**3GPP TSG-RAN WG1 Meeting #114 *R1-23xxxxx***

**Toulouse, France, August 21 – 25, 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **38.214** | **CR** | **-** | **Rev** | **-** | **Current version:** | **17.6.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of specification enhancements for NR sidelink evolution | | | | | | |
|  |  | | | | | | |
| ***Source to WG:*** | Nokia | | | | | | |
| ***Source to TSG:*** |  | | | | | | |
|  |  | | | | | | |
| ***Work item code:*** | NR\_SL\_enh2 | | |  | ***Date:*** | | 2023-09-08 |
|  |  | |  | |  | |  |
| ***Category:*** | **B** |  | | | ***Release:*** | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | |
| ***Reason for change:*** | | Introduction of specification support for NR sidelink evolution. | | | | | |
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| ***Summary of change:*** | | Introduction of specification procedures facilitating co-channel coexistence of LTE sidelink and NR sidelink. | | | | | |
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| ***Consequences if not approved:*** | Specification does not support enhancements of NR sidelink evolution. | | | |
|  |  | | | |
| ***Clauses affected:*** | 2, 8, 8.1, 8.1.2.1, 8.1.3.2, 8.1.4, 8.1.5 | | | |
|  |  | | | |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  | Other core specifications | ... |
| ***affected:*** |  | **X** | Test specifications | ... |
| ***(show related CRs)*** |  | **X** | O&M Specifications | ... |
|  |  | | | |
| ***Other comments:*** |  | | | |
|  |  | | | |
| ***This CR's revision history:*** |  | | | |

<omitted text>

# 2 References

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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# 8 Physical sidelink shared channel related procedures

A UE can be configured by higher layers with one or more sidelink resource pools. A sidelink resource pool can be for transmission of PSSCH, as described in Clause 8.1, or for reception of PSSCH, as described in Clause 8.3 and can be associated with either sidelink resource allocation mode 1 or sidelink resource allocation mode 2.

In the frequency domain,

- If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is not provided, or it is set to ‘contiguousRB', a sidelink resource pool consists of *sl-NumSubchannel* contiguous sub-channels. A sub-channel consists of *sl-SubchannelSize* contiguous PRBs, where *sl-NumSubchannel* and *sl-SubchannelSize* are higher layer parameters.

* If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’, in the frequency domain, a sidelink resource pool consists of sl-NumSubchannel sub-channels, where each sub-channel consists of *numInterlacePerSubchannel* interlaces having contiguous interlace indices.

For operation with shared spectrum channel access for frequency range 1, a sidelink resource pool can be (pre-)configured to include integer number of RB sets. A UE can be configured with intra-cell guard bands according to the higher layer parameter *intraCellGuardBandsSL-List*. The configured intra-cell guard band PRBs between any two adjacent RB sets can be used only for PSSCH transmission, if and only if, the UE has successfully performed channel access procedure in both adjacent RB sets.

The set of slots that may belong to a sidelink resource pool is denoted by where

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- the slot index is relative to slot#0 of the radio frame corresponding to SFN 0 of the serving cell or DFN 0,

- the set includes all the slots except the following slots,

- slots in which S-SS/PSBCH block (S-SSB) or additional transmission occasion for S-SSB is configured,

- slots in each of which at least one of *Y-th*, *(Y+1)-th*, …, *(Y+X-1)-th* OFDM symbols are not semi-statically configured as UL as per the higher layer parameter *tdd-UL-DL-ConfigurationCommon* of the serving cell if providedor *sl-TDD-Configuration* if provided or *sl-TDD-Config* of the received PSBCH if provided, where *Y* and *X* are set by the higher layer parameters *sl-StartSymbol* and *sl-LengthSymbols*, respectively.

- The reserved slots which are determined by the following steps.

1) the remaining slots excluding slots and slots from the set of all the slots are denoted by arranged in increasing order of slot index.

2) a slot belongs to the reserved slots if , here and where denotes the length of bitmap configured by higher layers.

- The slots in the set are arranged in increasing order of slot index.

The UE determines the set of slots assigned to a sidelink resource pool as follows:

- a bitmap associated with the resource pool is used where the length of the bitmap is configured by higher layers.

- a slot belongs to the set if where .

- The slots in the set are re-indexed such that the subscripts *i* of the remaining slots are successive {0, 1, …, where is the number of the slots remaining in the set.

The UE determines the set of resource blocks assigned to a sidelink resource pool as follows:

- The resource block pool consists of PRBs.

- If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is not provided, or is set to ‘contiguousRB', the sub-channel *m* for consists of a set of contiguous resource blocks with the physical resource block number for , where , and *numSubchannel* are given by higher layer parameters *sl-StartRB-Subchannel*, *sl-SubchannelSize* and *sl-NumSubchannel*, respectively.

- If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’, the sub-channel *m* for consists of a set of *numInterlacePerSubchannel* interlaces, where each interlace consists of at least 10 resource blocks as defined in clause 4.4.4.6 of [4, TS 38.211]. The lowest RB in the resource pool is given by the higher layer parameter *startRBResourcePool*. The sub-channel *m* is indexed per RB set and is periodically indexed across multiple RB sets within the resource pool. The sub-channel with the same index is mapped to the set of *numInterlacePerSubchannel* interlace(s) with the same index(s) in different RB sets.

