**3GPP TSG-RAN WG1 Meeting #121**

**St Julian’s, Malta, May 19th – 23th, 2025**

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| *CR-Form-v12.3* |
| **Draft CHANGE REQUEST** |
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|  | **38.214** | **CR** |  | **rev** |  | **Current version:** |  |  |
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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 |  | Radio Access Network |  | Core Network |  |

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| ***Title:***  |  |
|  |  |
| ***Source to WG:*** | Nokia |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_FeMIMO  |  | ***Date:*** | 2025-05-29 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | In clauses 5.2.1.2, 5.2.1.4.1, 5.2.1.4.2, 5.2.1.4.3, there are several inconsistencies with respect to the higher layer parameter names used for *groupBasedBeamReporting*.In clause 5.1.2.1, the definition and physical meaning of S0 are inconsistent. S and S0 are misdefined with each other. |
|  |  |
| ***Summary of change:*** | In clauses 5.2.1.2, 5.2.1.4.1, 5.2.1.4.2, 5.2.1.4.3, fixed several inconsistencies with respect to the higher layer parameter names used for groupBasedBeamReporting.In clause 5.1.2.1, revised the second half of the first sub-bullet in the third bullet and clarify the definition of S0 and S, respectively. |
|  |  |
| ***Consequences if not approved:*** | Higher layer parameter names inconsistency with TS 38.331.In clause 5.1.2.1, the content of the clause is not consistent with itself on the physical meaning and definition of the S0 and S. The starting symbol S of the PDSCH scheduled by two PDCCH candidates from two respective search space sets will be misdetermined. |
|  |  |
| ***Clauses affected:*** | 5.1.2.1, 5.2.1.2, 5.2.1.4.1, 5.2.1.4.2, 5.2.1.4.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

<ommited text>

#### 5.1.2.1 Resource allocation in time domain

When the UE is scheduled to receive PDSCH by a DCI, the *Time domain resource assignment* field value *m* of the DCI provides a row index *m* + 1 to an allocation table. The determination of the used resource allocation table is defined in Clause 5.1.2.1.1. The indexed row defines the slot offset *K0*, the start and length indicator *SLIV*, or directly the start symbol *S* and the allocation length *L*, and the PDSCH mapping type to be assumed in the PDSCH reception.

Given the parameter values of the indexed row:

- The slot allocated for the PDSCH is *Ks*, where , if UE is configured with ca-SlotOffset for at least one of the scheduled and scheduling cell, and *Ks* = , otherwise, and where *n* is the slot with the scheduling DCI, and *K0* is based on the numerology of PDSCH, and  and are the subcarrier spacing configurations for PDSCH and PDCCH, respectively, and

- $N\_{slot, offset, PDCCH}^{CA}$ and $μ\_{offset,PDCCH}$ are the $N\_{slot, offset}^{CA}$ and the, respectively, which are determined by higher-layer configured ca-SlotOffset, for the cell receiving the PDCCH respectively,$ N\_{slot, offset, PDSCH}^{CA}$ and $μ\_{offset,PDSCH}$ are the $N\_{slot, offset}^{CA}$ and the, respectively, which are determined by higher-layer configured ca-SlotOffset for the cell receiving the PDSCH, as defined in clause 4.5 of [4, TS 38.211].

- The reference point *S0* for starting symbol *S* is defined as:

- if configured with *referenceOfSLIVDCI-1-2*, and when receiving PDSCH scheduled by DCI format 1\_2 with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI with *K0=0*, and PDSCH mapping Type B, the starting symbol *S* is relative to the starting symbol *S0* of the PDCCH monitoring occasion where DCI format 1\_2 is detected; 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 candidate that starts later in time is used for the purpose of determining the starting symbol *S*;

- otherwise, the starting symbol *S* is relative to the start of the slot using *S0=0.*

- The number of consecutive symbols *L* counting from the starting symbol *S* allocated for the PDSCH are determined from the start and length indicator *SLIV*:

if  then



else



where, and

- the PDSCH mapping type is set to Type A or Type B as defined in Clause 7.4.1.1.2 of [4, TS 38.211].

The UE shall consider the *S* and *L* combinations defined in table 5.1.2.1-1 satisfying  for normal cyclic prefix and  for extended cyclic prefix as valid PDSCH allocations:

Table 5.1.2.1-1: Valid *S* and *L* combinations

|  |  |  |
| --- | --- | --- |
| PDSCH mapping type | Normal cyclic prefix | Extended cyclic prefix |
| *S* | *L* | *S+L* | *S* | *L* | *S+L* |
| Type A | {0,1,2,3}(Note 1) | {3,…,14} | {3,…,14} | {0,1,2,3}(Note 1) | {3,…,12} | {3,…,12} |
| Type B | {0,…,12} | {2,…,13} | {2,…,14} | {0,…,10} | {2,4,6} | {2,…,12} |
| Note 1: S = 3 is applicable only if *dmrs-TypeA-Position* = 3 |

When configured with SCS m = 5 or m = 6, the UE does not expect to be scheduled with more than one unicast PDSCH in a slot, by a single DCI scheduling multiple PDSCHs or by multiple DCIs, where multiple DCIs are not associated with CORESETs having different *coresetpoolIndex*.

