**3GPP TSG RAN WG1 #110bis-e** **R1-221xxxx**

e-meeting, October 10th – 19th, 2022

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| *CR-Form-v12.2* |
| **DRAFT CHANGE REQUEST** |
|  |
|  | **38.213** | **CR** |  | **rev** |  | **Current version:** | **17.3.0** |  |
|  |
| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | Rel-17 editorial corrections for TS 38.213 |
|  |  |
| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** | R1 |
|  |  |
| ***Work item code:*** | , NR\_SL\_enh-Core,

|  |
| --- |
| , NR\_IAB\_enh,  |

NR\_L1enh\_URLLC-Core, NR\_DSS, , NR\_redcap-Core, NR\_MBS-Core, NR\_UE\_pow\_sav\_enh-Core, NR\_SmallData\_INACTIVE-Core  |  | ***Date:*** | 2022-10-24 |
|  |  |  |  |  |
| ***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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | 1. Misaligned RRC parameter names with TS 38.331 v17.2.0.
2. Missing references to higher layer parameters
3. Miscellaneous clarifications/editorial corrections
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|  |  |
| ***Summary of change:*** | 1. Aligned RRC parameter names with TS 38.331 v17.2.0.
2. Add missing references to higher layer parameters
3. Miscellaneous clarifications/editorial corrections
 |
|  |  |
| ***Consequences if not approved:*** | Inconsistent specifications |
|  |  |
| ***Clauses affected:*** | 6, 7, 8.2, 8.2A, 9.1.2, 9.1.2.1, 9.1.3.1, 9.1.4, 9.2.1, 9.2.2, 9.2.3, 10.1, 10.1.1, 10.4, 10.4A, 11.1, 11.1.1, 14, 16.2.4.2, 16.3.0, 16.3.1, 17.1, 18, 19.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS 38.331 |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\*\*\* Unchanged text is omitted \*\*\*

### 6 Link recovery procedures

A UE can be provided, for each BWP of a serving cell, a set of periodic CSI-RS resource configuration indexes by *failureDetectionResourcesToAddModList* and a set of periodic CSI-RS resource configuration indexes and/or SS/PBCH block indexes by *candidateBeamRSList* or *candidateBeamRSListExt* or *candidateBeamRSSCellList* for radio link quality measurements on the BWP of the serving cell. Instead of the sets and , for each BWP of a serving cell, the UE can be provided respective two sets and of periodic CSI-RS resource configuration indexes by failureDetectionSet1 and failureDetectionSet2 that can be activated by a MAC CE [11 TS 38.321] and corresponding two sets and of periodic CSI-RS resource configuration indexes and/or SS/PBCH block indexes by *candidateBeamRS-List* and *candidateBeamRS-List2*, respectively, for radio link quality measurements on the BWP of the serving cell. The set is associated with the set and the set is associated with the set .

\*\*\* Unchanged text is omitted \*\*\*

For the PCell or the PSCell, the UE can be provided, by *PRACH-ResourceDedicatedBFR*, a configuration for PRACH transmission as described in clause 8.1. For PRACH transmission in slot and according to antenna port quasi co-location parameters associated with periodic CSI-RS resource configuration or with SS/PBCH block associated with index provided by higher layers [11, TS 38.321], the UE monitors PDCCH in a search space set provided by *recoverySearchSpaceId* for detection of a DCI format with CRC scrambled by C-RNTI or MCS-C-RNTI starting from slot , where is the SCS configuration for the PRACH transmission and is a number of slots provided by *kmac* [12, TS 38.331] or if *kmac* is not provided, within a window configured by *BeamFailureRecoveryConfig*. For PDCCH monitoring in a search space set provided by *recoverySearchSpaceId* and for corresponding PDSCH receptions, the UE assumes the same antenna port quasi-collocation parameters as the ones associated with index until the UE receives by higher layers an activation for a TCI state or any of the parameters *tci-StatesPDCCH-ToAddList* and/or *tci-StatesPDCCH-ToReleaseList*. After the UE detects a DCI format with CRC scrambled by C-RNTI or MCS-C-RNTI in the search space set provided by *recoverySearchSpaceId*, the UE continues to monitor PDCCH candidates in the search space set provided by *recoverySearchSpaceId* until the UE receives a MAC CE activation command for a TCI state or *tci-StatesPDCCH-ToAddList* and/or *tci-StatesPDCCH-ToReleaseList.*

\*\*\* Unchanged text is omitted \*\*\*

If a UE is provided *dl-OrJoint-TCIStateList* or *TCI-UL-State* indicating a unified TCI state for the PCell or the PSCell and the UE provides BFR MAC CE in Msg3 or MsgA of contention based random access procedure, after 28 symbols from the last symbol of the PDCCH reception that determines the completion of the contention based random access procedure as described in [11, TS 38.321], the UE

- if *SSB-MTC-AdditionalPCI* is not provided, monitors PDCCH in all CORESETs, and receives PDSCH and aperiodic CSI-RS resource in a CSI-RS resource set with same indicated TCI state as for the PDCCH and PDSCH using the same antenna port quasi co-location parameters as the ones associated with the corresponding index , if any

- transmits PUSCH, PUCCH and SRS that uses a same spatial domain filter with same indicated TCI state as for the PUSCH and PUCCH, using a same spatial domain filter as for the last PRACH transmission using the following parameters for determination of a corresponding power as described in clauses 7.1.1, 7.2.1, and 7.3.1

- the RS index for obtaining the downlink pathloss estimate

- the values of , , and the PUSCH power control adjustment state provided by *p0AlphaSetforPUSCH* associated with the smallest value of *ul-powercontrolId* for the PCell or the PSCell

- the value of and the PUCCH power control adjustment state provided by *p0AlphaSetforPUCCH* associated with the smallest value of *ul-powercontrolId* for the PCell or the PSCell

- the values of , , and the SRS power control adjustment state provided by *p0AlphaSetforSRS* associated with the smallest value of *ul-powercontrolId* for the PCell or the PSCell

\*\*\* Unchanged text is omitted \*\*\*

If a UE is provided *dl-OrJoint-TCIStateList* or *TCI-UL-State* indicating a unified TCI state, after 28 symbols from a last symbol of a PDCCH reception with a DCI format scheduling a PUSCH transmission with a same HARQ process number as for the transmission of the first PUSCH and having a toggled NDI field value, the UE

- monitors PDCCH in all CORESETs, and receives PDSCH and aperiodic CSI-RS resource in a CSI-RS resource set using the same antenna port quasi co-location parameters as the ones associated with the corresponding index , if any

- transmits PUSCH, PUCCH and SRS that uses a same spatial domain filter with same indicated TCI state as for the PUSCH and PUCCH, using a same spatial domain filter as the one corresponding to , if any, and using the following parameters for determination of a corresponding power as described in clauses 7.1.1, 7.2.1, and 7.3.1

- the RS index for obtaining the downlink pathloss estimate

- the values of , , and the PUSCH power control adjustment state provided by *p0AlphaSetforPUSCH* associated with the smallest value of *ul-powercontrolId* for the corresponding SCell

- the value of and the PUCCH power control adjustment state provided by *p0AlphaSetforPUCCH* associated with the smallest value of *ul-powercontrolId* for the corresponding SCell

- the values of , , and the SRS power control adjustment state provided by *p0AlphaSetforSRS* associated with the smallest value of *ul-powercontrolId* for the corresponding SCell

\*\*\* Unchanged text is omitted \*\*\*

7 Uplink Power control

Uplink power control determines a power for PUSCH, PUCCH, SRS, and PRACH transmissions.

A UE does not expect to simultaneously maintain more than four pathloss estimates per serving cell for all PUSCH/PUCCH/SRS transmissions as described in clauses 7.1.1, 7.2.1, and 7.3.1, except for SRS transmissions configured by *SRS-PosResourceSet* as described in clause 7.3.1. If the UE is provided a number of RS resources for pathloss estimation for PUSCH/PUCCH/SRS transmissions that is larger than 4, the UE maintains for pathloss estimation RS resources corresponding to RS resource indexes as described in clauses 7.1.1, 7.2.1, and 7.3.1. If an RS resource updated by MAC CE, as described in clauses 7.1.1, 7.2.1 and 7.3.1, is one from the RS resources the UE maintains for pathloss estimation for PUSCH/PUCCH/SRS transmissions, the UE applies the pathloss estimation based on the RS resources starting from the first slot that is after slot where is the slot where the UE would transmit a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, is the SCS configuration for the PUCCH or PUSCH, respectively, that is determined in the slot when the MAC CE command is applied and is a number of slots for SCS configuration provided by *kmac* or if *kmac* is not provided*.*

\*\*\* Unchanged text omitted \*\*\*

In the remaining of this clause, if a UE is provided *TCI-State* in *dl-OrJoint-TCIStateList* or *TCI-UL-State* and for an indicated *TCI-State* or *TCI-UL-State* as described in [6, TS 38.214]

- in clauses 7.1.1, 7.2.1, and 7.3.1, the RS index for obtaining the downlink pathloss estimate for PUSCH, PUCCH, and SRS transmission is provided by pathlossReferenceRS-Id-r17 *PL-RS* associated with or included in the indicated *TCI-State* or *TCI-UL-State* except for SRS transmission that is not provided *followUnifiedTCIstateSRS*

- in clause 7.1.1, if *p0AlphaSetforPUSCH* is provided, the values of , , and the PUSCH power control adjustment state are provided by *p0AlphaSetforPUSCH* associated with the indicated *TCI-State* or *TCI-UL-State*

 in clause 7.2.1, if *p0AlphaSetforPUCCH* is provided, the values of and the PUCCH power control adjustment state are provided by *p0AlphaSetforPUCCH* associated with the indicated *TCI-State* or *TCI-UL-State*

- in clause 7.3.1, if *p0AlphaSetforSRS* is provided,

 if *followUnifiedTCIstateSRS* is provided for a SRS resource set, the values of , , and SRS power control adjustment state are provided by *p0AlphaSetforSRS* associated with the indicated *TCI-State* or *TCI-UL-State*

- else, if *followUnifiedTCIstateSRS* is not provided for a SRS resource set and for a SRS resource from the SRS resource set, the values of , , and SRS power control adjustment state are provided by *p0AlphaSetforSRS* associated with *TCI-State* or *TCI-UL-State* of an SRS resource with lowest *SRS-ResourceId* in the SRS resource set and a RS index for obtaining a pathloss estimate for the SRS transmission is provided by PL-RS associated with or included in the *TCI-State* or *TCI-UL-State* of an SRS resource with lowest *SRS-ResourceId* in the SRS resource set

\*\*\* Unchanged text omitted \*\*\*

## 8.2 Random access response - Type-1 random access procedure

In response to a PRACH transmission, a UE attempts to detect a DCI format 1\_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in clause 10.1, that is at least one symbol, after the last symbol of the PRACH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in clause 10.1. Ifor, as defined in [4, TS 38.211], is not zero, the window starts after an additional msec where is defined in [4, TS 38.211] and is provided by *kmac* or if *kmac* is not provided. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by *ra-ResponseWindow*.