A UE is not expected to use the last PRBs in the resource pool.

## 8.1 UE procedure for transmitting the physical sidelink shared channel

Each PSSCH transmission is associated with an PSCCH transmission.

That PSCCH transmission carries the 1st stage of the SCI associated with the PSSCH transmission; the 2nd stage of the associated SCI is carried within the resource of the PSSCH.

If the UE transmits SCI format 1-A on PSCCH according to a PSCCH resource configuration in slot *n* and PSCCH resource *m*, then for the associated PSSCH transmission in the same slot

- one transport block is transmitted with up to two layers;

- The number of layers (ʋ) is determined according to the '*Number of DMRS port'* field in the SCI;

- The set of consecutive symbols within the slot for transmission of the PSSCH is determined according to clause 8.1.2.1;

- The set of contiguous or interlaced resource blocks for transmission of the PSSCH is determined according to clause 8.1.2.2;

Transform precoding is not supported for PSSCH transmission.

Only wideband precoding is supported for PSSCH transmission.

The DM-RS antenna ports cid:image011.png@01D5F222.20AEBCB0 in Clause 8.4.1.1.2 of [4, TS38.211] are determined according to the ordering of DM-RS port(s) given by Tables 8.3.1.1-3 in Clause 8.3.1.1 of [5, TS 38.212].

The UE shall set the contents of the SCI format 2-A as follows:

- the UE shall set value of the *'HARQ process number'* field as indicated by higher layers.

- the UE shall set value of the '*NDI*' field as indicated by higher layers.

- the UE shall set value of the '*Redundancy version*' field as indicated by higher layers.

- the UE shall set value of the '*Source ID*' field as indicated by higher layers.

- the UE shall set value of the '*Destination ID*' field as indicated by higher layers.

- the UE shall set value of the '*HARQ feedback enabled/disabled indicator*' field as indicated by higher layers.

- the UE shall set value of the '*Cast type indicator*' field as indicated by higher layers.

- the UE shall set value of the '*CSI request*' field as indicated by higher layers.

- the UE shall set value of the ‘*CAPC*’ field as indicated by higher layers.

- the UE shall set value of the ‘*COT sharing cast type*’ field as indicated by higher layers.

- the UE shall set value of the ‘*COT sharing Additional ID’* field as indicated by higher layers.

- the UE shall set value of the ‘*Remaining COT duration’* field as indicated by higher layers.

The UE shall set the contents of the SCI formats 2-B as follows:

- the UE shall set value of the '*HARQ process number*' field as indicated by higher layers.

- the UE shall set value of the '*NDI*' field as indicated by higher layers.

- the UE shall set value of the '*Redundancy version*' field as indicated by higher layers.

- the UE shall set value of the '*Source ID*' field as indicated by higher layers.

- the UE shall set value of the '*Destination ID*' field as indicated by higher layers.

- the UE shall set value of the '*HARQ feedback enabled/disabled indicator*' field as indicated by higher layers.

- the UE shall set value of the '*Zone ID*' field as indicated by higher layers.

- the UE shall set the '*Communication range requirement*' field as indicated by higher layers.

- the UE shall set value of the ‘*CAPC*’ field as indicated by higher layers.

- the UE shall set value of the ‘*COT sharing cast type’* field as indicated by higher layers

- the UE shall set value of the ‘*COT sharing Additional ID’* field as indicated by higher layers.

- the UE shall set value of the ‘*Remaining COT duration’* field as indicated by higher layers.

The UE shall set the contents of the SCI format 2-C as follows:

- the UE shall set value of the *'HARQ process number'* field as indicated by higher layers.

- the UE shall set value of the '*NDI*' field as indicated by higher layers.

- the UE shall set value of the '*Redundancy version*' field as indicated by higher layers.

- the UE shall set value of the '*Source ID*' field as indicated by higher layers.

- the UE shall set value of the '*Destination ID*' field as indicated by higher layers.

- the UE shall set value of the '*HARQ feedback enabled/disabled indicator*' field as indicated by higher layers.

- the UE shall set value of the '*CSI request*' field as indicated by higher layers.

- the UE shall set value of the ‘*CAPC*’ field as indicated by higher layers.

- the UE shall set value of the ‘*COT sharing cast type’* field as indicated by higher layers

- the UE shall set value of the ‘*COT sharing Additional ID’* field as indicated by higher layers.

- the UE shall set value of the ‘*Remaining COT duration’* field as indicated by higher layers.

- the UE shall set value of '*Providing/Requesting indicator*' field as indicated by higher layers.

- if '*Providing/Requesting indicator*' indicates SCI format 2-C is used to convey an explicit request for inter-UE coordination information:

- the UE shall set value of the '*Priority*' field as indicated by higher layers.

- the UE shall set value of the '*Number of subchannels*' field as indicated by higher layers.