When receiving PDSCH scheduled by DCI format 1\_1 or 1\_2 in PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, or CS-RNTI with NDI=1, if the UE is configured with *pdsch-AggregationFactor* in *pdsch-config*, the same symbol allocation is applied across the *pdsch-AggregationFactor* consecutive slots. When receiving PDSCH scheduled by DCI format 1\_1 or 1\_2 in PDCCH with CRC scrambled by CS-RNTI with NDI=0, or PDSCH scheduled without corresponding PDCCH transmission using *sps-Config* and activated by DCI format 1\_1 or 1\_2, the same symbol allocation is applied across the *pdsch-AggregationFactor*, in *sps-Config* if configured, or across the *pdsch-AggregationFactor* in *pdsch-config* otherwise, consecutive slots. The UE may expect that the TB is repeated within each symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots and the PDSCH is limited to a single transmission layer. For PDSCH scheduled by DCI format 1\_1 or 1\_2 in PDCCH with CRC scrambled by CS-RNTI with NDI=0, or PDSCH scheduled without corresponding PDCCH transmission using *sps-Config* and activated by DCI format 1\_1 or 1\_2, the UE is not expected to be configured with the time duration for the reception of *pdsch-AggregationFactor* repetitions, in *sps-Config* if configured, or across the *pdsch-AggregationFactor* in *pdsch-config* otherwise, larger than the time duration derived by the periodicity P obtained from the corresponding *sps-Config*. The redundancy version to be applied on the *n*th transmission occasion of the TB, where *n* = 0, 1, …*pdsch-AggregationFactor* -1, is determined according to table 5.1.2.1-2 and "*rvid* indicated by the DCI scheduling the PDSCH" in table 5.1.2.1-2 is assumed to be 0 for PDSCH scheduled without corresponding PDCCH transmission using *sps-Config* and activated by DCI format 1\_1 or 1\_2.

When receiving PDSCH scheduled by DCI format 4\_1, or 4\_2 in PDCCH with CRC scrambled by G-RNTI for multicast, if the UE is configured with *pdsch-AggregationFactor* in the *MBS-RNTI-SpecificConfig* associated withthe corresponding G-RNTI for multicast, the same symbol allocation is applied across the *pdsch-AggregationFactor* consecutive slots. When receiving PDSCH scheduled by DCI format 4\_1 or 4\_2 for multicast reception in PDCCH with CRC scrambled by G-CS-RNTI, or PDSCH without corresponding PDCCH transmission using associated *SPS-Config* and activated by the DCI format 4\_1 or 4\_2 in PDCCH with CRC scrambled by G-CS-RNTI, the same symbol allocation is applied across the *pdsch-AggregationFactor* in associated *SPS-Config* if configured, or across *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* in *pdsch-ConfigMulticast* if provided by an entry indicated by the 'Time domain resource assignment' field of the activating DCI, or 1 otherwise, consecutive slots. The redundancy version to be applied on the *n*th transmission occasion of the TB, where *n* = 0, 1, …*pdsch-AggregationFactor* -1, is determined according to table 5.1.2.1-2 and "rvid indicated by the DCI scheduling the PDSCH" in table 5.1.2.1-2 is assumed to be 0 for PDSCH scheduled without corresponding PDCCH transmission using *SPS-Config* and activated by DCI format 4\_1 or 4\_2. When receiving PDSCH scheduled by DCI format 4\_0 in PDCCH with CRC scrambled by G-RNTI for broadcast, if the UE is configured with *pdsch-AggregationFactor* in the *PDSCH-ConfigPTM*, the same symbol allocation is applied across the *pdsch-AggregationFactor* consecutive slots, and the redundancy version to be applied on the *n*th transmission occasion of the TB, where *n* = 0, 1, …*pdsch-AggregationFactor* -1, is determined according to table 5.1.2.1-2.

When receiving PDSCH scheduled by DCI in PDCCH with CRC scrambled by G-CS-RNTI for multicast reception or G-RNTI, if the DCI field 'Time domain resource assignment' indicates an entry which contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* in the *pdsch-ConfigMulticast* or *PDSCH-Config-Broadcast*,the same SLIV is applied for all PDSCH transmission occasions across the *repetitionNumber* consecutive slots. When receiving PDSCH scheduled without corresponding PDCCH transmission using associated *SPS-Config* and activated by DCI in PDCCH with CRC scrambled by G-CS-RNTI for multicast reception, if the DCI field 'Time domain resource assignment' of the activating DCI indicates an entry which contains *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* in the *pdsch-ConfigMulticast*,the same SLIV is applied for all PDSCH transmission occasions across the *repetitionNumber* consecutive slots. The redundancy version to be applied on the *n*th transmission occasion of the TB, where *n* = 0, 1, …*repetitionNumber* -1, is determined according to table 5.1.2.1-2 and "*rvid* indicated by the DCI scheduling the PDSCH" in table 5.1.2.1-2 is assumed to be 0 for PDSCH scheduled without corresponding PDCCH transmission using *sps-Config* and activated by DCI format with CRC scrambled by G-CS-RNTI.