\*\*\* Unchanged text omitted \*\*\*

## 8.2A Random access response - Type-2 random access procedure

In response to a transmission of a PRACH and a PUSCH, or to a transmission of only a PRACH if the PRACH preamble is mapped to a valid PUSCH occasion, a UE attempts to detect a DCI format 1\_0 with CRC scrambled by a corresponding MsgB-RNTI during a window controlled by higher layers [11, TS 38.321]. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in clause 10.1, that is at least one symbol, after the last symbol of the PUSCH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set. Ifor, as defined in [4, TS 38.211], is not zero, the window starts after an additional msec where is defined in [4, TS 38.211] and is provided by *kmac* or if *kmac* is not provided. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by *msgB-ResponseWindow*.

\*\*\* Unchanged text omitted \*\*\*

### 9.1.2 Type-1 HARQ-ACK codebook determination

\*\*\* Unchanged text omitted \*\*\*

If the UE is provided *pdsch-AggregationFactor-r16* in *SPS-Config*, or *pdsch-AggregationFactor* in *PDSCH-Config* and no entry in *pdsch-TimeDomainAllocationList* and *pdsch-TimeDomainAllocationListDCI-1-2* includes *repetitionNumber* in *PDSCH-TimeDomainResourceAllocation-r16*, is a maximum value of *pdsch-AggregationFactor-r16* in *SPS-Config*, or *pdsch-AggregationFactor* in *PDSCH-Config*; otherwise . The UE reports HARQ-ACK information for a PDSCH reception

\*\*\* Unchanged text omitted \*\*\*

while

if {

a UE is configured to receive SPS PDSCHs from slot to slot for SPS PDSCH configuration on serving cell , excluding SPS PDSCHs that are not required to be received in any slot among overlapping SPS PDSCHs, if any according to [6, TS 38.214], or based on a UE capability for a number of PDSCH receptions in a slot according to [6, TS 38.214], or due to overlapping with a set of symbols indicated as uplink by *tdd-UL-DL-ConfigurationCommon* or by *tdd-UL-DL-ConfigurationDedicated* where is provided by *pdsch-AggregationFactor-r16* in *sps-Config* or, if *pdsch-AggregationFactor-r16* is not included in *sps-Config*, by *pdsch-AggregationFactor* in *pdsch-config*, and

HARQ-ACK information for the SPS PDSCH is associated with the PUCCH

}

 = HARQ-ACK information bit for this SPS PDSCH reception

;

end if

;

end while

\*\*\* Unchanged text omitted \*\*\*

#### 9.1.2.1 Type-1 HARQ-ACK codebook in physical uplink control channel

\*\*\* Unchanged text omitted \*\*\*

a) on a set of slot timing values associated with the active UL BWP on the primary cell or, if the PUCCH transmission is indicated by a DCI format to be on the PUCCH-sSCell as described in clause 9A, on a set of slot timing values associated with the active UL BWP on the PUCCH-sSCell

- If the UE is configured to monitor PDCCH for DCI format 1\_0 and is not configured to monitor PDCCH for either DCI format 1\_1 or DCI format 1\_2 for serving cell , or the active DL BWP for serving cell is dormant BWP, is provided by the slot timing values {1, 2, 3, 4, 5, 6, 7, 8} for SCS configuration of PUCCH transmission , {7, 8, 12, 16, 20, 24, 28, 32} for , and {13, 16, 24, 32, 40, 48, 56, 64} for

- If the UE is configured to monitor PDCCH for DCI format 1\_1 and is not configured to monitor PDCCH for DCI format 1\_2 for serving cell , is provided by *dl-DataToUL-ACK* or *dl-DataToUL-ACK-r16* or *dl-DataToUL-ACK-r17*

- If the UE is configured to monitor PDCCH for DCI format 1\_2 and is not configured to monitor PDCCH for DCI format 1\_1 for serving cell , is provided by *dl-DataToUL-ACK-DCI-1-2* or *dl-DataToUL-ACK-DCI-1-2-r17*

- If the UE is configured to monitor PDCCH for DCI format 1\_1 and DCI format 1\_2 for serving cell , is provided by the union of *dl-DataToUL-ACK* or *dl-DataToUL-ACK-r16* or *dl-DataToUL-ACK-r17* and *dl-DataToUL-ACK-DCI-1-2* or *dl-DataToUL-ACK-DCI-1-2-r17*

- If an inapplicable value in *dl-DataToUL-ACK-r16* or *dl-DataToUL-ACK-r17* is provided, the value is excluded from

- If the UE is configured to monitor PDCCH for multicast DCI formats for serving cell

- if the UE is not provided *type1-Codebook-GenerationMode =* 'mode1', is additionally provided by the union of *dl-DataToUL-ACK* from *pucch-ConfigMulticast1/pucch-ConfigurationListMulticast1* or *pucch-ConfigMulticast2/pucch-ConfigurationListMulticast2* and *dl-DataToUL-ACK-ForDCI Format4-1*

- if the UE is not provided *dl-DataToUL-ACK-ForDCI Format4-1*, is provided by the union of *dl-DataToUL-ACK from pucch-ConfigurationListMulticast1 or pucch-ConfigurationListMulticast2* and the slot timing values {1, 2, 3, 4, 5, 6, 7, 8}

- if the UE is provided *type1-Codebook-GenerationMode =* 'mode1', the UE

- determines a first set as , where is a set of slot timing values for the multicast DCI formats, a second set as , and a third set as

\*\*\* Unchanged text omitted \*\*\*

If the UE is configured to monitor PDCCH for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI and is provided *type1-Codebook-Generation-Mode* ='mode1', the UE separately applies the following pseudo-code for each of the first set, the second set, and third set as the set of slot timing values , and for the corresponding sets of row indexes as to obtain first, second, and third Type-1 HARQ-ACK sub-codebooks, and concatenates the first, second, and third, Type-1 HARQ-ACK sub-codebooks to obtain the Type-1 HARQ-ACK codebook.

If *timeDomainHARQ-BundlingType1* is provided

- set

- set to the set of row indexes that include the last SLIV of each row of set

If the set of rows includes a row with more than one SLIV entry as described in [6, TS 38.214] and *timeDomainHARQ-BundlingType1* is not provided, the set of rows and the set of slot timing values are updated in this clause according to the following pseudo-code.

\*\*\* Unchanged text omitted \*\*\*

while

if or *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook

Set – index of a DL slot overlapping with an UL slot

Set to a number of DL slots overlapping with UL slot if *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook; otherwise,

while

if *pdsch-TimeDomainAllocationListForMultiPDSCH* and *timeDomainHARQ-BundlingType1* are provided for serving cell

;

;

elseif *pdsch-TimeDomainAllocationListForMultiPDSCH* is provided and *timeDomainHARQ-BundlingType1* is not provided for serving cell

;

else

Set to the set of rows

end if

Set to the cardinality of

Set – index of row in set

if slot starts at a same time as or after a slot for an active DL BWP change on serving cell or an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn* or *pucch-sSCellDynDCI-1-2*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn* and *pucch-sSCellDynDCI-1-2,* and slot is before the slot for the active DL BWP change on serving cell or the active UL BWP change on the serving cell of PUCCH transmission, or *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook and slot overlaps with UL slot , , where is a DL slot with a smallest index among DL slots overlapping with UL slot ,

;

else

while

if the UE is not provided *timeDomainHARQ-BundlingType1* and is provided *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* and, for each slot from slot to slot , at least one symbol of the PDSCH time resource derived by row is configured as UL by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* where is the *k*-th slot timing value in set , where is a DL slot with a smallest index among DL slots overlapping with UL slot , or *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook and the end of the PDSCH time resource for row is not within any UL slot , or if *pdsch-TimeDomainAllocationListForMultiPDSCH* is provided and HARQ-ACK information for PDSCH time resource derived by row in slot cannot be provided in slot

;

elseif the UE is provided *timeDomainHARQ-BundlingType1* and *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* and, for each slot , at least one symbol of each PDSCH time resource derived by row of set is configured as UL by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated*, and for each slot from to slot at least one symbol of the PDSCH time resource derived by row of set *R* is configured as UL by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if the row of set *R* belongs to time domain resource allocation table configured for DCI format 1\_2, where = 0,1,…,, , and is the cardinality of .

;

;

else

;

end if

end while

\*\*\* Unchanged text omitted \*\*\*

while

if or *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook

Set – index of a DL slot overlapping with an UL slot

Set to a number of DL slots overlapping with UL slot if *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook; otherwise,

while

if *pdsch-TimeDomainAllocationListForMultiPDSCH* and *timeDomainHARQ-BundlingType1* are provided for serving cell

;

;

elseif *pdsch-TimeDomainAllocationListForMultiPDSCH* is provided and *timeDomainHARQ-BundlingType1* is not provided for serving cell

;

else

Set to the set of rows

end if

\*\*\* Unchanged text omitted \*\*\*

while

if the UE is not provided *timeDomainHARQ-BundlingType1* and is provided *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* and, for each slot from slot to slot , at least one symbol of the PDSCH time resource derived by row is configured as UL by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* where is the *k*-th slot timing value in set , where is a DL slot with a smallest index among DL slots overlapping with UL slot , or *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook and the end of the PDSCH time resource for row is not within any UL slot , or if *pdsch-TimeDomainAllocationListForMultiPDSCH* is provided and HARQ-ACK information for PDSCH time resource derived by row in slot cannot be provided in slot

;

elseif the UE is provided *timeDomainHARQ-BundlingType1* and *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* and, for each slot , at least one symbol of each PDSCH time resource derived by row of set is configured as UL by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated*, and for each slot from to slot at least one symbol of the PDSCH time resource derived by row of set *R* is configured as UL by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if the row of set *R* belongs to time domain resource allocation table configured for DCI format 1\_2, where = 0,1,…,.

;

;

else

;

end if

end while

\*\*\* Unchanged text omitted \*\*\*

Set to the number of serving cells configured by higher layers for the UE

while

Set – index of occasion for candidate PDSCH reception, or SPS PDSCH release, or TCI state update

while

if *timeDomainHARQ-BundlingType1* is provided for serving cell and a PDSCH associated with occasion is scheduled by a DCI format indicating a TDRA row that includes more than one SLIV entry

if *harq-ACK-SpatialBundlingPUCCH* is not provided and the UE is configured by *maxNrofCodeWordsScheduledByDCI* with reception of two transport blocks for the active DL BWP of serving cell

if the PDSCH is associated with the last SLIV in the TDRA row

\*\*\* Unchanged text omitted \*\*\*

- is the cardinality for the union of all sets of occasions for unicast or multicast PDSCH receptions or SPS PDSCH releases for serving cell

- is the number of transport blocks the UE receives in PDSCH reception occasion for serving cell if *harq-ACK-SpatialBundlingPUCCH* and *PDSCH-CodeBlockGroupTransmission* are not provided, or the number of transport blocks the UE receives in PDSCH reception occasion for serving cell if *PDSCH-CodeBlockGroupTransmission* is provided and the PDSCH reception is scheduled by a DCI format that does not support CBG-based PDSCH receptions, or the number of PDSCH receptions if *harq-ACK-SpatialBundlingPUCCH* is provided or SPS PDSCH release or TCI state update in PDSCH reception occasion for serving cell and the UE reports corresponding HARQ-ACK information in the PUCCH.

- If *timeDomainHARQ-BundlingType1* is provided for serving cell and for a DCI format indicating a TDRA row that includes more than one SLIV entry on the serving cell , the UE considers as received only a PDSCH associated with the last SLIV.