- the UE shall set value of the '*Resource reservation period*' field as indicated by higher layers.

- the UE shall set value of the '*Resource selection window location*' field as indicated by higher layers.

- the UE shall set value of the '*Resource set type*' field as indicated by higher layers if higher layer parameter *sl-DetermineResourceType* is configured to 'UE-B's request'; otherwise this field is omitted.

- if '*Providing/Requesting indicator*' indicates SCI format 2-C is used to convey inter-UE coordination information:

- the UE shall set value of the '*Resource set type*' field as indicated by higher layers.

- the UE shall set value of the '*Resource combination(s)*' field (clause 8.1.5A) as indicated by higher layers.

- the UE shall set value of the *'Lowest subchannel indices'* as indicated by higher layers

- the UE shall set value of the '*First resource location*' as indicated by higher layers

- the UE shall set value of the '*Reference slot location*' as indicated by higher layers

### 8.1.1 Transmission schemes

Only one transmission scheme is defined for the PSSCH and is used for all PSSCH transmissions.

PSSCH transmission is performed with up to two antenna ports, with antenna ports 1000-1001 as defined in clause 8.2.4 of [4, TS 38.211].

### 8.1.2 Resource allocation

In sidelink resource allocation mode 1:

- for PSSCH and PSCCH transmission, dynamic grant, configured grant type 1 and configured grant type 2 are supported. The configured grant Type 2 sidelink transmission is semi-persistently scheduled by a SL grant in a valid activation DCI according to Clause 10.2A of [6, TS 38.213].

#### 8.1.2.1 Resource allocation in time domain

The UE shall transmit the PSSCH in the same slot as the associated PSCCH.

The minimum resource allocation unit in the time domain is a slot.

The UE shall transmit the PSSCH in consecutive symbols within the slot, subject to the following restrictions:

- The UE shall not transmit PSSCH in symbols which are not configured for sidelink. A symbol is configured for sidelink, according to higher layer parameters *sl-StartSymbol* and *sl-LengthSymbols*, where *sl-StartSymbol* is the symbol index of the first symbol of *sl-LengthSymbols* consecutive symbols configured for sidelink.

- Within the slot, PSSCH resource allocation starts at symbol *sl-StartSymbol+1,* except when *startingSymbolFirst* and *startingSymbolSecond* are provided for the sidelink resource pool*.* If *startingSymbolFirst* and *startingSymbolSecond* are provided for a sidelink resource pool, there are at maximum 2 candidate starting symbols for PSSCH transmission for slots without PSFCH symbols.*.*

- The UE shall not transmit PSSCH in symbols which are configured for use by PSFCH, if PSFCH is configured in this slot.

- The UE shall not transmit PSSCH in the last symbol configured for sidelink.

- The UE shall not transmit PSSCH in the symbol immediately preceding the symbols which are configured for use by PSFCH, if PSFCH is configured in this slot.

- For operation with shared spectrum channel access in frequency range 1, for the first SL transmission to initiate a channel occupancy for a slot, if no a resource reservation is transmitted or detected for the slot and the RB set(s) of the intended PSCCH/PSSCH transmission, the UE determines a duration of a cyclic prefix extension *Text* to be applied according to [4, TS 38.211] where the index for [4, TS 38.211] is chosen randomly from a set of values configured per priority of the PSCCH/PSSCH by the higher layer parameter *CPEStartingPositionsPSCCH-PSSCH-InitiateCOT*. Otherwise, the UE uses a configured default cyclic prefix extension *Text* indicated by *DefaultCPEStartingPositionsPSCCH-PSSCH-InitiateCOT*.

- For operation with shared spectrum channel access in frequency range 1, for the SL transmission by a UE in a shared channel occupancy initiated by another UE*,* the UE transmitting in the shared channel occupancy determines the duration of a cyclic prefix extension *Text* according higher layer parameter *DefaultCPEStartingPositionsPSCCH-PSSCH-SharedCOT*, unless the UE is configured with multiple CPE starting positions transmitting in a shared channel occupancy by *CPEStartingPositionsPSCCH-PSSCH-SharedCOT,* in which case the UE determines the duration of a cyclic prefix extension *Text* to be applied according to [4, TS 38.211] where the index for [4, TS 38.211] is chosen randomly from a set of values configured per priority of the PSCCH/PSSCH by the higher layer parameter *CPEStartingPositionsPSCCH-PSSCH-SharedCOT.*

In sidelink resource allocation mode 1:

- For sidelink dynamic grant, the PSSCH transmission is scheduled by a DCI format 3\_0.

- For sidelink configured grant type 2, the configured grant is activated by a DCI format 3\_0.

- For sidelink dynamic grant and sidelink configured grant type 2:

- The "Time gap" field value *m* of the DCI format 3\_0 provides an index *m* + 1 into a slot offset table. That table is given by higher layer parameter *sl-DCI-ToSL-Trans* and the table value at index *m* + 1 will be referred to as slot offset .