If a UE is configured with higher layer parameter *repetitionNumber* or if the UE is configured by *repetitionScheme* set to one of 'fdmSchemeA', 'fdmSchemeB' and 'tdmSchemeA', the UE does not expect to be configured with *pdsch-AggregationFactor* for the same PDSCH.

If a UE is configured with *pdsch-TimeDomainAllocationListForMultiPDSCH* in which one or more rows contain multiple SLIVs for PDSCH, the UE does not expect to be configured with higher layer parameter *repetitionNumber* in *pdsch-TimeDomainAllocationListForMultiPDSCH*.

If a UE is configured with *pdsch-TimeDomainAllocationListForMultiPDSCH* in which one or more rows contain multiple SLIVs for PDSCH on a DL BWP of a serving cell, the UE does not apply *pdsch-AggregationFactor* in *PDSCH-config*, if configured, to DCI format 1\_1 on the DL BWP of the serving cell.

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, when any two DL DCIs end in the same symbol and at least one of the DCIs schedules multiple PDSCHs, the UE does not expect that the scheduled PDSCH(s) by the two DCIs have overlapping spans, where the span associated with a DCI is defined from the beginning of the first scheduled PDSCH or up to the end of the last scheduled PDSCH.

Table 5.1.2.1-2: Applied redundancy version when *pdsch-AggregationFactor* or *repetitionNumber* is present

|  |  |
| --- | --- |
| *rvid* indicated by the DCI scheduling the PDSCH | *rvid* to be applied to *n*th transmission occasion |
| *n* mod 4 = 0 | *n* mod 4 = 1 | *n* mod 4 = 2 | *n* mod 4 = 3 |
| 0 | 0 | 2 | 3 | 1 |
| 2 | 2 | 3 | 1 | 0 |
| 3 | 3 | 1 | 0 | 2 |
| 1 | 1 | 0 | 2 | 3 |

A PDSCH reception in a slot of a multi-slot PDSCH reception is omitted according to the conditions in clause 11.1 and clause 17.2 of [6, TS38.213].

The UE is not expected to receive a PDSCH with mapping type A in a slot, if the PDCCH scheduling the PDSCH was received in the same slot and was not contained within the first three symbols of the slot. 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], if the two PDCCH candidates scheduling the PDSCH with mapping Type A were received in the same slot as the PDSCH, both PDCCH candidates are expected to be contained within the first three symbols of the slot.

The UE is not expected to receive a PDSCH with mapping type B in a slot, if the first symbol of the PDCCH scheduling the PDSCH was received in a later symbol than the first symbol indicated in the PDSCH time domain resource allocation. 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 UE is not expected to receive a PDSCH with mapping type B in a slot, if the first symbol of the PDCCH candidate that starts later in time scheduling the PDSCH was received in a later symbol than the first symbol indicated in the PDSCH time domain resource allocation.

When the UE is configured with *minimumSchedulingOffsetK0* in an active DL BWP it applies a minimum scheduling offset restriction indicated by the 'Minimum applicable scheduling offset indicator'field in DCI format 1\_1 or DCI format 0\_1 if the same field is available. When the UE is configured with *minimumSchedulingOffsetK0* in an active DL BWP and it has not received 'Minimum applicable scheduling offset indicator' field in DCI format 0\_1 or 1\_1, the UE shall apply a minimum scheduling offset restriction indicated based on 'Minimum applicable scheduling offset indicator' value '0'. When the minimum scheduling offset restriction is applied the UE is not expected to be scheduled with a DCI in slot *n* to receive a PDSCH scheduled with C-RNTI, CS-RNTI or MCS-C-RNTI with *K*0 smaller than $ \left⌈K\_{0min}⋅\frac{2^{μ^{'}}}{2^{μ}}\right⌉$, where *K*0minand $μ$ are the applied minimum scheduling offset restriction and the numerology of the active DL BWP of the scheduled cell when receiving the DCI in slot *n,* respectively, and $μ^{'}$ is the numerology of the new active DL BWP in case of active DL BWP change in the scheduled cell and is equal to $μ$, otherwise. The minimum scheduling offset restriction is not applied when PDSCH transmission is scheduled with C-RNTI, CS-RNTI or MCS-C-RNTI in common search space associated with CORESET0 and default PDSCH time domain resource allocation is used, in the search space set provided by *recoverySearchSpaceId* when monitoring PDCCH as described in [6, TS 38.213] or when PDSCH transmission is scheduled with SI-RNTI, MSGB-RNTI or RA-RNTI. The application delay of the change of the minimum scheduling offset restriction is determined in Clause 5.3.1.