- is the number of CBGs the UE receives in a PDSCH reception occasion for serving cell if *PDSCH-CodeBlockGroupTransmission* is provided and the PDSCH reception is scheduled by a DCI format that supports CBG-based PDSCH receptions and the UE reports corresponding HARQ-ACK information in the PUCCH.

\*\*\* Unchanged text omitted \*\*\*

9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel

\*\*\* Unchanged text omitted \*\*\*

A value of the counter downlink assignment indicator (DAI) field in DCI formats denotes the accumulative number of {serving cell, PDCCH monitoring occasion}-pairs in which PDSCH receptions, excluding PDSCH receptions that provide only transport blocks for HARQ processes associated with disabled HARQ-ACK information if *downlinkHARQ-FeedbackDisabled* is provided, or HARQ-ACK information bits that are not in response for PDSCH receptions, associated with the DCI formats, excluding the SPS activation DCI, is present up to the current serving cell and current PDCCH monitoring occasion,

- first, if the UE indicates by *type2-HARQ-ACK-Codebook* support for more than one PDSCH reception on a serving cell that are scheduled from a same PDCCH monitoring occasion, in increasing order of the PDSCH reception starting time for the same {serving cell, PDCCH monitoring occasion} pair,

- second in ascending order of serving cell index, and

- third in ascending order of PDCCH monitoring occasion index , where .

If, for an active DL BWP of a serving cell, the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode* = *joint*, the value of the counter DAI is in the order of the first CORESETs and then the second CORESETs for a same serving cell index and a same PDCCH monitoring occasion index.

The value of the total DAI, when present [5, TS 38.212], in a DCI format denotes the total number of {serving cell, PDCCH monitoring occasion}-pair(s) in which PDSCH reception(s), excluding PDSCH receptions that provide only transport blocks for HARQ processes associated with disabled HARQ-ACK information if *downlinkHARQ-FeedbackDisabled* is provided, or HARQ-ACK information that does not correspond to PDSCH receptions, associated with DCI formats, excluding the SPS activation DCI, is present, up to the current PDCCH monitoring occasion and is updated from PDCCH monitoring occasion to PDCCH monitoring occasion. If, for an active DL BWP of a serving cell, the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode* = *joint*, the total DAI value counts the {serving cell, PDCCH monitoring occasion}-pair(s) for both the first CORESETs and the second CORESETs.

\*\*\* Unchanged text omitted \*\*\*

If a UE is configured to receive SPS PDSCH and the UE multiplexes HARQ-ACK information for one activated SPS PDSCH reception based on *downlinkHARQ-FeedbackDisabled* if provided [12, TS 38.331], including the ones associated with the corresponding activation DCI, in the PUCCH in slot , the UE generates one HARQ-ACK information bit associated with the SPS PDSCH reception and appends it to the HARQ-ACK information bits.

If a UE is configured to receive SPS PDSCH and the UE multiplexes HARQ-ACK information for multiple activated SPS PDSCH receptions, including the ones associated with the corresponding activation DCI and excluding the ones that provide only transport blocks for HARQ processes associated with disabled HARQ-ACK information if *downlinkHARQ-FeedbackDisabled* is provided, in the PUCCH in slot , the UE generates the HARQ-ACK information as described in clause 9.1.2 and appends it to the HARQ-ACK information bits.

The UE generates HARQ-ACK information with ACK value in response to a detection of a DCI format that does not trigger a Type-3 HARQ-ACK codebook report and has associated HARQ-ACK information without scheduling a PDSCH reception.

\*\*\* Unchanged text omitted \*\*\*

If a UE is

- not provided *PDSCH-CodeBlockGroupTransmission* for any serving cell, or

- not provided *pdsch-TimeDomainAllocationListForMultiPDSCH* for any serving cell, or

- provided *pdsch-TimeDomainAllocationListForMultiPDSCH* and *nrofHARQ-BundlingGroups* with for a serving cell

for PDSCH receptions scheduled by a DCI format that does not support CBG-based PDSCH receptions, or for SPS PDSCH reception, or for a DCI format having associated HARQ-ACK information without scheduling PDSCH reception, and if , the UE determines a number of HARQ-ACK information bits for obtaining a transmission power for a PUCCH, as described in clause 7.2.1, as

where

\*\*\* Unchanged text omitted \*\*\*

-  if the value of *maxNrofCodeWordsScheduledByDCI* is 2 for any serving cell and *harq-ACK-SpatialBundlingPUCCH* is not provided for G-RNTI or G-CS-RNTI ; otherwise, .

- or , for G-RNTI or G-CS-RNTI , is

- if *harq-ACK-SpatialBundlingPUCCH* is not provided, the number of transport blocks the UE receives in a PDSCH, or the number of transport block groups the UE receives in PDSCHs if *nrofHARQ-BundlingGroups* with is provided, scheduled by a DCI format that the UE detects in PDCCH monitoring occasion for serving cell

- else if *harq-ACK-SpatialBundlingPUCCH* is provided, the number of PDSCHs, or the number of PDSCH groups if *nrofHARQ-BundlingGroups* with is provided, scheduled by a DCI format that the UE detects in PDCCH monitoring occasion for serving cell

- else, the number of DCI formats that the UE detects and have associated a HARQ-ACK information without scheduling PDSCH reception in PDCCH monitoring occasion for serving cell .

- or , for G-RNTI or G-CS-RNTI , is the number of SPS PDSCH receptions by the UE on serving cell for which the UE transmits corresponding HARQ-ACK information in the same PUCCH as for HARQ-ACK information corresponding to PDSCH receptions within the or PDCCH monitoring occasions, respectively.

\*\*\* Unchanged text omitted \*\*\*

If a UE is provided *nrofHARQ-BundlingGroups* and is not provided *harq-ACK-SpatialBundlingPUCCH* for a serving cell , the UE generates HARQ-ACK information over transport block groups (TBGs) for PDSCH receptions where, for a maximum number of PDSCH receptions scheduled by a DCI format on the serving cell, a maximum number of TBGs is provided by *nrofHARQ-BundlingGroups*. If the UE detects a DCI format scheduling PDSCH receptions on the serving cell , the UE generates HARQ-ACK information bits for the first TBs and, if applicable, generates HARQ-ACK information bits for the second TBs as described in clause 9.1.1 by setting and . For a TBG associated with at least one PDSCH that does not overlap with an UL symbol indicated by *tdd-UL-DL-ConfigurationCommon*,or by *tdd-UL-DL-ConfigurationDedicated* if provided, the UE assumes that TB(s) provided by a PDSCH that overlaps with an UL symbol indicated by *tdd-UL-DL-ConfigurationCommon*,or by *tdd-UL-DL-ConfigurationDedicated* if provided, are correctly received. For a TBG associated only with PDSCHs that overlap with UL symbols indicated by *tdd-UL-DL-ConfigurationCommon*,or by *tdd-UL-DL-ConfigurationDedicated* if provided, the UE generates a NACK value for the TBG.

If a UE is provided *nrofHARQ-BundlingGroups* and *harq-ACK-SpatialBundlingPUCCH* for a serving cell , the UE generates HARQ-ACK information over PDSCH reception groups for PDSCH receptions scheduled by a DCI format on the serving cell where a maximum number of PDSCH reception groups, , is provided by *nrofHARQ-BundlingGroups*. If the UE detects a DCI format scheduling PDSCH receptions on the serving cell , the UE generates HARQ-ACK information bits for the PDSCH receptions as described in clause 9.1.1 by setting and , after binary AND operation of the HARQ-ACK information bits corresponding to the first and second transport blocks of each PDSCH reception. For a PDSCH reception group associated with at least one PDSCH that does not overlap with an UL symbol indicated by *tdd-UL-DL-ConfigurationCommon*,or by *tdd-UL-DL-ConfigurationDedicated* if provided, the UE assumes that TBs provided by a PDSCH that overlaps with an UL symbol indicated by *tdd-UL-DL-ConfigurationCommon*,or by *tdd-UL-DL-ConfigurationDedicated* if provided, are correctly received. For a PDSCH reception group associated only with PDSCHs that overlap with UL symbols indicated by *tdd-UL-DL-ConfigurationCommon*,or by *tdd-UL-DL-ConfigurationDedicated* if provided, the UE generates a NACK value for the PDSCH reception group.

If a UE

- is provided *pdsch-TimeDomainAllocationListForMultiPDSCH* and, if provided, *nrofHARQ-BundlingGroups* with value for serving cells; and

- is not provided *pdsch-TimeDomainAllocationListForMultiPDSCH* or is provided *nrofHARQ-BundlingGroups* with value , for serving cells where

the UE determines the according to the previous pseudo-code with the following modifications

- is used for the determination of a first HARQ-ACK sub-codebook for

- SPS PDSCH reception,

- any DCI format having associated HARQ-ACK information without scheduling PDSCH reception, and

- PDSCH reception scheduled by a DCI format scheduling one PDSCH

- PDSCH reception with for TBG-based HARQ-ACK information on the serving cells,

- is replaced by for the determination of a second HARQ-ACK sub-codebook corresponding to the serving cells for TBG-based HARQ-ACK information, or for TB-based HARQ-ACK information corresponding to multiple PDSCH receptions scheduled by a single DCI format, and

- if, for an active DL BWP of a serving cell, the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode* = *joint,* the serving cell is counted as two times where the first time corresponds to the first CORESETs and the second time corresponds to the second CORESETs, and

- instead of generating one or two HARQ-ACK information bits per PDSCH for a serving cell from the serving cells, the UE generates HARQ-ACK information bits for the PDSCH receptions scheduled by a DCI format, where is the maximum value between across all serving cells if the UE is provided *nrofHARQ-BundlingGroups*, and across all serving cells where the UE is not provided *nrofHARQ-BundlingGroups*, and is the value of *maxNrofCodeWordsScheduledByDCI* for serving cell if *harq-ACK-SpatialBundlingPUCCH* is not provided; else, . If for a serving cell where the UE is provided *nrofHARQ-BundlingGroups*, it is , the UE generates NACK for the last HARQ-ACK information bits for serving cell . If for a serving cell where the UE is not provided *nrofHARQ-BundlingGroups*, it is , the UE generates NACK for the last HARQ-ACK information bits for serving cell .

- The pseudo-code operation when *PDSCH-CodeBlockGroupTransmission* is provided is not applicable.

- The counter DAI value and the total DAI value apply separately for each HARQ-ACK sub-codebook.

- The UE generates the HARQ-ACK codebook by appending the second HARQ-ACK sub-codebook to the first HARQ-ACK sub-codebook.