- The slot of the first sidelink transmission scheduled by the DCI is the first SL slot of the corresponding resource pool that starts not earlier than , where is the starting time of the downlink slot carrying the corresponding DCI, is the timing advance value corresponding to the TAG of the serving cell on which the DCI is received and is the slot offset between the slot of the DCI and the first sidelink transmission scheduled by DCI and is the SL slot duration.

- The "Configuration index" field of the DCI format 3\_0, if provided and not reserved, indicates the index of the sidelink configured type 2.

- For sidelink configured grant type 1:

- The slot of the first sidelink transmissions follows the higher layer configuration according to [10, TS 38.321].

<omitted text>

#### 8.1.3.2 Transport block size determination

For the PSSCH assigned by SCI, if Table 5.1.3.1-2 is used and *,* or a table other than Table 5.1.3.1-2 is usedand *,* the UE shall first determine the TBS as specified below:

The UE shall first determine the number of REs (*NRE*) within the slot.

- A UE first determines the number of REs allocated for PSSCH within a PRB () by , where

- is the number of subcarriers in a physical resource block,

- = *sl-LengthSymbols* -2, where *sl-LengthSymbols* is the number of sidelink symbols within the slot provided by higher layers. If *startingSymbolFirst* and *startingSymbolSecond* are provided for a sidelink resource pool, the number of sidelink symbols assumed in transport block size determination is determined by a reference number of symbols, *numRefSymbolLength*, provided by higher layers.

- = 3 if '*PSFCH overhead indication'* field of SCI format 1-A indicates "1", and = 0 otherwise, if higher layer parameter *sl-PSFCH-Period* is 2 or 4. If higher layer parameter *sl-PSFCH-Period* is 0, . If higher layer parameter *sl-PSFCH-Period* is 1, .

- is the overhead given by higher layer parameter *sl-X-Overhead*,

- is given by Table 8.1.3.2-1 according to higher layer parameter *sl-PSSCH-DMRS-TimePatternList.*

Table 8.1.3.2-1: according to higher layer parameter *sl-PSSCH-DMRS-TimePatternList*

|  |  |
| --- | --- |
| *sl-PSSCH-DMRS-TimePatternList* |  |
| {2} | 12 |
| {3} | 18 |
| {4} | 24 |
| {2,3} | 15 |
| {2,4} | 18 |
| {3,4} | 21 |
| {2,3,4} | 18 |

- A UE determines the total number of REs allocated for PSSCH () by , where

- *nPRB* is the total number of allocated PRBs for the PSSCH. If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’, a reference number of PRBs per interlace within 1 RB set, *numRefPRBOfInterlace*, is provided by higher layers for determination of total number of PRBs for PSSCH.,

- is the total number of REs occupied by the PSCCH and PSCCH DM-RS.

- is the number of coded modulation symbols generated for 2nd-stage SCI transmission (prior to duplication for the 2nd layer, if present) according to Clause 8.4.4 of [5, TS 38.212], with the assumption of .

The UE determines TBS according to Steps 2), 3), and 4) in clause 5.1.3.2.

A UE is not expected to receive an SCI indicating if Table 5.1.3.1-2 is used, or otherwise.

8.1.4 UE procedure for determining the subset of resources to be reported to higher layers in PSSCH resource selection in sidelink resource allocation mode 2

In resource allocation mode 2, the higher layer can request the UE to determine a subset of resources from which the higher layer will select resources for PSSCH/PSCCH transmission. To trigger this procedure, in slot *n,* the higher layer provides the following parameters for this PSSCH/PSCCH transmission:

- the resource pool from which the resources are to be reported;

- L1 priority, ;

- the remaining packet delay budget;

- If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is not provided, the number of sub-channels to be used for the PSSCH/PSCCH transmission in a slot is . If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘contiguousRB', corresponds to the number of sub-channels within all used RB sets to be used for the PSCCH/PSSCH transmission in a slot. If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’, corresponds to the number of sub-channels to be used for the PSSCH/PSCCH transmission in a slot in each RB set,

- If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’, the number of used RB sets for one PSCCH/PSSCH transmission, LRBset.

- the number of sub-channels to be used for the PSSCH/PSCCH transmission in a slot, ;

- optionally, the resource reservation interval, , in units of msec.

- if the higher layer requests the UE to determine a subset of resources from which the higher layer will select resources for PSSCH/PSCCH transmission as part of re-evaluation or pre-emption procedure, the higher layer provides a set of resources which may be subject to re-evaluation and a set of resources which may be subject to pre-emption.

- it is up to UE implementation to determine the subset of resources as requested by higher layers before or after the slot - , where is the slot with the smallest slot index among and , and is equal to , whereis defined in slots in Table 8.1.4-2 whereis the SCS configuration of the SL BWP.

- Optionally, the indication of resource selection mechanism.

- *rbSetsWithConsecutiveLBTFailure*, which indicates the RB sets where consecutive LBT failure has been indicated.

The following higher layer parameters affect this procedure:

*- sl-SelectionWindowList*:internal parameter is set to the corresponding value from higher layer parameter *sl-SelectionWindowList* for the given value of .