The UE is not expected to be configured with *referenceOfSLIVDCI-1-2* for serving cells configured for cross-carrier scheduling with a scheduling cell of a different downlink SCS configuration.

When a UE is configured by the higher layer parameter *repetitionScheme* set to 'tdmSchemeA*'* and indicated DM-RS port(s) within one CDM group in the DCI field '*Antenna Port(s)'*, the number of PDSCH transmission occasions is derived by the number of TCI states indicated by the DCI field *'Transmission Configuration Indication'* of the scheduling DCI*.*

- If two TCI states are indicated by the DCI field '*Transmission Configuration Indication*', the UE is expected to receive two PDSCH transmission occasions, where the first TCI state is applied to the first PDSCH transmission occasion and resource allocation in time domain for the first PDSCH transmission occasion follows Clause 5.1.2.1. The second TCI state is applied to the second PDSCH transmission occasion, and the second PDSCH transmission occasion shall have the same number of symbols as the first PDSCH transmission occasion. If the UE is configured by the higher layers with a value$ \overbar{K}$ in *StartingSymbolOffsetK*, it shall determine that the first symbol of the second PDSCH transmission occasion starts after $\overbar{K}$ symbols from the last symbol of the first PDSCH transmission occasion. If the value$ \overbar{K}$ is not configured via the higher layer parameter *StartingSymbolOffsetK*, $\overbar{K}$ = 0 shall be assumed by the UE. The UE is not expected to receive more than two PDSCH transmission layers for each PDSCH transmission occasion. For two PDSCH transmission occasions, the redundancy version to be applied is derived according to Table 5.1.2.1-2, where $n=0, 1$ applied respectively to the first and second TCI state. The UE expects the PDSCH mapping type indicated by DCI field '*Time domain resource assignment*' to be mapping type B, and the indicated PDSCH mapping type is applied to both PDSCH transmission occasions.

- Otherwise, the UE is expected to receive a single PDSCH transmission occasion, and the resource allocation in the time domain follows Clause 5.1.2.1.

When a UE configured by the higher layer parameter *PDSCH-config* that indicates at least one entry contains*repetitionNumber* in *PDSCH-TimeDomainResourceAllocation*,

- If two TCI states are indicated by the DCI field 'Transmission Configuration Indication' 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)', the same SLIV is applied for all PDSCH transmission occasions across the *repetitionNumber* consecutive slots, the first TCI state is applied to the first PDSCH transmission occasion and resource allocation in time domain for the first PDSCH transmission occasion follows Clause 5.1.2.1.

 When the value indicated by *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* equals to two, the second TCI state is applied to the second PDSCH transmission occasion. When the value indicated by *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation* is larger than two, the UE may be further configured to enable *cyclicMapping* or *sequenticalMapping* in *tciMapping*.

- When *cyclicMapping* is enabled, the first and second TCI states are applied to the first and second PDSCH transmission occasions, respectively, and the same TCI mapping pattern continues to the remaining PDSCH transmission occasions.

- When *sequenticalMapping* is enabled, first TCI state is applied to the first and second PDSCH transmission occasions, and the second TCI state is applied to the third and fourth PDSCH transmission occasions, and the same TCI mapping pattern continues to the remaining PDSCH transmission occasions.

The UE may expect that each PDSCH transmission occasion is limited to two transmission layers. For all PDSCH transmission occasions associated with the first TCI state, the redundancy version to be applied is derived according to Table 5.1.2.1-2, where $n$ is counted only considering PDSCH transmission occasions associated with the first TCI state. The redundancy version for PDSCH transmission occasions associated with the second TCI state is derived according to Table 5.1.2.1-3, where additional shifting operation for each redundancy version $rv\_{s} $is configured by higher layer parameter *sequenceOffsetforRV* and $n$ is counted only considering PDSCH transmission occasions associated with the second TCI state.