If and , the UE also determines for obtaining a PUCCH transmission power, as described in clause 7.2.1, with

where

- if , is the value of the counter DAI in the last DCI format scheduling more than one PDSCH receptions for any serving cell from the serving cells with TBG-based HARQ-ACK information or with TB-based HARQ-ACK information that the UE detects within the PDCCH monitoring occasions

- if , is the value of the total DAI in the last DCI format scheduling more than one PDSCH receptions with TBG-based HARQ-ACK information or with TB-based HARQ-ACK information for any serving cell from the serving cells that the UE detects within the PDCCH monitoring occasions

- , if the UE does not detect any DCI format scheduling more than one PDSCH receptions with TBG-based HARQ-ACK information or with TB-based HARQ-ACK information for any serving cell from the serving cells in any of the PDCCH monitoring occasions

- is the total number of DCI formats scheduling more than one PDSCH receptions with TBG-based HARQ-ACK information or with TB-based HARQ-ACK information for any serving cell from the serving cells that the UE detects within the PDCCH monitoring occasions for serving cell . if the UE does not detect any DCI format scheduling more than one PDSCH receptions for serving cell in any of the PDCCH monitoring occasions

- if *harq-ACK-SpatialBundlingPUCCH* is provided,

- if *nrofHARQ-BundlingGroups* is provided, is the number of PDSCH groups that include at least one PDSCH not overlapping with a UL symbol indicated by *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* if provided, that the UE receives in serving cell from the serving cells in PDCCH monitoring occasion and the UE reports corresponding HARQ-ACK information in the PUCCH

- if *nrofHARQ-BundlingGroups* is not provided, is the number of PDSCHs that the UE receives in serving cell from the serving cells in PDCCH monitoring occasion and the UE reports corresponding HARQ-ACK information in the PUCCH

- if harq-ACK-SpatialBundlingPUCCH is not provided,

- if *nrofHARQ-BundlingGroups* is provided, is the number of TBGs including at least one PDSCH not overlapping with an UL symbol indicated by *tdd-UL-DL-ConfigurationCommon*, or by *tdd-UL-DL-ConfigurationDedicated* if provided, that the UE receives in serving cell from the serving cells in PDCCH monitoring occasion and the UE reports corresponding HARQ-ACK information in the PUCCH

- if *nrofHARQ-BundlingGroups* is not provided, is the number of transport blocks in PDSCHs that the UE receives in serving cell from the serving cells in PDCCH monitoring occasion and the UE reports corresponding HARQ-ACK information in the PUCCH.

\*\*\* Unchanged text omitted \*\*\*

9.1.4 Type-3 HARQ-ACK codebook determination

If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback*, the UE determines HARQ-ACK information bits, for a total number of HARQ-ACK information bits, of a Type-3 HARQ-ACK codebook according to the following procedure. If the UE is provided *pdsch-HARQ-ACK-EnhType3ToAddModList* and a DCI format scheduling PDSCH reception and triggering the Type-3 HARQ-ACK codebook includes an enhanced Type 3 codebook indicator field that provides a value for *pdsch-HARQ-ACK-EnhType3Index*, the UE determines a size of a set of indicated serving cells and a size of a set of indicated numbers of HARQ processes for each indicated serving cell and each indicated HARQ process number from the entry in *pdsch-HARQ-ACK-EnhType3ToAddModList* corresponding to the *pdsch-HARQ-ACK-EnhType3Index* value. If the DCI format does not include the enhanced Type 3 codebook indicator field, the *pdsch-HARQ-ACK-EnhType3Index* value is zero.

\*\*\* Unchanged text omitted \*\*\*

If

- a UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, and

- the CRC of the DCI is scrambled by a C-RNTI or an MCS-C-RNTI, and

- *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in the DCI format are equal to 0, or

- *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in the DCI format are equal to 1, or

- *resourceAllocation = dynamicSwitch* and all bits of the frequency domain resource assignment field in the DCI format are equal to 0 or 1

the DCI format provides a request for a Type-3 HARQ-ACK codebook report and does not schedule a PDSCH reception. If the UE is provided *pdsch-HARQ-ACK-EnhType3ToAddModList* and the DCI format includes an enhanced Type 3 codebook indicator field that provides a value for *pdsch-HARQ-ACK-EnhType3Index*, the UE determines a number of indicated serving cells and a number of indicated HARQ processes for each indicated serving cell from the entry in *pdsch-HARQ-ACK-EnhType3ToAddModList* corresponding to the *pdsch-HARQ-ACK-EnhType3Index* value. If the DCI format does not include the enhanced Type 3 codebook indicator field, the *pdsch-HARQ-ACK-EnhType3Index* value is provided by the value of MCS field in the DCI format. The UE is expected to provide HARQ-ACK information in response to the request for the Type-3 HARQ-ACK codebook after symbols from the last symbol of a PDCCH providing the DCI format, where the value of for is provided in clause 10.2 by replacing "SPS PDSCH release" with "DCI format".

If a UE multiplexes HARQ-ACK information in a PUSCH transmission, the UE generates the HARQ-ACK codebook as described in this clause except that *harq-ACK-SpatialBundlingPUCCH* is replaced by *harq-ACK-SpatialBundlingPUSCH*.

\*\*\* Unchanged text is omitted \*\*\*

### 9.2.1 PUCCH Resource Sets

If a UE does not have dedicated PUCCH resource configuration, provided by *PUCCH-ResourceSet* in *PUCCH-Config*, a PUCCH resource set is provided by *pucch-ResourceCommon* through an index to a row of Table 9.2.1-1 for transmission of HARQ-ACK information on PUCCH in an initial UL BWP of PRBs. For operation in FR2-2, *nrofPRBs* provided in *PUCCH-ConfigCommon* can also provide a number of RBs for the PUCCH resource set; otherwise .

The PUCCH resource set includes sixteen resources, each corresponding to a PUCCH format, a first symbol, a duration, a PRB offset , and a cyclic shift index set for a PUCCH transmission.

\*\*\* Unchanged text is omitted \*\*\*

9.2.2 PUCCH Formats for UCI transmission

<omitted>

A spatial setting for a PUCCH transmission by a UE is provided by

- an indicated *TCI-State* or *TCI-UL-State*, if provided, as described in [6, TS 38.214];

- *PUCCH-SpatialRelationInfo* if the UE is configured with a single value for *pucch-SpatialRelationInfoId*;

- as described in [11, TS 38.321], if the UE is provided multiple values for *PUCCH-SpatialRelationInfo*. The UE applies corresponding actions in [11, TS 38.321] and a corresponding setting for a spatial domain filter to transmit PUCCH in the first slot that is after slot where is the slot where the UE would transmit a PUCCH with HARQ-ACK information with ACK value corresponding to a PDSCH reception providing the *PUCCH-SpatialRelationInfo*, each slot consists of symbols as defined in [4, TS 38.211],and is the SCS configuration for the PUCCH

- If *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *ssb-Index*, the UE transmits the PUCCH using a same spatial domain filter as for a reception of a SS/PBCH block with index provided by *ssb-Index* for a same serving cell or, if *servingCellId* is provided, for a serving cell indicated by *servingCellId*

- else if *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *csi-RS-Index*, or the indicated *TCI-State* provides *csi-rs* configured with *qcl-Type* set to 'typeD', the UE transmits the PUCCH using a same spatial domain filter as for a reception of a CSI-RS with resource index provided by *csi-RS-Index* or csi-rs for a same serving cell or, if *servingCellId* or *cell* is provided, for a serving cell indicated by *servingCellId* or *cell*

- else *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *srs*, the UE transmits the PUCCH using a same spatial domain filter as for a transmission of a SRS with resource index provided by *resource* for a same serving cell and/or active UL BWP or, if *servingCellId* and/or *uplinkBWP* are provided, for a serving cell indicated by *servingCellId* and/or for an UL BWP indicated by *uplinkBWP*

\*\*\* Unchanged text is omitted \*\*\*

### 9.2.3 UE procedure for reporting HARQ-ACK

\*\*\* Unchanged text is omitted \*\*\*

For DCI format 1\_0, the PDSCH-to-HARQ\_feedback timing indicator field values map to {1, 2, 3, 4, 5, 6, 7, 8} for SCS configuration of PUCCH transmission , to {7, 8, 12, 16, 20, 24, 28, 32} for , and to {13, 16, 24, 32, 40, 48, 56, 64} for . For a unicast DCI format, other than DCI format 1\_0 or requesting Type-3 HARQ-ACK codebook report without scheduling a PDSCH reception as described in clause 9.1.4, the PDSCH-to-HARQ\_feedback timing indicator field values, if present, map to values for a set of number of slots provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, or *dl-DataToUL-ACK-DCI-1-2*, or *dl-DataToUL-ACK-r17,* or *dl-DataToUL-ACK-DCI-1-2-r17* as defined in Table 9.2.3-1. If the DCI format indicates a cell for the PUCCH transmission, as described in clause 9.A, the PDSCH-to-HARQ\_feedback timing indicator field value maps to slots of the active UL BWP of the cell; otherwise, the PDSCH-to-HARQ\_feedback timing indicator field value maps to slots of the active UL BWP of the PCell. For DCI format 4\_1, the PDSCH-to-HARQ\_feedback timing indicator field values are provided by *dl-DataToUL-ACK-MulticastDCI-Format4-1* or, if *dl-DataToUL-ACK-MulticastDCI-Format4-1* is not provided, by {1, 2, 3, 4, 5, 6, 7, 8}. For DCI format 4\_2, the PDSCH-to-HARQ\_feedback timing indicator field values are provided by *dl-DataToUL-ACK* from *pucch-ConfigMulticast1/pucch-ConfigurationListMulticast1* or *pucch-ConfigMulticast2/pucch-ConfigurationListMulticast2.*

If the UE is provided *subslotLengthForPUCCH*, is the last UL slot for PUCCH transmission that overlaps with a PDSCH reception or with a PDCCH reception providing a DCI format having associated HARQ-ACK information without scheduling a PDSCH reception; otherwise, is the last UL slot for PUCCH transmission that overlaps with the DL slot for the PDSCH reception or with the DL slot for the PDCCH reception in case of a DCI format that triggers a HARQ-ACK information report and does not schedule a PDSCH reception.

For a SPS PDSCH reception ending in DL slot , the UE transmits the PUCCH in UL slot where is provided by the PDSCH-to-HARQ\_feedback timing indicator field, if present, in a DCI format activating the SPS PDSCH reception.

If the UE detects a DCI format that does not include a PDSCH-to-HARQ\_feedback timing indicator field and schedules a PDSCH reception or activates a SPS PDSCH reception ending in DL slot , the UE provides corresponding HARQ-ACK information in a PUCCH transmission within UL slot where is provided by *dl-DataToUL-ACK*, or *dl-DataToUL-ACK-r16*, or *dl-DataToUL-ACK-DCI-1-2*, or *dl-DataToUL-ACK-r17*, or *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1*.

If the UE detects a DCI format scheduling a number of PDSCH receptions ending in DL slot  or if the UE detects a DCI format generating a HARQ-ACK information bit and does not schedule a PDSCH reception through a PDCCH reception ending in DL slot , the UE provides corresponding HARQ-ACK information in a PUCCH transmission within UL slot , where is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, or *dl-DataToUL-ACK-DCI-1-2*, or *dl-DataToUL-ACK-r17*, or *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1*.

A PUCCH transmission with HARQ-ACK information is subject to the limitations for UE transmissions described in clause 11.1 and clause 11.1.1.