*- sl-Thres-RSRP-List*: this higher layer parameter provides an RSRP threshold for each combination , where is the value of the priority field in a received SCI format 1-A and is the priority of the transmission of the UE selecting resources; for a given invocation of this procedure, .

*- sl-RS-ForSensing* selects if the UE uses the PSSCH-RSRP or PSCCH-RSRP measurement, as defined in clause 8.4.2.1.

*- sl-ResourceReservePeriodList*

*- sl-SensingWindow*: internal parameter is defined as the number of slots corresponding to *sl-SensingWindow* msec

*- sl-TxPercentageList*: internal parameter for a given is defined as *sl-TxPercentageList ()* converted from percentage to ratio

- *sl-PreemptionEnable*: if *sl-PreemptionEnable* is provided, and if it is not equal to 'enabled', internal parameter is set to the higher layer provided parameter *sl-PreemptionEnable.*

- Optionally, minimum number of *Y* slots as (*sl*-*MinNumCandidateSlotsPeriodic*), which indicates the minimum number of *Y* slots that are included in the candidate resources corresponding to periodic-based partial sensing and contiguous partial sensing for resource (re)selection triggered by periodic transmission ().

- Optionally, minimum number of slots as (*sl*-*MinNumCandidateSlotsAperiodic*), which indicates the minimum number of slots that are included in the candidate resources corresponding to periodic-based partial sensing and/or contiguous partial sensing results (if available) for resource (re)selection triggered by aperiodic transmission ().

- Optionally, sensing occasion as *sl-PBPS-OccasionReservePeriodList,* which indicates the subset of periodicity values from *sl-ResourceReservePeriodList* used to determine periodic sensing occasions in periodic-based partial sensing. If not configured, all periodicity values from *sl-ResourceReservePeriodList* are used to determine periodic sensing occasions in periodic-based partial sensing.

- Optionally, additional sensing occasions as *sl-Additional-PBPS-Occasion*, which indicates that UE additionally monitors periodic sensing occasions that correspond to a set of values. The possible values of the set at least includes the most recent sensing occasion before the first slot of the candidate slots for a given reservation periodicity and the last periodic sensing occasion prior to the most recent one for the given reservation periodicity. If not (pre-)configured, the UE monitors the most recent sensing occasion before the first slot of the candidate slots for the given periodicity used to determine periodic sensing occasions in periodic-based partial sensing.

- Optionally, indication of the size in logical slots of contiguous partial sensing window for periodic transmissions as defined by the parameter *sl-CPS-WindowPeriodic*.

Optionally, indication of the size in logical slots of contiguous partial sensing window for aperiodic transmissions as defined by the parameter *sl-CPS-WindowAperiodic.*

- Optionally, indication of whether UE is required to perform SL reception of PSCCH and RSRP measurement for partial sensing on slots in SL DRX inactive time as *sl-PartialSensingInactiveTime.*

In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink, that is coexistence over time and frequency resources that are shared between NR sidelink and LTE sidelink:

- *sl-NRPSSCH-EUTRA-ThresRSRP-List*: this higher layer parameter provides an RSRP threshold for each combination , where is the value of the priority field in a received LTE SCI format 1, and is the priority of the transmission of the UE selecting resources; for a given invocation of this procedure, .

- *sl-NRPSFCH-EUTRA-ThresRSRP-List*: this higher layer parameter, if provided, provides an RSRP threshold for each combination , where is the value of the priority field in a received LTE SCI format 1, and is the priority of the transmission of the UE selecting resources; for a given invocation of this procedure, .

The resource reservation interval, , if provided, is converted from units of msec to units of logical slots, resulting in according to clause 8.1.7.

When the resource pool is (pre-)configured with *sl-AllowedResourceSelectionConfig* including full sensing, and full sensing is configured in the UE by higher layers, the UE performs full sensing.

When periodic reservation for another TB (*sl-MultiReserveResource*) is enabled for the resource pool, the resource pool is (pre-)configured with *sl-AllowedResourceSelectionConfig* including partial sensing, and partial sensing is configured by higher layer, the UE performs periodic-based partial sensing, unless other conditions state otherwise in the specification.

When a UE is triggered by higher layer to report resources for resource (re-)selection in a mode 2 Tx pool, the resource pool is (pre-)configured with *sl-AllowedResourceSelectionConfig* including partial sensing, and partial sensing is configured by higher layer, the UE performs contiguous partial sensing, unless stated otherwise in the specification.

Notation:

denotes the set of slots which belongs to the sidelink resource pool and is defined in Clause 8.

For dynamic co-channel coexistence of LTE sidelink and NR sidelink, denotes the set of subframes that may belong to an LTE sidelink resource pool as defined in clause 14.1.5 of [19, TS36.213].