Table 5.1.2.1-3: Applied redundancy version for the second TCI state when *sequenceOffsetforRV* is present

|  |  |
| --- | --- |
| *rvid* indicated by the DCI scheduling the PDSCH | *rvid* to be applied to *n*th transmission occasion with second TCI state |
| *n* mod 4 = 0 | *n* mod 4 = 1 | *n* mod 4 = 2 | *n* mod 4 = 3 |
| $$0$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ |
| $$2$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ |
| $$3$$ | $$(3+ rv\_{s}) mod 4$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ |
| $$1$$ | $$(1+ rv\_{s}) mod 4$$ | $$(0+ rv\_{s}) mod 4$$ | $$(2+ rv\_{s}) mod 4$$ | $$(3+ rv\_{s}) mod 4$$ |

- If one TCI state is indicated by the DCI field 'Transmission Configuration Indication' 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)', the same SLIV is applied for all PDSCH transmission occasions across the *repetitionNumber* consecutive slots, the first PDSCH transmission occasion follows Clause 5.1.2.1, the same TCI state is applied to all PDSCH transmission occasions. The UE may expect that each PDSCH transmission occasion is limited to two transmission layers. For all PDSCH transmission occasions, the redundancy version to be applied is derived according to Table 5.1.2.1-2, where $n$ is counted considering PDSCH transmission occasions.

- Otherwise, the UE is expected to receive a single PDSCH transmission occasion, and the resource allocation in the time domain follows Clause 5.1.2.1.

For *pdsch-TimeDomainAllocationListForMultiPDSCH* in *pdsch-Config* each PDSCH has a separate SLIV, mapping type and *K0*. The number of scheduled PDSCHs is signalled by the number of indicated SLIVs in the row of the *pdsch-TimeDomainAllocationListForMultiPDSCH* signalled in DCI format 1\_1.

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 indicated re-transmission of PDSCH corresponding to a DL SPS by DCI format 1\_1, 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 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, the UE does not expect to be scheduled with one or multiple PDSCH receptions by a single DCI format 1\_1, where each PDSCH reception overlaps with a UL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided.

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#### 5.2.1.2 Resource settings

Each CSI Resource Setting *CSI-ResourceConfig* contains a configuration of a list of S≥1 CSI Resource Sets (given by higher layer parameter *csi-RS-ResourceSetList*), where the list is comprised of references to either or both of NZP CSI-RS resource set(s) and SS/PBCH block set(s) or the list is comprised of references to CSI-IM resource set(s). Each CSI Resource Setting is located in the DL BWP identified by the higher layer parameter *BWP-id*, and all CSI Resource Settings linked to a CSI Report Setting have the same DL BWP.

The time domain behavior of the CSI-RS resources within a CSI Resource Setting are indicated by the higher layer parameter *resourceType* and can be set to aperiodic, periodic, or semi-persistent. For periodic and semi-persistent CSI Resource Settings, when the UE is configured with *groupBasedBeamReporting-v1710*, the number of CSI Resource Sets configured is S=2, otherwise the number of CSI-RS Resource Sets configured is limited to S=1. For periodic and semi-persistent CSI Resource Settings, the configured periodicity and slot offset is given in the numerology of its associated DL BWP, as given by *BWP-id.* When a UE is configured with multiple *CSI-ResourceConfigs* consisting the same NZP CSI-RS resource ID, the same time domain behavior shall be configured for the *CSI-ResourceConfigs*. When a UE is configured with multiple *CSI-ResourceConfigs* consisting the same CSI-IM resource ID, the same time-domain behavior shall be configured for the *CSI-ResourceConfigs*. All CSI Resource Settings linked to a CSI Report Setting shall have the same time domain behavior.

The following are configured via higher layer signaling for one or more CSI Resource Settings for channel and interference measurement:

- CSI-IM resource for interference measurement as described in Clause 5.2.2.4.

- NZP CSI-RS resource for interference measurement as described in Clause 5.2.2.3.1.

- NZP CSI-RS resource for channel measurement as described in Clause 5.2.2.3.1.

The UE may assume that the NZP CSI-RS resource(s) for channel measurement and the CSI-IM resource(s) for interference measurement configured for one CSI reporting are resource-wise QCLed with respect to 'typeD'. When NZP CSI-RS resource(s) is used for interference measurement, the UE may assume that the NZP CSI-RS resource for channel measurement and the CSI- IM resource or NZP CSI-RS resource(s) for interference measurement configured for one CSI reporting are QCLed with respect to 'typeD'.

For L1-SINR measurement:

- When one Resource Setting is configured, the Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel and interference measurement on NZP CSI-RS for L1-SINR computation. UE may assume that same 1 port NZP CSI-RS resource(s) with density 3 REs/RB is used for both channel and interference measurements.

- When two Resource Settings are configured, the first one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement on SSB or NZP CSI-RS and the second one (given by either higher layer parameter *csi-IM-ResourcesForInterference* or higher layer parameter *nzp-CSI-RS-ResourcesForInterference*) is for interference measurement performed on CSI-IM or on 1 port NZP CSI-RS with density 3 REs/RB, where each SSB or NZP CSI-RS resource for channel measurement is associated with one CSI-IM resource or one NZP CSI-RS resource for interference measurement by the ordering of the SSB or NZP CSI-RS resource for channel measurement and CSI-IM resource or NZP CSI-RS resource for interference measurement in the corresponding resource sets. The number of SSB(s) or CSI-RS resources for channel measurement equals to the number of CSI-IM resources or the number of NZP CSI-RS resource for interference measurement.