Table 9.2.3-1: Mapping of PDSCH-to-HARQ\_feedback timing indicator field values to numbers of slots

|  |  |
| --- | --- |
| PDSCH-to-HARQ\_feedback timing indicator  | Number of slots  |
| 1 bit | 2 bits | 3 bits |  |
| '0' | '00' | '000' | 1st value provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, *dl-DataToUL-ACK-DCI-1-2*, *dl-DataToUL-ACK-r17*, *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1*  |
| '1' | '01' | '001' | 2nd value provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, *dl-DataToUL-ACK-DCI-1-2*, *dl-DataToUL-ACK-r17*, *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1* |
|  | '10' | '010' | 3rd value provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, *dl-DataToUL-ACK-DCI-1-2*, *dl-DataToUL-ACK-r17*, *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1* |
|  | '11' | '011' | 4th value provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, *dl-DataToUL-ACK-DCI-1-2*, *dl-DataToUL-ACK-r17*, *dl-DataToUL-ACK-DCI-1-2-r17*, *dl-DataToUL-ACK-MulticastDCI-Format4-1* |
|  |  | '100' | 5th value provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, *dl-DataToUL-ACK-DCI-1-2*, *dl-DataToUL-ACK-r17*, *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1* |
|  |  | '101' | 6th value provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, *dl-DataToUL-ACK-DCI-1-2*, *dl-DataToUL-ACK-r17*, *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1* |
|  |  | '110' | 7th value provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, *dl-DataToUL-ACK-DCI-1-2*, *dl-DataToUL-ACK-r17*, *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1* |
|  |  | '111' | 8th value provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, *dl-DataToUL-ACK-DCI-1-2*, *dl-DataToUL-ACK-r17*, *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1* |

For a PUCCH transmission with HARQ-ACK information, a UE determines a PUCCH resource on the cell of the PUCCH transmission, as described in clause 9.A, after determining a set of PUCCH resources for HARQ-ACK information bits, as described in clause 9.2.1. The PUCCH resource determination is based on a PUCCH resource indicator field [5, TS 38.212], if present, in a last DCI format, excluding the SPS activation DCI, among the DCI formats that have a value of a PDSCH-to-HARQ\_feedback timing indicator field, if present, or a value of *dl-DataToUL-ACK*, or *dl-DataToUL-ACK-r16*, or *dl-DataToUL-ACK-DCI-1-2*, or *dl-DataToUL-ACK-r17,* or *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1*, indicating a same slot for the PUCCH transmission, that the UE detects and for which the UE transmits corresponding HARQ-ACK information in the PUCCH. For PUCCH resource determination, detected DCI formats are first indexed in an ascending order across serving cells indexes for a same PDCCH monitoring occasion and are then indexed in an ascending order across PDCCH monitoring occasion indexes. For indexing DCI formats within a serving cell for a same PDCCH monitoring occasion, if the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs on an active DL BWP of a serving cell, and with *ackNackFeedbackMode* = *joint* for the active UL BWP, detected DCI formats from PDCCH receptions in the first CORESETs are indexed prior to detected DCI formats from PDCCH receptions in the second CORESETs.

The PUCCH resource indicator field values map to values of a set of PUCCH resource indexes, as defined in Table 9.2.3-2 for a PUCCH resource indicator field of 3 bits, provided by *resourceList* for PUCCH resources from a set of PUCCH resources provided by *PUCCH-ResourceSet* with a maximum of eight PUCCH resources. If the PUCCH resource indicator field includes 1 bit or 2 bits, the values map to the first two values or the first four values, respectively, of Table 9.2.3-2. If the last DCI format does not include a PUCCH resource indicator field, the first value of Table 9.2.3-2 is used.

For the first set of PUCCH resources and when the size of *resourceList* is larger than eight, when a UE provides HARQ-ACK information in a PUCCH transmission in response to detecting a last DCI format in a PDCCH reception, among DCI formats with a value of the PDSCH-to-HARQ\_feedback timing indicator field, if present, or a value of *dl-DataToUL-ACK*, or *dl-DataToUL-ACK-r16*, or *dl-DataToUL-ACK-DCI-1-2*, or *dl-DataToUL-ACK-r17,* or *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDCI-Format4-1*, indicating a same slot for the PUCCH transmission, the UE determines a PUCCH resource with index , , as

\*\*\* Unchanged text is omitted \*\*\*

## 10.1 UE procedure for determining physical downlink control channel assignment

\*\*\* Unchanged text is omitted \*\*\*

- a Type2A-PDCCH CSS set configured by *peiSearchSpace* in *DownlinkConfigCommonSIB* for a DCI format 2\_7 with CRC scrambled by a PEI-RNTI on the primary cell of the MCG

- a Type3-PDCCH CSS set configured by

- *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common* for DCI formats with CRC scrambled by INT-RNTI, SFI-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, TPC-SRS-RNTI, or CI-RNTI and, only for the primary cell, C-RNTI, MCS-C-RNTI, CS-RNTI(s), or PS-RNTI, or

- *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI, or

- *searchSpaceMCCH* and *searchSpaceMTCH* on a secondary cell for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI, and

- a USS set configured by

\*\*\* Unchanged text is omitted \*\*\*

If the active DL BWP and the initial DL BWP for a UE have same SCS and same CP length and the active DL BWP includes all RBs of the CORESET with index 0, or the active DL BWP is the initial DL BWP, or the active DL BWP includes all RBs of an MBS frequency resource provided by *cfr-ConfigMCCH-MTCH* as described in clause 18, the CORESET configured for Type0-PDCCH CSS set has CORESET index 0 and the Type0-PDCCH CSS set has search space set index 0.

If the active DL BWP and an MBS frequency resource provided by *cfr-ConfigMCCH-MTCH* for a UE have same SCS and same CP length and the active DL BWP includes all RBs of the MBS frequency resource, and if the UE is provided *searchSpaceMCCH* or *searchSpaceMTCH* for Type0B-PDCCH CSS set on the primary cell or for Type3-PDCCH CSS set on a secondary cell, the UE monitors PDCCH for detection of broadcast DCI formats, as described in clause 18, on the active DL BWP.

\*\*\* Unchanged text is omitted \*\*\*

If a UE monitors PDCCH candidates for DCI formats with CRC scrambled by a C-RNTI and the UE is provided a non-zero value for *searchSpaceID* in *PDCCH-ConfigCommon* for a Type0/0A/2-PDCCH CSS set, or monitors PDCCH candidates for DCI formats with CRC scrambled by a MCCH-RNTI or a G-RNTI and the UE is provided a non-zero value for *searchSpaceMCCH* and *searchSpaceMTCH* in *PDCCH-ConfigCommon* for a Type0/0B-PDCCH CSS set, the UE determines monitoring occasions for PDCCH candidates of the Type0/0A/2-PDCCH CSS set, or of the Type0/0B-PDCCH set, respectively, based on the search space set associated with the value of *searchSpaceID*.

\*\*\* Unchanged text is omitted \*\*\*

For a CORESET with index 0,

- if the UE is provided *TCI-State* and if *followUnifiedTCIstate* = '*enabled*' for the CORESET, the UE assumes that a DM-RS antenna port for PDCCH receptions in the CORESET and a DM-RS antenna port for PDSCH receptions scheduled by DCI formats provided by PDCCH receptions in the CORESET are quasi co-located with the reference signals provided by the indicated *TCI-State* [6, TS 38.214]

- else, the UE assumes that a DM-RS antenna port for PDCCH receptions in the CORESET is quasi co-located with

- the one or more DL RS configured by a TCI state, where the TCI state is indicated by a MAC CE activation command for the CORESET, if any, or

- a SS/PBCH block the UE identified during a most recent random access procedure not initiated by a PDCCH order that triggers a contention-free random access procedure, if no MAC CE activation command indicating a TCI state for the CORESET is received after the most recent random access procedure, or a SS/PBCH block the UE identified during a most recent configured grant PUSCH transmission as described in clause 19.

For a CORESET other than a CORESET with index 0, if a UE is provided a single TCI state for a CORESET, or if the UE receives a MAC CE activation command for one or two of the provided TCI states for a CORESET, the UE assumes that the DM-RS antenna port associated with PDCCH receptions in the CORESET is quasi co-located with the one or more DL RS configured by the TCI states. For a CORESET with index 0, the UE expects that a CSI-RS configured with *qcl-Type* set to 'typeD' in a TCI state indicated by a MAC CE activation command for the CORESET is provided by a SS/PBCH block

- if the UE receives a MAC CE activation command for one of the TCI states, the UE applies the activation command in the first slot that is after slot where is the slot where the UE would transmit a PUCCH with HARQ-ACK information for the PDSCH providing the activation command, is the SCS configuration for the PUCCH in the slot when the activation command is applied, and is a number of slots for SCS configuration provided by *kmac* or if *kmac* is not provided.

If a UE is provided *TCI-State* in *dl-OrJoint-TCIStateList*, a DM-RS antenna port for PDCCH receptionsin a CORESET, other than a CORESET with index 0, associated only with USS sets and/or Type3-PDCCH CSS sets, and a DM-RS antenna port for PDSCH receptions scheduled by DCI formats provided by PDCCH receptions in the CORESET are quasi co-located with reference signals provided by the indicated *TCI-State* [6, TS 38.214].

If a UE is provided *followUnifiedTCIstate* for a CORESET, other than a CORESET with index 0, associated at least with CSS sets other than Type3-PDCCH CSS sets, and if *followUnifiedTCIstate* is set as enabled, a DM-RS antenna port for PDCCH receptions in the CORESET and a DM-RS antenna port for PDSCH receptions scheduled by DCI formats provided by PDCCH receptions in the CORESET are quasi co-located with reference signals provided by the indicated *TCI-State*.

\*\*\* Unchanged text is omitted \*\*\*

A UE does not expect to be configured CSS sets, except for CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI, that result to corresponding total, or per scheduled cell, numbers of monitored PDCCH candidates and non-overlapped CCEs per slot, per group of slots for a corresponding combination , or per span that exceed the corresponding maximum numbers per slot, or per group of slots for a corresponding combination , or per span, respectively.

\*\*\* Unchanged text is omitted \*\*\*

In the following pseudocode, if the UE is provided *monitoringCapabilityConfig* = *r17monitoringcapability* for the primary cell,and are replaced by and respectively, and and are replaced by and respectively.

For all search space sets that a UE monitors PDCCH on the primary cell within a slot , or within a group of slots for a corresponding combination , or within a span in slot , denote by a set of CSS sets, except for CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI, with cardinality of and by a set of USS sets and CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI with cardinality of for scheduling on the primary cell. The location of search space sets , , in is according to an ascending order of the search space set index.