The following steps are used:

1) A candidate single-slot resource for transmission is defined as a set of contiguous sub-channels with sub-channel *x+j* in slot where . The UE shall assume that any set of contiguous sub-channels included in the corresponding resource pool within the time interval correspond to one candidate single-slot resource for UE performing full sensing, in a set of *Y* candidate slots within the time interval correspond to one candidate single-slot resource for UE performing periodic-based partial sensing together with contiguous partial sensing and resource (re)selection triggered by periodic transmission (), or in a set of *Y'* candidate slots within the time interval correspond to one candidate single-slot resource for UE performing at least contiguous partial sensing and resource (re)selection triggered by aperiodic transmission (), where

- selection of is up to UE implementation under , where is defined in slots in Table 8.1.4-2 where is the SCS configuration of the SL BWP;

- if is shorter than the remaining packet delay budget (in slots) then is up to UE implementation subject to remaining packet delay budget (in slots); otherwise is set to the remaining packet delay budget (in slots).

- is selected by UE where .

- is selected by UE where . When the UE performs at least contiguous partial sensing and if , the UE selects a set of candidate slots with corresponding PBPS and/or CPS results (if available). If the number of candidate slots is smaller than , it is up to UE implementation to include other candidate slots.

If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘contiguousRB', the UE shall exclude candidate single-slot resource, whose lowest sub-channel of a RB set includes resource blocks of the intra-cell guardband PRBs, configured by higher layer parameter, *intraCellGuardBandsSL-List*.

If *rbSetsWithConsecutiveLBTFailure* is provided, the UE shall exclude candidate single-slot resources, whose associated RB sets is included in the *rbSetsWithConsecutiveLBTFailure* parameter.

The total number of candidate single-slot resources is denoted by .

2) The sensing window is defined by the range of slots [), when the UE performs full sensing, where is defined above and is defined in slots in Table 8.1.4-1 where is the SCS configuration of the SL BWP. The UE shall monitor slots which belongs to a sidelink resource pool within the sensing window except for those in which its own transmissions occur. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots.

When the UE performs periodic-based partial sensing, the UE shall monitor slots at , where is a slot of the selected candidate slots and is converted to units of logical slot according to clause 8.1.7. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots.

The value of corresponds to *sl-PBPS-OccasionReservePeriodList* if (pre-)configured, otherwise, the values correspond to all periodicity from *sl-ResourceReservePeriodList.*

The UE monitors sensing occasion(s) determined by *sl-Additional-PBPS-Occasion*, as previously described, and not earlier than . For a given periodicity , the values of *k* correspond to the most recent sensing occasion earlier than if *sl-Additional-PBPS-Occasion* is not (pre-)configured, and additionally includes the value of *k* corresponding to the last periodic sensing occasion prior to the most recent one if *sl-Additional-PBPS-Occasion* is (pre-)configured. is the first slot of the selected *Y* candidate slots of PBPS.

When the UE performs periodic-based partial sensing and contiguous partial sensing with periodic reservation for another TB (*sl-MultiReserveResource*) enabled and , the contiguous partial sensing window is defined by the range of slots . *n*+*T*A is *M* consecutive logical slots earlier than slot , and *n*+*T*B is slots earlier than , where is the first slot of the selected *Y* candidate slots of PBPS, and , are in units of physical time/slots. The value of *M* is (pre-)configured with the *sl-CPS-WindowPeriodic*. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots. If *sl-CPS-WindowPeriodic* is not (pre-)configured, *M* equals to 31.

When the UE performs at least contiguous partial sensing and if , the contiguous partial sensing window is defined by the range of slots . and are both selected such that the UE has sensing results starting at least *M* consecutive logical slots before and ending at slots earlier than , where is the first slot of the selected candidate slots. The value of *M* is (pre-)configured with the *sl-CPS-WindowAperiodic*. The UE shall perform the behaviour in the following steps based on PSCCH decoded and RSRP measured in these slots. If *sl-CPS-WindowAperiodic* is not (pre-)configured, *M* equals to 31. When the minimum *M* slots for CPS cannot be guaranteed and when , it is up to UE implementation to either continue with step 3) or perform random selection.

Whether the UE is required to performs SL reception of PSCCH and RSRP measurement for partial sensing on slots in SL DRX inactive time is enabled/disabled by higher layer parameter *sl-PartialSensingInactiveTime.* When it is enabled, if UE performs periodic-based partial sensing on the slots in SL DRX inactive time for a given periodicity corresponding to , UE monitors only the default periodic sensing occasions (most recent sensing occasion) from the slots; if UE performs contiguous partial sensing on the slots in SL DRX inactive time, UE monitors a minimum of *M* slots from the slots.

2LTE) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The [LTE sensing window is defined by] the range of LTE subframes [], where is the LTE subframe in which this procedure is triggered and which overlaps slot *n*, is 1100 msec and is up to UE implementation under ; is 4+T msec, where T ≤ 4 msec. The UE shall perform the procedures in 5LTE3 and 6LTE based on PSCCH decoded and RSRP measured in these LTE subframes.

3) The internal parameter is set to the corresponding value of RSRP threshold indicated by the *i*-th field in *sl-Thres-RSRP-List*, where .

3LTE) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink:

* The internal parameter is set to the corresponding value of RSRP threshold indicated by the *i*-th field in *sl-NRPSSCH-EUTRA-ThresRSRP-List*, where .
* The internal parameter is set to the corresponding value of RSRP threshold indicated by the *i*-th field in *sl-NRPSFCH-EUTRA-ThresRSRP-List*, if provided, where . If *sl-NRPSFCH-EUTRA-ThresRSRP-List* is not provided then each element of is set to minus Infinity dBm.