- UE may apply the SSB, or 'typeD' RS configured with *qcl-Type* set to 'typeD' to the NZP CSI-RS resource for channel measurement, as the reference RS for determining 'typeD' assumption for the corresponding CSI-IM resource or the corresponding NZP CSI-RS resource for interference measurement configured for one CSI reporting.

- UE may expect that the NZP CSI-RS resource set for channel measurement and the NZP-CSI-RS resource set for interference measurement, if any, are configured with the higher layer parameter *repetition*.

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##### 5.2.1.4.1 Resource Setting configuration

For aperiodic CSI, each trigger state configured using the higher layer parameter *CSI-AperiodicTriggerState* is associated with one or multiple *CSI-ReportConfig* where the *CSI-ReportConfig* not configured with *groupBasedBeamReporting-v1710* is linked to periodic, or semi-persistent, or aperiodic resource setting(s):

- When one Resource Setting is configured, the Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement for L1-RSRP or for channel and interference measurement for L1-SINR computation.

- When two Resource Settings are configured, the first one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement and the second one (given by either higher layer parameter *csi-IM-ResourcesForInterference* or higher layer parameter *nzp-CSI-RS-ResourcesForInterference*) is for interference measurement performed on CSI-IM or on NZP CSI-RS.

- When three Resource Settings are configured, the first Resource Setting (higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement, the second one (given by higher layer parameter *csi-IM-ResourcesForInterference*) is for CSI-IM based interference measurement and the third one (given by higher layer parameter *nzp-CSI-RS-ResourcesForInterference*) is for NZP CSI-RS based interference measurement.

For aperiodic CSI, and for periodic and semi-persistent CSI resource settings, each trigger state configured using the higher layer parameter *CSI-AperiodicTriggerState* is associated with one or multiple *CSI-ReportConfig* where the *CSI-ReportConfig* configured with *groupBasedBeamReporting-v1710* is linked to periodic or semi-persistent, setting(s):

- When one Resource Setting is configured, the Resource setting is given by *resourcesForChannelMeasurement* for L1-RSRP measurement. In such a case, the number of configured CSI Resource Sets in the Resource Setting is S=2

For aperiodic CSI, and for aperiodic CSI resource settings, each trigger state configured using the higher layer parameter *CSI-AperiodicTriggerState* is associated with one or multiple *CSI-ReportConfig* where the *CSI-ReportConfig* configured with *groupBasedBeamReporting-v1710* is associated with *resourcesForChannel* and *resourcesForChannel2*, which correspond to first and second resource sets, respectively, for L1-RSRP measurement.

For semi-persistent or periodic CSI, each *CSI-ReportConfig* is linked to periodic or semi-persistent Resource Setting(s):

- When one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is configured, the Resource Setting is for channel measurement for L1-RSRP or for channel and interference measurement for L1-SINR computation.

- When two Resource Settings are configured, the first Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement and the second Resource Setting (given by higher layer parameter *csi-IM-ResourcesForInterference*) is used for interference measurement performed on CSI-IM. For L1-SINR computation, the second Resource Setting (given by higher layer parameter *csi-IM-ResourcesForInterference* or higher layer parameter *nzp-CSI-RS-ResourceForInterference*) is used for interference measurement performed on CSI-IM or on NZP CSI-RS.

A UE is not expected to be configured with more than one CSI-RS resource in resource set for channel measurement for a *CSI-ReportConfig* with the higher layer parameter *codebookType* set to 'typeII', 'typeII-PortSelection', 'typeII-r16', 'typeII-PortSelection-r16', or 'typeII-PortSelection-r17'. A UE is not expected to be configured with more than 64 NZP CSI-RS resources and/or SS/PBCH block resources in resource setting for channel measurement for a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'none', 'cri-RI-CQI', 'cri-RSRP', 'ssb-Index-RSRP', 'cri-SINR' or 'ssb-Index-SINR', 'cri-RSRP- Index', 'ssb-Index-RSRP- Index', 'cri-SINR- Index' or 'ssb-Index-SINR- Index'. If interference measurement is performed on CSI-IM, each CSI-RS resource for channel measurement is resource-wise associated with a CSI-IM resource by the ordering of the CSI-RS resource and CSI-IM resource in the corresponding resource sets. The number of CSI-RS resources for channel measurement equals to the number of CSI-IM resources.

An NZP CSI-RS Resource Set for channel measurement with $2\leq K\_{s}\leq 8$ resources can be configured with two Resource Groups, with $K\_{1}\geq 1$ resources in Group 1 and $K\_{2}\geq 1$ resources in Group 2, such that $K\_{1}+K\_{2}=K\_{s}$, and with $N\in \{1,2\}$ Resource Pairs. Each Resource Pair consists of one resource from Group 1 and one resource from Group 2. The same resource can be associated with two Resource Pairs in frequency range 1 but not in frequency range 2.