\*\*\* Unchanged text is omitted \*\*\*

If a UE

- is configured for single cell operation or for operation with carrier aggregation in a same frequency band,

- monitors PDCCH candidates in overlapping PDCCH monitoring occasions in multiple CORESETs that have been configured with same or different *qcl-Type* set to 'typeD' properties on active DL BWP(s) of one or more cells, and

- is provided *twoQCLTypeDforPDCCHRepetition*

the UE monitors PDCCHs only in a first CORESET with *qcl-Type* set to first 'typeD' properties and, if any, in a second CORESET with *qcl-Type* set to second 'typeD' properties that are different than the first 'typeD' properties, and in any other CORESET from the multiple CORESETs with corresponding *qcl-Type* set to either the first 'typeD' properties or to the second 'typeD' properties

- the first CORESET corresponds to the CSS set with the lowest index in the cell with the lowest index containing CSS sets, if any; otherwise, to the USS set with the lowest index in the cell with lowest index

- excluding CSS sets and USS sets associated with CORESETs with *qcl-Type* set to first 'typeD' properties, the second CORESET corresponds to the CSS set with the lowest index in the cell with the lowest index containing CSS sets, if any; otherwise, to the USS set with the lowest index in the cell with lowest index, where the CSS set or the USS set includes *searchSpaceLinkingId* with same value as any CSS set or any USS set associated with CORESETs with *qcl-Type* set to first 'typeD' properties

- the lowest USS set index is determined over all USS sets with at least one PDCCH candidate in overlapping PDCCH monitoring occasions

If a UE

- is configured for single cell operation or for operation with carrier aggregation in a same frequency band,

- monitors PDCCH candidates in overlapping PDCCH monitoring occasions in multiple CORESETs that have been configured with same or different *qcl-Type* set to 'typeD' properties on active DL BWP(s) of one or more cells,

- one or more CORESETs have two activated TCI states, and

- reports *sfn-QCL-TypeD-Collision-twoTCI*

the UE monitors PDCCHs only in a CORESET with a first *qcl-Type* set to first 'typeD' properties and, if any, a second *qcl-Type* set to second 'typeD' properties that are different than the first 'typeD' properties, and in any other CORESET from the multiple CORESETs with corresponding *qcl-Type* set to the first 'typeD' properties and/or to the second 'typeD' properties

- the CORESET corresponds to the CSS set with the lowest index in the cell with the lowest index containing CSS, if any; otherwise, to the USS set with the lowest index in the cell with lowest index

- the lowest USS set index is determined over all USS sets with at least one PDCCH candidate in overlapping PDCCH monitoring occasions

\*\*\* Unchanged text is omitted \*\*\*

If a UE is provided *resourceBlocks* and s*ymbolsInResourceBlock* in *RateMatchPattern* of *pdsch-ConfigMulticast*, or if the UE is additionally provided *periodicityAndPattern* in *RateMatchPattern* of *pdsch-ConfigMulticast*, the UE can determine a set of RBs in symbols of a slot that are not available for PDSCH reception scheduled by a multicast DCI format. If a PDCCH candidate that provides a multicast DCI format is mapped to one or more REs that overlap with REs of any RB in the set of RBs in symbols of the slot, the UE does not expect to monitor the PDCCH candidate.

A UE does not expect to be configured with *dci-FormatsSL* and *dci-FormatsExt* in a same USS.

### 10.1.1 Self-carrier and cross-carrier scheduling on the primary cell

A UE can be configured for scheduling on the primary cell from the primary cell and from a secondary cell [12, TS 38.331]. The UE is either not provided *monitoringCapabilityConfig* for the primary cell or for the secondary cell, or the UE is provided only *monitoringCapabilityConfig* = *r15monitoringcapability* for the primary cell and for the secondary cell. The UE is not provided *coresetPoolIndex* on the primary cell or on the secondary cell.

The SCS configuration for the active DL BWP on the primary cell is smaller than or equal to the SCS configuration for the active DL BWP on the secondary cell.

If a UE indicates capability *disablingScalingFactorDeactSCell* [18, TS 38.306] and the secondary cell is deactivated, or if the UE indicates capability *disablingScalingFactorDormantSCell* [18, TS 38.306] and the active DL BWP of the secondary cell is a dormant DL BWP for the UE, applies for the procedures described in the remaining of this clause. If , the UE determines and , and determines and , by including the primary cell only in the downlink cells in , as described in clause 10.1. If , the UE determines and by including the primary cell once in the downlink cells in , as described in clause 10.1.

\*\*\* Unchanged text is omitted \*\*\*

## 10.4 Search space set group switching and skipping of PDCCH monitoring

\*\*\* Unchanged text is omitted \*\*\*

A UE can be provided group indexes for a Type3-PDCCH CSS set or USS set by *searchSpaceGroupIdList-r17* for PDCCH monitoring on an active DL BWP of a serving cell and, if the UE is not provided *PDCCHSkippingDurationList* for the active DL BWP of the serving cell, a DCI format 0\_1 and a DCI format 0\_2 that schedule PUSCH transmissions and a DCI format 1\_1 and a DCI format 1\_2 that schedule PDSCH receptions can include a PDCCH monitoring adaptation field of 1 bit or of 2 bits for the serving cell.

If the field has 1 bit and for PDCCH monitoring by the UE according to Type3-PDCCH CSS sets or USS sets on the active DL BWP of the serving cell

- a '0' value for the bit indicates start of PDCCH monitoring according to search space sets with group index 0 and stop of PDCCH monitoring according to search space sets with other group indexes, if any

- a '1' value for the bit indicates start of PDCCH monitoring according to search space sets with group index 1 and stop of PDCCH monitoring according to search space sets with other group indexes, if any, and the UE sets the timer value to the one provided by *searchSpaceSwitchTimer-r17*, if provided

If the field has 2 bits and for PDCCH monitoring by the UE according to Type3-PDCCH CSS sets or USS sets on the active DL BWP of the serving cell

- a '00' value for the bit indicates start of PDCCH monitoring according to search space sets with group index 0 and stop of PDCCH monitoring according to search space sets with other group indexes, if any

- a '01' value for the bit indicates start of PDCCH monitoring according to search space sets with group index 1 and stop of PDCCH monitoring according to search space sets with other group indexes, if any, and the UE sets the timer value to the one provided by *searchSpaceSwitchTimer-r17*, if provided

- a '10' value for the bit indicates start of PDCCH monitoring according to search space sets with group index 2 and stop of PDCCH monitoring according to search space sets with other group indexes, if any, and the UE sets the timer value to the one provided by *searchSpaceSwitchTimer-r17*, if provided

- a '11' value is reserved

A UE can be provided a set of durations by *PDCCHSkippingDurationList* and group indexes for a Type3-PDCCH CSS set or USS set by *searchSpaceGroupIdList-r17* for PDCCH monitoring on an active DL BWP of a serving cell and, a DCI format 0\_1 and a DCI format 0\_2 that schedule PUSCH transmissions, and a DCI format 1\_1 and a DCI format 1\_2 that schedule PDSCH receptions can include a PDCCH monitoring adaptation field of 2 bits.

If the set of durations includes one value and for PDCCH monitoring by the UE according to Type3-PDCCH CSS sets or USS sets on the active DL BWP of the serving cell

- a '00' value for the bits indicates start of PDCCH monitoring according to search space sets with group index 0 and stop of PDCCH monitoring according to search space sets with group index 1, if any

- a '01' value for the bits indicates start of PDCCH monitoring according to search space sets with group index 1 and stop of PDCCH monitoring according to search space sets with group index 0, if any, and the UE sets the timer value to the one provided by *searchSpaceSwitchTimer-r17*, if provided

- a '10' value for the bits indicates skipping PDCCH monitoring for a duration provided by the value in the set of durations

- a '11' value is reserved

If the set of durations includes two values and for PDCCH monitoring by the UE according to Type3-PDCCH CSS sets or USS sets on active DL BWP of the serving cell

- a '00' value for the bits indicates start of PDCCH monitoring according to search space sets with group index 0 and stop of PDCCH monitoring according to search space sets with group index 1, if any

- a '01' value for the bits indicates start of PDCCH monitoring according to search space sets with group index 1 and stop of PDCCH monitoring according to search space sets with group index 0, if any, and the UE sets the timer value to the one provided by *searchSpaceSwitchTimer-r17*, if provided

- a '10' value for the bits indicates skipping PDCCH monitoring for a duration provided by the first value in the set of durations

- a '11' value for the bits indicates skipping PDCCH monitoring for a duration provided by the second value in the set of durations

\*\*\* Unchanged text is omitted \*\*\*

## 10.4A PDCCH monitoring for early indication of paging

\*\*\* Unchanged text is omitted \*\*\*

A paging indication field of DCI format 2\_7 includes segments of bits, where . For a subgroup index , , a UE determines a value for the bit in the paging indication field, where is a paging occasion index, and , , , , and are defined in [17, TS 38.304]. When the value is '1', the UE monitors a paging occasion determined according to [17, TS 38.304]; otherwise, the UE is not required to monitor the paging occasion.

If , the number of symbols from the start of the frame to the start of the first PDCCH monitoring occasion for DCI format 2\_7 that is associated with paging occasion index is the -th value from the values provided by *firstPDCCH-MonitoringOccasionOfPEI-O*.

\*\*\* Unchanged text is omitted \*\*\*

## 11.1 Slot configuration

\*\*\* Unchanged text is omitted \*\*\*

For a UE operation with shared spectrum channel access in FR1, or in FR2-2 when the UE is provided *ChannelAccessMode2* = '*enabled*', if the UE is provided *csi-RS-ValidationWithDCI*, is not provided *CO-DurationsPerCell*, and is not provided *SlotFormatCombinationsPerCell*, and if the UE is configured by higher layers to receive a CSI-RS in a set of symbols of a slot, the UE cancels the CSI-RS reception in the set of symbols of the slot if the UE does not detect a DCI format indicating an aperiodic CSI-RS reception or scheduling a PDSCH reception in the set of symbols of the slot.

If a UE is provided *channelAccessMode ='dynamic'* and is provided *availableRB-SetsToAddModList* and *availableRB-SetsToReleaseList*, the UE expects to be provided *co-DurationsPerCellToAddModList* and *co-DurationsPerCellToReleaseList* and/or *slotFormatCombToAddModList* and *slotFormatCombToReleaseList*.

\*\*\* Unchanged text is omitted \*\*\*

For a UE operation with shared spectrum channel access in FR1, or in FR2-2 when the UE is provided *ChannelAccessMode2* = '*enabled*', if a UE is configured by higher layers to receive a CSI-RS and the UE is provided *CO-DurationsPerCell*, for a set of symbols of a slot that are indicated as downlink or flexible by *tdd-UL-DL-ConfigurationCommon* or *tdd*-*UL-DL-ConfigurationDedicated*, or when *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated* are not provided, the UE cancels the CSI-RS reception in the set of symbols of the slot that are not within the remaining channel occupancy duration.

If a UE is configured by higher layers to receive a DL PRS in a set of symbols of a slot and the UE detects a DCI format 2\_0 with a slot format value other than 255 that indicates a slot format with a subset of symbols from the set of symbols as uplink, or the UE detects a DCI format indicating to the UE to transmit PUSCH, PUCCH, SRS, or PRACH in at least one symbol in the set of the symbols, the UE cancels the DL PRS reception in the set of symbols of the slot.

### 11.1.1 UE procedure for determining slot format

\*\*\* Unchanged text is omitted \*\*\*

If neither *CO-DurationsPerCell* nor *SlotFormatCombinationsPerCell*are provided and if *channelAccessMode* = "*semiStatic*" is provided, the procedures in this clause apply with assuming a channel occupancy time defined in clause 4.3 of [15, TS 37.213] is the remaining channel occupancy duration if a DL transmission burst(s) is detected within the channel occupancy time.

A SFI-index field value in a DCI format 2\_0 indicates to a UE a slot format for each slot in a number of slots for each DL BWP or each UL BWP starting from a slot where the UE detects the DCI format 2\_0. The number of slots is equal to or larger than a PDCCH monitoring periodicity for DCI format 2\_0. The SFI-index field includes  bits where maxSFIindex is the maximum value of the values provided by corresponding *slotFormatCombinationId*. A slot format is identified by a corresponding format index as provided in Table 11.1.1-1 where 'D' denotes a downlink symbol, 'U' denotes an uplink symbol, and 'F' denotes a flexible symbol.