4) The set is initialized to the set of all the candidate single-slot resources.

5) The UE shall exclude any candidate single-slot resource from the set if it meets all the following conditions:

- the UE has not monitored slot in Step 2.

- for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.

5LTE1) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall exclude any candidate single-slot resource from the set if all the following conditions are met:

- the resource pool overlaps with an LTE sidelink resource pool;

- the UE has not monitored LTE subframe .

- for any periodicity value allowed by the LTE higher layer parameter *restrictResourceReservationPeriod* and a hypothetical LTE SCI format 1 received in LTE subframe with '*Resource reservation’* field set to that periodicity value and indicating all subchannels of the LTE sidelink resource pool in this LTE subframe, condition c in step 6LTE would be met.

5LTE2) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall exclude any candidate single-slot resource from the set if all the following conditions are met:

- the UE has a selected sidelink grant for LTE V2X according to [19, TS 36.321] .

- the selected sidelink grant for LTE V2X determines the set of LTE resource blocks and LTE subframes which overlaps in time with for *j=*0, 1, …, ;

- the priority value associated with the selected sidelink grant for LTE V2X is lower than ; It is up to UE implementation whether or not to apply this exclusion step if the priority value associated with selected sidelink grant for LTE V2X is higher than or equal to .

5LTE3) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall exclude any candidate single-slot resource from the set if all the following conditions are met:

a) the resource pool is configured with PSFCH resources;

b) an LTE SCI format 1 is received in LTE subframe , and the '*Resource reservation'* field and '*Priority*' field in the received LTE SCI format 1 indicate the values and , respectively according to Clause 14.2.1 in [19, TS 36.213], where LTE subframes are indexed according to Clause 14.1.5 in [19, TS 36.213];

c) the LTE PSSCH-RSRP measurement according to the received LTE SCI format 1 is higher than

d) the SCI format received in LTE subframe or the same SCI format which is assumed to be received in LTE subframe(s) determines according to clause 14.1.1.4C or clause 14.2.4 in [19, TS 36.213] the set of LTE subframes which overlaps with PSFCH slots associated with for *q*=1, 2, …, *Q* and *j=*0, 1, …, where the PSFCH association is according to [6, TS 38.213]. and *Q* are determined as in condition c) of step 6LTE.

5a) If the number of candidate single-slot resources remaining in the set is smaller than , the set is initialized to the set of all the candidate single-slot resources as in step 4.

6) The UE shall exclude any candidate single-slot resource from the set if it meets all the following conditions:

a) the UE receives an SCI format 1-A in slot , and '*Resource reservation period'* field, if present, and '*Priority*' field in the received SCI format 1-A indicate the values and , respectively according to Clause 16.4 in [6, TS 38.213];

b) the RSRP measurement performed, according to clause 8.4.2.1 for the received SCI format 1-A, is higher than

c) the SCI format received in slot or the same SCI format which, if and only if the '*Resource reservation period*' field is present in the received SCI format 1-A, is assumed to be received in slot(s) determines according to clause 8.1.5 the set of resource blocks and slots which overlaps with for *q*=1, 2, …, *Q* and *j=*0, 1, …, . Here, is converted to units of logical slots according to clause 8.1.7, if and , where if the UE is configured with full sensing by its higher layer, if slot *n* belongs to the set , otherwise slot is the first slot after slot *n* belonging to the set ; If UE is configured with partial sensing by its higher layer, if slot belongs to the set , otherwise, slot is the first slot after slot belonging to the set . Otherwise . If the UE is configured with full sensing by its higher layer, is set to selection window size *T2* converted to units of msec. If UE is configured with partial sensing by its higher layer, shall be converted to milliseconds, where slot is the last slot of the or candidate slots. The slot is the first slot of the selected/remaining set of or candidate slots.

6LTE) In case of dynamic co-channel coexistence of LTE sidelink and NR sidelink: The UE shall exclude any candidate single-slot resource from the set if all the following conditions are met:

a) an LTE SCI format 1 is received in LTE subframe , and the '*Resource reservation'* field and '*Priority*' field in the received LTE SCI format 1 indicate the values and , respectively according to Clause 14.2.1 in [19, TS 36.213], where LTE subframes are indexed according to Clause 14.1.5 in [19, TS 36.213];

b) the LTE PSSCH-RSRP measurement according to the received LTE SCI format 1 is higher than

c) the SCI format received in LTE subframe or the same SCI format which is assumed to be received in LTE subframe(s) determines according to clause 14.1.1.4C or clause 14.2.4 in [19, TS 36.213] the set of LTE resource blocks and LTE subframes which overlaps with for *q*=1, 2, …, *Q* and *j=*0, 1, …, . Here, is with determined according to Table 14.1.1-1 in [19, TS 36.213], if and , where if subframe belongs to the set , otherwise subframe is the first subframe after subframe belonging to the set ; Otherwise . is set to selection window size *T2* converted to units of msec.

