and denotes i-th resource time offset in logical slots of a resource pool with respect to the first resource where for N = 2, ; and for N = 3, , .

The starting sub-channel of the first resource is determined according to clause 8.1.2.2. The number of contiguously allocated sub-channels for each of the N resources and the starting sub-channel indexes of resources indicated by the received SCI format 1-A, except the resource in the slot where SCI format 1-A was received, are determined from "Frequency resource assignment" which is equal to a frequency RIV (FRIV) where.

If *sl-MaxNumPerReserve* is 2 then

If *sl-MaxNumPerReserve* is3 then

where

- denotes the starting sub-channel index for the second resource

- denotes the starting sub-channel index for the third resource

- is the number of sub-channels in a resource pool, or if the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', the number of sub-channels in each RB set, provided according to the higher layer parameter *sl-NumSubchannel*

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', the applied interlace index(s) in different RB sets are the same.

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', the starting RB set of the first resource is determined according to the clause 8.1.2.2. The number of contiguously allocated RB sets for each of the N resources LRBset≥1 and the starting RB set indexes of resources indicated by the received SCI format 1-A, except the resource in the slot where SCI format 1-A was received, are determined from "Frequency resource assignment" which is equal to a frequency RIV (FRIV), where

If sl-MaxNumPerReserve is 2 then

If sl-MaxNumPerReserve is 3 then

where

- denotes the starting RB set index for the second resource,

- denotes the starting RB set index for the third resource,

- is the number of RB sets in a resource pool,

- is the number of RB sets for each of the indicated resources,

- for FRIV indication, within the resource pool, RB sets are numbered in increasing order from 0 to from lowest frequency location to highest frequency location.

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', the resource is determined by an intersection of the interlaces corresponding to the indicated sub-channel(s) and the union of the indicated set of RB sets and intra-cell guard bands between the indicated RB sets, if any.

If TRIV indicates *N* < *sl-MaxNumPerReserve*,

- if the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to 'interlaceRB', the starting sub-channel indexes and the starting RB set indexes corresponding to *sl-MaxNumPerReserve* minus *N* last resources are not used.

- otherwise, the starting sub-channel indexes corresponding to *sl-MaxNumPerReserve* minus *N* last resources are not used.

The number of slots in one set of the time and frequency resources for transmission opportunities of PSSCH is given by where = 10\*SL\_RESOURCE\_RESELECTION\_COUNTER [10, TS 38.321] if configured else is set to 1.

If a set of sub-channels in slot is determined as the time and frequency resource for PSSCH transmission corresponding to the selected sidelink grant (described in [10, TS 38.321]), the same set of sub-channels in slots are also determined for PSSCH transmissions corresponding to the same sidelink grant where *j=*1, 2,*…,* , , if provided, is converted from units of msec to units of logical slots, resulting in according to clause 8.1.7, and is determined by Clause 8. Here, is the resource reservation interval indicated by higher layers.

### 8.1.5A UE procedure for determining slots and resource blocks indicated by a preferred or non-preferred resource set

The set of slots and resource blocks indicated by a set of preferred or non-preferred resource(s) is determined as described below.

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is not provided, or it is set to ‘contiguousRB', the set of preferred or non-preferred resources , is indicated by a reference slot and tuples , indicated by the 'resource combination' field, where for each tuple is indicated by the 9 MSBs, followed by and (if present).

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB', the set of preferred or non-preferred resources , is indicated by a reference slot and tuples , indicated by the 'resource combination' field, where for each tuple is indicated by the 9 MSBs, followed by , and (if present).

The reference slot is indicated by the 'Reference slot location' field as a combination of DFN index and slot index [5, TS 38.212], with the 10 MSBs indicating the DFN index. , and if any are interpreted according to clause 8.1.5, with the following modifications:

- the value of *sl-MaxNumPerReserve* is fixed to 3.

- "slot where SCI format 1-A was received" is replaced by slot indicated as the first resource location of a .