\*\*\* Unchanged text is omitted \*\*\*

# 14 Integrated access-backhaul operation

\*\*\* Unchanged text is omitted \*\*\*

If an IAB-node is provided an index in a Timing Delta MAC CE [11, TS 38.321] from a serving cell, the IAB-node may assume that is a time difference between a DU transmission of a signal from the serving cell and a reception of the signal by the IAB-MT when , where

- is the difference between the IAB-MT reception time and the IAB-MT transmission time for IAB-MT transmission timing mode 'Case-6', and is defined in clause 4.3.1 of [4, TS 38.211] for IAB-MT transmission timing mode 'Case-1' and parent node reception mode 'Case-7'

- and are determined as

- and , if the serving cell providing the Timing Delta MAC CE operates in FR1

- and , if the serving cell providing the Timing Delta MAC CE operates in FR2

The IAB node may assume that a same value of index is provided from a serving cell for the IAB-MT transmission timing modes 'Case-7' and 'Case-1'

The IAB-node may use the time difference to determine a DU transmission time.

For a serving cell of an IAB-MT, the IAB-MT can be provided by Timing Case Indication MAC CE [11, TS 38.321] an indication of the IAB-MT transmission timing mode in a slot. Upon reception of the Timing Case Indication for a serving cell in a TAG, the IAB-MT applies a same IAB-MT transmission timing mode in a slot on all serving cells in the TAG.

If the indicated IAB-MT transmission timing mode in a slot is set to 'Case-1', the IAB-MT transmission time is determined as for a "UE" in clause 4.2.

If the indicated IAB-MT transmission timing mode in a slot is set to 'Case-6', the IAB-node sets the IAB-MT transmission time to the transmission time of the IAB-DU.

If the indicated IAB-MT transmission timing mode in a slot is set to 'Case-7', the IAB-MT is provided a timing advance offset value for a serving cell by Case-7 Timing advance offset MAC CE [11, TS 38.321]. The IAB-MT determines its uplink transmission timing as where and are obtained as for a "UE" in clause 4.2 and where is provided by the Case-7 Timing advance offset MAC CE [11, TS 38.321].

A slot format for an IAB-DU or an IAB-MT includes downlink symbols, uplink symbols, and flexible symbols.

\*\*\* Unchanged text is omitted \*\*\*

With reference to slots of an IAB-DU cell, a symbol in a slot of an IAB-DU cell can be configured to be of hard, soft, or unavailable type by *HSNA Slot Configuration List* in *gNB-DU Cell Resource Configuration* [16, TS 38.473].

When a downlink, uplink, or flexible symbol is configured as hard, the IAB-DU cell can respectively transmit, receive, or either transmit or receive in the symbol. A symbol of a slot is equivalent to being configured as hard if an IAB-DU would transmit a SS/PBCH block, PDCCH for Type0-PDCCH CSS sets configured by *pdcchConfigSIB1*, or a periodic CSI-RS in the symbol of the slot, or would receive a PRACH or a SR in the symbol of the slot.

When a downlink, uplink, or flexible symbol is configured as soft, the IAB-DU cell can respectively transmit, receive or either transmit or receive in the symbol only if

- the IAB-MT does not transmit or receive during the symbol of the IAB-DU cell, or

- with respect to all serving cells, the IAB-MT would transmit or receive during the symbol of the IAB-DU cell, and the transmission or reception during the symbol of the IAB-DU cell is not changed due to a use of the symbol by the IAB-DU, or

- the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft symbol as available if the IAB-MT is not configured with an SCG, or

- the IAB-MT detects two DCI formats 2\_5 with an AI index field indicating the soft symbol as available from the MCG and SCG, respectively, or

- the IAB-MT detects a DCI format 2\_5 with an AI index field value indicating the soft symbol as available from one cell group and with respect to all serving cells of the other cell group

- the IAB-MT does not transmit or receive during the symbol of the IAB-DU cell, or

- the IAB-MT would transmit or receive during the symbol of the IAB-DU cell, and the transmission or reception during the symbol of the IAB-DU cell does not change due to a use of the symbol by the IAB-DU.

When the IAB-MT receives a DCI format 2\_5 from a serving cell in a cell group, the IAB-MT applies the information of the DCI format 2\_5 to all serving cells of the cell group.

When a symbol is configured as unavailable, the IAB-DU neither transmits nor receives in the symbol.

With reference to slots of an IAB-DU cell, the IAB-DU can be provided an indication of hard, soft or unavailable type per RB set for symbols configured as downlink, uplink or flexible in a slot by *Frequency-Domain HSNA Configuration List* [16, TS 38.473]. The RB set size and the number of RB sets are configured by *RB Set Configuration* [16, TS 38.473]. If an indication of hard, soft or unavailable type is not provided for an RB set of a symbol in a slot, the IAB-DU applies the configuration of hard, soft or unavailable type provided by *HSNA Slot Configuration List* in *gNB-DU Cell Resource Configuration* [16, TS 38.473] for the RB set of the symbol in the slot. If an indication of hard, soft, or unavailable type is provided for an RB set in a symbol of a slot, the IAB-DU applies the configuration of hard, soft, or unavailable type provided by *Frequency-Domain HSNA Configuration List* [16, TS 38.473] when the IAB-node uses simultaneous transmission and reception in the slot.

When an RB set of a downlink, uplink, or flexible symbol is configured as hard, the IAB-DU cell can respectively transmit, receive, or either transmit or receive on the RB set in the symbol. An RB set of a symbol is equivalent to being configured as hard if an IAB-DU would transmit a SS/PBCH block, PDCCH for Type0-PDCCH CSS sets configured by *pdcchConfigSIB1*, or a periodic CSI-RS in the RB set of the symbol, or would receive a PRACH or a SR in the RB set of the symbol.

\*\*\* Unchanged text is omitted \*\*\*

If an IAB-node is provided an AvailabilityIndicator, the IAB-node is provided an AI-RNTI by *ai-RNTI* and a payload size of a DCI format 2\_5 by *dci-PayloadSizeAI*. The IAB-node is also provided a search space set configuration, by *SearchSpace*, for monitoring PDCCH.

For each cell of an IAB-DU in a set of cells of the IAB-DU, the IAB-DU can be provided:

- an identity of the IAB-DU cell by *iab-DU-CellIdentity*

- a location of an availability indicator (AI) index field in DCI format 2\_5 by positionInDCI-AI or by positionInDCI-AI-r17

- a set of availability combinations by availabilityCombinationsor by availabilityCombinationsRBGroups, where each availability combination in the set of availability combinations includes

- resourceAvailability indicating availability of soft symbols in one or more slots for the IAB-DU cell, or one *resourceAvailability* indicating availability of soft resources in all RB sets in one or more slots for the IAB-DU cell, or one or multiple RB set groups by *rb-SetGroups* with each RB set group by *RB-SetGroup* indicating *resourceAvailability* for soft resources in one or more slots for the associated *rb-Sets*, and

- a mapping for the soft symbol, and/or for soft resources, availability combinations provided by *resource*Availability to a corresponding AI index field value in DCI format 2\_5 provided by availabilityCombinationId

The IAB-DU can assume a same SCS configuration for *availabilityCombinations* or availabilityCombinationsRBGroups for a cell as an SCS configuration provided by *gNB-DU Cell Resource Configuration* for the cell.

\*\*\* Unchanged text is omitted \*\*\*

#### 16.2.4.2 Simultaneous PSFCH transmission/reception

\*\*\* Unchanged text is omitted \*\*\*

If a UE

- would transmit PSFCHs and receive PSFCHs, and

- transmissions of the PSFCHs would overlap in time with receptions of the PSFCHs

the UE transmits or receives only a set of PSFCHs corresponding to the smallest priority field value, as determined by a first set of SCI format 1-A and/or a second set of SCI format 1-A [5, TS 38.212] that are respectively associated with PSFCHs with HARQ-ACK information from the PSFCHs and PSFCHs with HARQ-ACK information from the PSFCHs when one or more of the PSFCHs provide HARQ-ACK information. If none of the PSFCHs and none of the PSFCHs provide HARQ-ACK information, the UE transmits or receives only a set of PSFCHs corresponding to the smallest priority value of the first set of PSFCHs and the second set of PSFCHs that are respectively associated with the PSFCHs and the PSFCHs when the PSFCHs provide conflict information.

If a UE would transmit PSFCHs in a PSFCH transmission occasion, the UE first transmits PSFCHs with HARQ-ACK information from PSFCHs corresponding to the smallest priority field values from the priority field values, if any. Subsequently, the UE transmits remaining PSFCHs with conflict information corresponding to the smallest remaining priority field values from the priority field values, if any.

\*\*\* Unchanged text is omitted \*\*\*

### 16.3.0 UE procedure for transmitting PSFCH with control information

A UE can be indicated by an SCI format scheduling a PSSCH reception to transmit a PSFCH with HARQ-ACK information in response to the PSSCH reception. The UE provides HARQ-ACK information that includes ACK or NACK, or only NACK.

A UE can be provided, by *sl-PSFCH-Period*, a number of slots in a resource pool for a period of PSFCH transmission occasion resources. If the number is zero, PSFCH transmissions from the UE in the resource pool are disabled.

A UE can be enabled, by *sl-InterUE-CoordinationScheme2*, to transmit a PSFCH with conflict information in a resource pool. The UE can determine, based on an indication by a SCI format 1-A, a set of resources that includes one or more slots and resource blocks that are reserved for PSSCH transmission. If the UE determines a conflict for a reserved resource for PSSCH transmission, the UE provides conflict information in a PSFCH.

\*\*\* Unchanged text is omitted \*\*\*

A UE is provided by *sl-PSFCH-RB-Set* a set of PRBs in a resource pool for PSFCH transmission with HARQ-ACK information in a PRB of the resource pool. A UE can be provided by *sl-RB-SetPSFCH* a set of PRBs in a resource pool for PSFCH transmission with conflict information in a PRB of the resource pool. A UE expects that different PRBs are (pre)configured for conflict information and HARQ-ACK information. For a number of sub-channels for the resource pool, provided by *sl-NumSubchannel*, and a number of PSSCH slots associated with a PSFCH slot that is less than or equal to , the UE allocates the PRBs from the PRBs to slot among the PSSCH slots associated with the PSFCH slot and sub-channel , where , , , and the allocation starts in an ascending order of and continues in an ascending order of . The UE expects that isa multiple of *.*

The second OFDM symbol of PSFCH transmission in a slot is defined as .