Except for L1-SINR, if interference measurement is performed on NZP CSI-RS, a UE does not expect to be configured with more than one NZP CSI-RS resource in the associated resource set within the resource setting for channel measurement. Except for L1-SINR, the UE configured with the higher layer parameter *nzp-CSI-RS-ResourcesForInterference* may expect no more than 18 NZP CSI-RS ports configured in a NZP CSI-RS resource set.

For CSI measurement(s) other than L1-SINR, a UE assumes:

- each NZP CSI-RS port configured for interference measurement corresponds to an interference transmission layer.

- all interference transmission layers on NZP CSI-RS ports for interference measurement take into account the associated EPRE ratios configured in 5.2.2.3.1;

- other interference signal on REs of NZP CSI-RS resource for channel measurement, NZP CSI-RS resource for interference measurement, or CSI-IM resource for interference measurement.

For L1-SINR measurement with dedicated interference measurement resources, a UE assumes:

- the total received power on dedicated NZP CSI-RS resource for interference measurement or dedicated CSI-IM resource for interference measurement corresponds to interference and noise.

##### 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' or 'ssb-Index-SINR- Index'.

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 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.

- 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- v1710*, 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-r17* 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 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 'cri-RSRP', 'cri-RSRP-Index', '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 $K\_{s}>1 $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 $K\_{s}=2 $CSI-RS resources are configured, each resource shall contain at most 16 CSI-RS ports. If $2<K\_{s}\leq 8 $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', or 'cri-RI-LI-PMI-CQI' and the corresponding *NZP-CSI-RS-ResourceSet* for channel measurement is configured with $K\_{s}\geq 2$ resources, two Resource Groups with $K\_{1}\geq 1$ resources in Group 1, $K\_{2}\geq 1$ resources in Group 2, $K\_{1}+K\_{2}=K\_{s}$, and $N$ Resource Pairs:

- each resource can contain, subject to UE capability, at most 32 CSI-RS ports. For two Resource Groups with $K\_{i}$ resources (i=1,2), if $max\left\{K\_{1},K\_{2}\right\}=1$, the resource in NZP-CSI-RS-ResourceSet shall contain at most 32 CSI-RS ports; if $ max\left\{K\_{1},K\_{2}\right\}=2$, each resource in NZP-CSI-RS-ResourceSet shall contain at most 16 CSI-RS ports; if $2<max\left\{K\_{1},K\_{2}\right\}<8$, each resource in NZP-CSI-RS-ResourceSet shall contain at most 8 CSI-RS ports.

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

- The *CSI-ReportConfig* may be configured with higher layer parameter *sharedCMR*. $M\_{1}$ and $M\_{2}$ 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 $M=M\_{1}+M\_{2}$, such that the total number of CRI values configured for the *CSI-ReportConfig* is $M+N$.

- If the higher layer parameter *csi-ReportMode* is set to 'Mode1' and the higher layer parameter *numberOfSingleTRP-CSI-Mode1* is set to $X\in \{0\}$, $M\_{1}=M\_{2}=0$; otherwise,

- if the higher layer parameter *csi-ReportMode* is set to 'Mode1' and the higher layer parameter *numberOfSingleTRP-CSI-Mode1* is set to $X\in \{1,2\}$, or if *csi-ReportMode* is set to 'Mode2',

- if *sharedCMR* is configured: $M\_{1}=K\_{1}$ and $M\_{2}=K\_{2}$; 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, $M+N$ resources are configured in the corresponding *csi-IM-ResourceSet*. The $M$ resources for channel measurement defined above are resource-wise associated with the first $M$ CSI-IM resources by the ordering of the CSI-RS resources and CSI-IM resources in the corresponding Resource Set. The $N$ Resource Pairs for channel measurement are associated to the last $N$ 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 $N$ 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 $X\in \{0,1,2\}$, $X+1$ CRI(s) are reported:

- one CRI $k\_{1} \left(k\_{1}\geq 0\right)$ corresponds to the configured $(k\_{1}+1)$-th entry of the associated $N$ Resource Pairs in the corresponding CSI-RS Resource Set for channel measurement, and $(M+k\_{1}+1)$-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 $(k\_{1}+1)$-th Resource Pair, and one CQI; and

- if $X=1$, one CRI $k\_{2}$ ($k\_{2}\geq 0$) corresponds to the configured $(k\_{2}+1)$-th entry of the associated $M$ resources in the corresponding CSI-RS Resource Set for channel measurement, and $(k\_{2}+1)$-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 $k\_{2}$; or

- if $X=2$, one CRI $k\_{2}$ $(k\_{2}\geq 0)$ corresponds to the configured $(k\_{2}+1)$-th entry of the associated $M\_{1}$ resources in Group 1 of the corresponding CSI-RS Resource Set for channel measurement, and $(k\_{2}+1)$-th entry of the associated resources in the corresponding CSI-IM Resource Set, if configured, and one CRI $k\_{3}$ $(k\_{3}\geq 0)$ corresponds to the configured $(k\_{3}+1)$-th entry of the associated $M\_{2}$ resources in Group 2 of the corresponding CSI-RS Resource Set for channel measurement, and $(M\_{1}+k\_{3}+1)$-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 $k\_{2}$ and one RI, one PMI, one LI (if configured) and one or two CQIs conditioned on CRI $k\_{3}$.