- the first resource location of each for is indicated by a slot offset in logical slots with respect to the reference slot ; the slot offset is indicated by the 'first resource location' field; the first resource location of is at slot offset 0 with respect to the reference slot.

- "the received SCI format 1-A, except the resource in the slot where SCI format 1-A was received" is replaced by "each tuple".

- the starting sub-channel of the first resource of each tuple is separately indicated.

- if the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB', the starting RB set of the first resource of each tuple is separately indicated.

The starting sub-channel of the first resource of each tuple is indicated by the 'Lowest subChannel indices' field. The starting RB set of the first resource of each tuple, if any, is indicated by the 'Lowest RB set indices' field. The resource reservation period is encoded as in SCI format 1-A.

If the set is indicated by an SCI format 2-C, the number of tuples is .

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is not provided, or it is set to ‘contiguousRB', a UE forms the union of the subsets indicated by each tuple to obtain the set .

If the higher layer parameter *sl-TransmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB', a UE forms the union of the subsets indicated by each tuple to obtain the set .

<omitted text>

### 8.2.4 SL PRS transmission procedure

The following parameters for SL PRS transmission are associated with each SL PRS resource:

- SL PRS resource ID provided by *sl-PRS-ResourceID* indicates an identity of a SL PRS resource. The SL PRS resource is identified by the SL PRS resource ID that is unique within a slot of a dedicated SL PRS resource pool. For a shared SL PRS resource pool, a SL PRS resource is uniquely identified by a combination of the SL PRS resource ID, SL PRS frequency domain allocation within a slot indicated by “frequency resource assignment” field in the associated SCI format 1-A, and a starting symbol within the slot as determined by clause 8.2.4.1.1.

- *sl-CombSize* and *sl-PRS-comb-offset* indicates a comb offset and a comb size of the SL PRS resource in a dedicated SL PRS resource pool. *sl-PRS-CombSizeN-AndReOffset* indicates a comb offset and a comb size of the SL PRS resource in a shared SL PRS resource pool.

- *sl-PRS-starting-symbol* and *sl-NumberOfSymbols* indicates the starting symbol index and the number of symbols of the SL PRS resource within a slot in a dedicated SL PRS resource pool. *mNumberOfSymbols* indicates the number of symbols of the SL PRS resource within a slot in a shared SL PRS resource pool.

For a dedicated SL PRS resource pool, SL PRS resources for a same combination of number of SL PRS symbols and comb size can be mapped to a set of consecutive symbols in a slot. SL PRS resources for different combinations shall be mapped to non-overlapping sets of consecutive symbols in a slot. Up to four non-overlapping sets of consecutive symbols within a slot can be used to map SL PRS resources for same or different combinations, where the case of four non-overlapping sets of consecutive symbols only applies when for all the combinations.

In the case of dedicated SL PRS resource pool, that PSCCH carries the SCI format 1-B associated with the SL PRS transmission.

The UE may report the association information between the already transmitted SL PRSs of SL PRS resources and UE Tx ARP ID. The association information includes ARP ID(s) indicated by *sl-POS-ARP-ID-Tx*, SL PRS transmission timestamp(s) indicated by *sl-TimeStamp*, and optional SL PRS resource ID(s) indicated by *sl-PRS-ResourceID*.

<omitted text>

#### 8.2.4.2A UE procedure for determining slots and SL PRS resource(s) associated with an SCI format 1-B in a dedicated SL PRS resource pool

The set of slots and SL PRS resources for SL PRS transmission is determined by the PSCCH containing the associated SCI format 1-B, and fields '*Resource ID indication*', '*Time resource assignment*' of the associated SCI format 1-B as described below.

The set of slots is determined as in clause 8.1.5, with the following modifications:

- "SCI format 1-A" is replaced by "SCI format 1-B",

- "*sl-MaxNumPerReserve*" is replaced by "*sl-MaxNumPerReserveDedicatedSL-PRS-RP*".