A UE determines a number of PSFCH resources available for multiplexing HARQ-ACK or conflict information in a PSFCH transmission as where is a number of cyclic shift pairs for the resource pool provided by *sl-NumMuxCS-Pair* and, based on an indication by *sl-PSFCH-CandidateResourceType*,

- if *sl-PSFCH-CandidateResourceType* is configured as *startSubCH*, and the PRBs are associated with the starting sub-channel of the corresponding PSSCH

- if *sl-PSFCH-CandidateResourceType* is configured as *allocSubCH*, and the PRBs are associated with the sub-channels of the corresponding PSSCH

- for conflict information, the corresponding PSSCH is determined based on *sl-PSFCH-Occasion*

\*\*\* Unchanged text is omitted \*\*\*

A first UE determines a UE for providing the conflict information to in a PSFCH as follows

- if, for a resource pool, *sl-TypeUE-A* is not provided, the first UE has been indicated a first reserved resource and a second reserved resource as resources for PSSCH reception or, if for a resource pool *sl-TypeUE-A* is provided, has been indicated at least the first reserved resource or the second reserved resource for PSSCH reception,

- detects a first SCI format 1-A that includes a first priority value, , and the first reserved resource for PSSCH transmission from a second UE,

- detects a second SCI format 1-A that includes a second priority value, , and the second reserved resource for PSSCH transmission from a third UE, and

- determines that the first and second resources overlap in time and frequency

- the PSFCH occasions for resource conflict information of the second UE and the third UE are valid

- the conflict information receiver flag in SCI Format 1-A from the second UE and the third UE is set to 1, if *indicationUEBScheme2* = 'enabled'

- determines the first SCI format 1-A and the second SCI format 1-A are not received later than *sl-MinTimeGapPSFCH* before the PSFCH occasion for conflict information

- determines to transmit to the second UE the PSFCH with the conflict information

- determines to transmit to either the second UE or the third UE the PSFCH with the conflict information, if

The first UE can be provided conditions by *sl-OptionForCondition2-A-1* to determine conflict of reserved resources in a resource pool

- if *sl-OptionForCondition2-A-1* = '0', the first UE can be provided by, *sl-Thres-RSRP-List* , a list of RSRP thresholds for each priority combination [6, TS 38.214]

- if the first UE is an intended receiver for PSSCH in a reserved resource of the second UE, the first UE determines a resource conflict if the RSRP [6, TS 38.214] of the third UE is above a threshold

- if the first UE is an intended receiver for PSSCH in a reserved resource of the third UE, the first UE determines a resource conflict if the RSRP of the second UE is above a threshold

- if *sl-OptionForCondition2-A-1* = '1', the first UE can be provided a value by *sl-DeltaRSRP-Thresh*

- if the first UE is an intended receiver for PSSCH in a reserved resource of the second UE, the first UE determines a resource conflict if , where and are the RSRP measurements from the first UE for the second UE and the third UE, respectively

- if the first UE is an intended receiver for PSSCH in a reserved resource of the third UE, the first UE determines a resource conflict if

If a UE transmits a PSFCH with conflict information corresponding to a reserved resource indicated in an SCI format 1-A, the UE transmits the PSFCH in the resource pool in a slot determined based on *sl-PSFCH-Occasion*

- If *sl-PSFCH-Occasion* = '0', the UE transmits the PSFCH in a first slot that includes PSFCH resources and is at least a number of slots, provided by *sl-MinTimeGapPSFCH*, of the resource pool after a slot of a PSCCH reception that provides the SCI format 1-A. The PSFCH resource is in a slot that is at least slots [6, TS 38.214] before the resource associated with the conflict information; otherwise, the UE does not transmit the PSFCH with conflict information.

- If *sl-PSFCH-Occasion* = '1', the UE transmits the PSFCH in a latest slot that includes PSFCH resources and is at least slots before a slot of the resource associated with conflict information. The PSFCH resource is in a slot that is at least *sl-MinTimeGapPSFCH* slots after a slot of a PSCCH reception that provides the SCI format 1-A; otherwise, the UE does not transmit the PSFCH with conflict information.

### 16.3.1 UE procedure for receiving PSFCH with control information

\*\*\* Unchanged text is omitted \*\*\*

A UE that transmitted SCI format 1-A, indicating one or more reserved resources in a resource pool enabled by *sl-InterUE-CoordinationScheme2*, attempts to receive associated PSFCH with conflict information in a resource pool with PSFCH resources that the UE determines as described in clause 16.3.0. If the UE determines presence of a resource conflict based on conflict information in a PSFCH reception, the UE reports the resource conflict to higher layers

- if *sl-SlotLevelResourceExclusion* is not provided, the UE reports resources overlapping with a next in time reserved resource indicated by the SCI format 1-A

- if *sl-slotLevelResourceExclusion* is provided, the UE reports resources in a slot of a next in time reserved resource indicated by the SCI format 1-A

If a UE receives a PSFCH with conflict information corresponding to a reserved resource indicated in an SCI format 1-A, the UE receives the PSFCH in the resource pool in a slot determined based on *sl-PSFCHOccasion*

- If *sl-PSFCHOccasion* = '0', the UE receives the PSFCH in a first slot that includes PSFCH resources and is at least a number of slots, provided by *sl-MinTimeGapPSFCH*, of the resource pool after a slot of a PSCCH transmission that provides the SCI format 1-A. The PSFCH resource is in a slot that is at least slots [6, TS 38.214] before the resource associated with the conflict information; otherwise, the UE does not receive the PSFCH with conflict information

- If *sl-PSFCHOccasion* = '1', the UE receives the PSFCH in a latest slot that includes PSFCH resources and is at least slots before a slot of the resource associated with conflict information. The PSFCH resource is in a slot that is at least *sl-MinTimeGapPSFCH* slots after a slot of a PSCCH transmission that provides the SCI format 1-A; otherwise, the UE does not receive the PSFCH with conflict information

\*\*\* Unchanged text is omitted \*\*\*

## 17.1 RedCap UE procedures

\*\*\* Unchanged text is omitted \*\*\*

If a UE is provided *initialUplinkBWP-RedCap* in *UplinkConfigCommonSIB* and does not have dedicated PUCCH resource configuration, the UE transmits PUCCH with HARQ-ACK information as described in clause 9.2.1 using a PUCCH resource set provided by *pucch-ResourceCommonRedCap*, except that frequency hopping for the PUCCH transmission is disabled if *intra-SlotFH* is present in *PUCCH-ConfigCommon*. If frequency hopping of the PUCCH transmission is disabled then, for the PUCCH transmission, the UE determines the initial cyclic shift index in the set of initial cyclic shift indexes as and determines the PRB index as

- , if *intra-SlotFH* = '*fromLowerEdge*'

- , otherwise

where is provided by *additionalPRBOffset*, if provided; otherwise,

If a UE is not provided *initialUplinkBWP-RedCap* in *UplinkConfigCommonSIB* and does not have dedicated PUCCH resource configuration, the UE transmits PUCCH with HARQ-ACK information as described in clause 9.2.1 using a PUCCH resource set provided by *pucch-ResourceCommonRedCap* if *pucch-ResourceCommonRedCap* is present or by *pucch-ResourceCommon* if *pucch-ResourceCommonRedCap* is absent. For an initial DL BWP provided by *initialDownlinkBWP-RedCap* in *DownlinkConfigCommonSIB*, if a UE in RRC\_IDLE state or in RRC\_INACTIVE state monitors PDCCH according to Type1-PDCCH CSS set and does not monitor PDCCH according to Type2-PDCCH CSS set, the UE does not expect the initial DL BWP to include SS/PBCH blocks and the CORESET with index 0.

\*\*\* Unchanged text is omitted \*\*\*

# 18 Multicast Broadcast Services

This clause is applicable only for PDCCH receptions, PDSCH receptions, and PUCCH transmissions for MBS on a serving cell. DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI scheduling PDSCH receptions are referred to as multicast DCI formats and the PDSCH receptions are referred to as multicast PDSCH receptions. DCI formats with CRC scrambled by MCCH-RNTI or G-RNTI for MTCH scheduling PDSCH receptions are referred to as broadcast DCI formats and the PDSCH receptions are referred to as broadcast PDSCH receptions. HARQ-ACK information associated with multicast DCI formats or multicast PDSCH receptions is referred to as multicast HARQ-ACK information.

A UE can be provided one or more G-RNTIs per serving cell for scrambling the CRC of multicast DCI formats for scheduling PDSCH receptions. The UE can be provided one or more G-CS-RNTI per serving cell for scrambling the CRC of multicast DCI formats providing activation/release/scheduling retransmission for SPS PDSCH receptions.

A UE can be configured by *cfr-ConfigMCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. A UE monitors PDCCH for scheduling PDSCH receptions for MCCH or MTCH as described in clause 10.1.

In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331].

A UE can be configured, per DL BWP by *cfr-ConfigMulticast*, an MBS frequency resource within the DL BWP for PDCCH and PDSCH receptions [4, TS 38.211]. If *cfr-ConfigMulticast* does not include *locationAndBandwidthMulticast*, the MBS frequency resource is the DL BWP. In clauses referring to a higher layer parameter value provided by *PDCCH-Config* or *PDSCH-Config* or *SPS-Config* for a DL BWP, when applicable a corresponding higher layer parameter value for multicast PDCCH, PDSCH, or SPS PDSCH receptions is provided as described in [12, TS 38.331].

\*\*\* Unchanged text is omitted \*\*\*

If a UE is provided *pucch-ConfigurationListMulticast1* or *pucch-ConfigurationListMulticast2* for PUCCH transmissions with a priority value, the UE transmits a PUCCH with the priority value according to *pucch-ConfigurationListMulticast1* or *pucch-ConfigurationListMulticast2* for each G-RNTI or G-CS-RNTI that the UE provides associated HARQ-ACK information according to the first HARQ-ACK reporting mode or the second HARQ-ACK reporting mode, respectively. For HARQ-ACK information associated only with the second HARQ-ACK reporting mode, when the UE is provided *moreThanOneNackOnlyMode* and the UE provides the HARQ-ACK information according to the first HARQ-ACK reporting mode and in response to at least one DCI format detection, the UE determines a PUCCH resource from *pucch-ConfigMulticast1/pucch-ConfigurationListMulticast1*, if provided; otherwise, the UE determines a PUCCH resource from *pucch-Config/pucch-ConfigurationList*.

A PDSCH reception providing an initial transmission of a transport block is scheduled only by a multicast DCI format. For the first HARQ-ACK reporting mode, a PDSCH reception providing a retransmission of the transport block can be scheduled either by a multicast DCI format using a same G-RNTI as the G-RNTI of the initial transmission of the transport block, or by a unicast DCI format using a C-RNTI [6, TS 38.214].

\*\*\* Unchanged text is omitted \*\*\*

If a UE is provided *pdsch-HARQ-ACK-Codebook = dynamic* for multicast HARQ-ACK information, the UE generates a Type-2 HARQ-ACK codebook as described in clause 9.1.3.1.

If a UE would report unicast HARQ-ACK information and multicast HARQ-ACK information with same priority index in a slot, the UE multiplexes the unicast HARQ-ACK information and the multicast HARQ-ACK information following the procedures in this clause and in clauses 9.1.2 and 9.1.3.

If, for unicast and multicast HARQ-ACK information of same priority value, a UE

\*\*\* Unchanged text is omitted \*\*\*

## 19.1 Configured-grant based PUSCH transmission

\*\*\* Unchanged text is omitted \*\*\*

An association period, starting from frame with SFN 0, for mapping SS/PBCH block indexes, from the number of SS/PBCH block indexes, to valid PUSCH occasions and associated DM-RS resources is the smallest value in the set determined by the PUSCH configuration period provided by *periodicity* in *ConfiguredGrantConfig* according to Table 19.1-1 such that SS/PBCH block indexes are mapped at least once to valid PUSCH occasions and associated DM-RS resources within the association period. A UE is provided a number of SS/PBCH block indexes associated with a PUSCH occasion and a DM-RS resource by *sdt-SSB-PerCG-PUSCH*. If after an integer number of SS/PBCH block indexes to PUSCH occasions and associated DMRS resources mapping cycles within the association period there is a set of PUSCH occasions and associated DMRS resources that are not mapped to SS/PBCH block indexes, no SS/PBCH block indexes are mapped to the set of PUSCH occasions and associated DMRS resources. An association pattern period includes one or more association periods and is determined so that a pattern between PUSCH occasions with associated DMRS resources and SS/PBCH block indexes repeats at most every 640 msec. PUSCH occasions and associated DMRS resources not associated with SS/PBCH block indexes after an integer number of association periods, if any, are not used for PUSCH transmissions.

\*\*\* Unchanged text is omitted \*\*\*