- If the higher layer parameter *csi-ReportMode* is set to 'Mode2', one CRI $k\_{1}$ $(k\_{1}\geq 0)$ is reported, which corresponds to the $(k\_{1}+1)$-th entry of the $M+N$ resources or Resource Pairs in the corresponding CSI-RS Resource Set for channel measurement, and $(k\_{1}+1)$-th entry of the associated resources in the corresponding CSI-IM Resource Set, if configured. The first $M$ codepoints of the CRI correspond to resources associated to Group 1 and Group 2. The last $N$ codepoints of the CRI correspond to the $N$ configured Resource Pairs. The UE shall report one RI, one PMI, one LI, if configured, and one or two CQIs conditioned on CRI $k\_{1}$ if $k\_{1}<M$; 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 $(k\_{1}-M+1)$-th Resource Pair, and one CQI, otherwise.

- For a reported CRI corresponding to an entry of the $N$ 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: $\left\{1,1\right\}, \left\{1,2\right\}, \left\{2,1\right\}, \{2,2\}$.

- 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 $M$ 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 $N$ 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 $(i+1)$-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* 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*.

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*' or '*typeII-PortSelection-r17'*.

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 $N$ Resource Pairs, and the UE reports a CRI associated to a Resource Pair, and a rank combination $\{ν\_{1},ν\_{2}\}$, the first LI indicates which column of the precoder matrix of the first reported PMI corresponds to the strongest of the first $ν\_{1}$ 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 $ν\_{2}$ 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.

##### 5.2.1.4.3 L1-RSRP Reporting

For L1-RSRP computation

- the UE may be configured with CSI-RS resources, SS/PBCH Block resources or both CSI-RS and SS/PBCH block resources, when resource-wise quasi co-located with 'type C' and 'typeD' when applicable.

- the UE may be configured with CSI-RS resource setting up to 16 CSI-RS resource sets having up to 64 resources within each set. The total number of different CSI-RS resources over all resource sets is no more than 128.

For L1-RSRP reporting, if the higher layer parameter *nrofReportedRS* in *CSI-ReportConfig* is configured to be one, the reported L1-RSRP value is defined by a 7-bit value in the range [-140, -44] dBm with 1dB step size, if the higher layer parameter *nrofReportedRS* is configured to be larger than one, or if the higher layer parameter *groupBasedBeamReporting* is configured as 'enabled', or if the higher layer parameter *groupBasedBeamReporting-v1710* is configured*,* the UE shall use differential L1-RSRP based reporting, where the largest measured value of L1-RSRP is quantized to a 7-bit value in the range [-140, -44] dBm with 1dB step size, and the differential L1-RSRP is quantized to a 4-bit value. The differential L1-RSRP value is computed with 2 dB step size with a reference to the largest measured L1-RSRP value which is part of the same L1-RSRP reporting instance. The mapping between the reported L1-RSRP value and the measured quantity is described in [11, TS 38.133].

When the higher layer parameter *groupBasedBeamReporting-v1710*in *CSI-ReportConfig* is configured, the UE shall indicate the CSI Resource Set associated with the largest measured value of L1-RSRP, and for each group, CRI or SSBRI of the indicated CSI Resource Set is present first.

If the higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is set to "*notConfigured*", the UE shall derive the channel measurements for computing L1-RSRP value reported in uplink slot *n* based on only the SS/PBCH or NZP CSI-RS, no later than the CSI reference resource, (defined in TS 38.211[4]) associated with the CSI resource setting.

If the higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is set to "*Configured*", the UE shall derive the channel measurements for computing L1-RSRP reported in uplink slot *n* based on only the most recent, no later than the CSI reference resource, occasion of SS/PBCH or NZP CSI-RS (defined in [4, TS 38.211]) associated with the CSI resource setting.

When the UE is configured with *SSB-MTC-AddtionalPCI*, a CSI-SSB-ResourceSet configured for L1-RSRP reporting includes one set of SSB indices and one set of PCI indices, where each SSB index is associated with a PCI index.

When the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to ' cri-RSRP- Index' or 'ssb-Index-RSRP- Index' an index of UE capability value set, indicating the maximum supported number of SRS antenna ports, is reported along with the pair of SSBRI/CRI and L1-RSRP.

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