The first SL PRS resource is determined according to the sub-channel used for the PSCCH transmission containing the associated SCI format 1-B, where the index of the sub-channel in the resource pool is identical to the index of the SL PRS resource provided by *sl-PRS-ResourceID*.

The second SL-PRS and third SL PRS resource, if reserved by SCI format 1-B, are determined from " Resource ID indication" which is equal to a PRS Resource ID value (PRIV) where,

If *sl-MaxNumPerReserveDedicatedSL-PRS-RP* is 2 then

If *sl-MaxNumPerReserveDedicatedSL-PRS-RP* is 3 then

Where

- denotes the SL PRS resource ID for the second resource

- denotes the SL PRS resource ID for the third resource

- is the number of SL-PRS resources (pre-)configured in a slot of a resource pool.

If TRIV determined according to clause 8.1.5 indicates *N* < *sl-MaxNumPerReserveDedicatedSL-PRS-RP*, the SL PRS resource indices corresponding to *sl-MaxNumPerReserveDedicatedSL-PRS-RP* minus N last resources are not used.

The number of slots in one set of the time and frequency resources for transmission opportunities of SL PRS is given by where = 10\*SL\_RESOURCE\_RESELECTION\_COUNTER [10, TS 38.321] if configured else is set to 1.

If a SL PRS resource in slot is determined as the time and frequency resource for SL PRS transmission corresponding to the selected sidelink grant (described in [10, TS 38.321]), the same SL PRS resource in slots is also determined for SL PRS transmissions corresponding to the same sidelink grant where *j=*1, 2,*…,* , , if provided, is converted from units of msec to units of logical slots, resulting in according to clause 8.1.7, and is determined by Clause 8. Here, is the resource reservation interval indicated by higher layers.

#### 8.2.4.3 Sidelink congestion control in a dedicated SL PRS resource pool in sidelink resource allocation mode 2

When transmitting SL-PRS in a dedicated SL PRS resource pool the UE shall perform sidelink congestion control as specified in clause 8.1.6, with the following modification(s):

- "PSSCH" is replaced by "SL PRS"

- "*sl-CR-Limit*" is replaced by "*sl-PRS-CR-Limit*"

- the congestion control processing time *N* is based on µ of Table 8.1.6-1, Table 8.1.6-2 and Table 8.2.4.3-1 for UE processing capability 1, 2 and 3 respectively, where µ corresponds to the subcarrier spacing with which the SL PRS is to be transmitted. A UE shall only apply a single processing time capability in SL-PRS congestion control in dedicated SL PRS resource pool.

Table 8.2.4.3-1: Congestion control processing time for processing timing capability 3

|  |  |
| --- | --- |
| **µ** | Congestion control processing time *N* [slots] |
| 0 | 3 |
| 1 | 6 |
| 2 | 12 |
| 3 | 24 |

## 8.3 UE procedure for receiving the physical sidelink shared channel

For sidelink resource allocation mode 1, a UE upon detection of SCI format 1-A on PSCCH can decode PSSCH according to the detected SCI formats 2-A, 2-B, 2-C and 2-D, and associated PSSCH resource configuration configured by higher layers. The UE is not required to decode more than one PSCCH at each PSCCH resource candidate.

For sidelink resource allocation mode 2, a UE upon detection of SCI format 1-A on PSCCH can decode PSSCH according to the detected SCI formats 2-A, 2-B, 2-C and 2-D, and associated PSSCH resource configuration configured by higher layers. The UE is not required to decode more than one PSCCH at each PSCCH resource candidate.

A UE is required to decode neither the corresponding SCI formats 2-A, 2-B, 2-C, 2-D nor the PSSCH associated with an SCI format 1-A if the SCI format 1-A indicates an MCS table that the UE does not support.

In any slot without PSFCH symbols, the UE attempts, subject to UE capability, to decode PSSCH transmission starting from the second candidate starting symbol provided by *sl-StartingSymbolSecond*, if *sl-StartingSymbolFirst* and *sl-StartingSymbolSecond* are provided.

<omitted text>