6a) This step is executed only if the procedure in clause 8.1.4A is triggered.

6b) This step is executed only if the procedure in clause 8.1.4C is triggered.

7) If the number of candidate single-slot resources remaining in the set is smaller than , then [ and , if set, ] is increased by 3 dB for each priority value and the procedure continues with step 4.

7a) If sidelink DRX active time of RX UE is provided by the higher layer and there is no candidate single-slot resource remained within the sidelink DRX active time in the set , the UE based on its implementation additionally selects and includes at least one candidate single-slot resources within the sidelink DRX active time in the set .

The UE shall report set to higher layers.

If a resource from the set is not a member of , then the UE shall report re-evaluation of the resource to higher layers.

If a resource from the set meets the conditions below then the UE shall report pre-emption of the resource to higher layers.

- is not a member of , and

- meets the conditions for exclusion in step 6, with set to the final threshold after executing steps 1)-7), i.e. including all necessary increments for reaching , and

- the associated priority satisfies one of the following conditions:

- *sl-PreemptionEnable* is provided and is equal to 'enabled' and

- *sl-PreemptionEnable* is provided and is not equal to 'enabled', and and

**Table 8.1.4-1: depending on sub-carrier spacing**

|  |  |
| --- | --- |
|  | **[slots]** |
| 0 | 1 |
| 1 | 1 |
| 2 | 2 |
| 3 | 4 |

**Table 8.1.4-2: depending on sub-carrier spacing**

|  |  |
| --- | --- |
|  | **[slots]** |
| 0 | 3 |
| 1 | 5 |
| 2 | 9 |
| 3 | 17 |

When the UE performs periodic-based partial sensing and contiguous partial sensing, and when the UE is triggered to perform re-evaluation and/or pre-emption checking, and if ,

- During the *q*th reservation period (*q*=0,1,2,…, *Cresel*-1), candidate resource set (*SA*) is initialized to the remaining *Y* candidate slots starting from slot and ending at the last slot of the *Y* candidate slots, where the slot indices of the remaining *Y* candidate slots are equal to , where is a slot index of *Y* candidate slots used in the initial resource (re)selection.

- is the first candidate slot starting from slot *n+T3*.

- The UE performs PBPS for the remaining *Y* candidate slots according to , whereis a slot belonging to the remaining *Y* candidate slots, and *k* and *Preserve* are the same as resource (re)selection, where the values of *k* correspond to the most recent sensing occasion earlier than if *sl-Additional-PBPS-Occasion* is not (pre-)configured, and additionally includes the value of *k* corresponding to the last periodic sensing occasion prior to the most recent one if *sl-Additional-PBPS-Occasion* is (pre-)configured.

- The UE performs CPS starting from *M* logical slots earlier than to slots earlier than .

- By default, *M* is 31 unless (pre-)configured with another value by *sl-CPS-WindowPeriodic*.

When the UE is triggered to perform re-evaluation and/or pre-emption checking, performs at least contiguous partial sensing, and if ,

- Candidate resource set (*SA*) is initialized to the remaining *Y'* candidate slots starting from slot and ending at the last slot of the *Y'* candidate slots, where is the first candidate slot starting from slot *n+T3*.

- It is up to UE implementation that UE may perform PBPS for periodic sensing occasions after the resource (re)selection when higher layer parameter *sl-MultiReserveResource* is enabled

- UE performs CPS starting from at least *M* consecutive logical slots earlier than to slots earlier than

- For minimum size *M* of the contiguous partial sensing window , by default, *M* is 31 unless (pre-)configured with another value, by *sl-CPS-WindowAperiodic*.

When the minimum *M* slots for CPS cannot be guaranteed, UE senses in all available slots starting from the resource (re)selection trigger slot of the same TB to slots earlier than . The UE re-evaluation and pre-emption checking is based on all available sensing results after .

<omitted text>

### 8.1.5 UE procedure for determining slots and resource blocks for PSSCH transmission associated with an SCI format 1-A

The set of slots and resource blocks for PSSCH transmission is determined by the resource used for the PSCCH transmission containing the associated SCI format 1-A, and fields '*Frequency resource assignment*', '*Time resource assignment*' of the associated SCI format 1-A as described below.

'*Time resource assignment*' carries logical slot offset indication of N = 1 or 2 actual resources when *sl-MaxNumPerReserve* is 2, and N = 1 or 2 or 3 actual resources when *sl-MaxNumPerReserve* is 3, in a form of time RIV (TRIV) field which is determined as follows:

if

elseif

else

if

else

end if

end if

where the first resource is in the slot where SCI format 1-A was received, and denotes i-th resource time offset in logical slots of a resource pool with respect to the first resource where for N = 2, ; and for N = 3, , .

The starting sub-channel of the first resource is determined according to clause 8.1.2.2. The number of contiguously allocated sub-channels for each of the N resources and the starting sub-channel indexes of resources indicated by the received SCI format 1-A, except the resource in the slot where SCI format 1-A was received, are determined from "Frequency resource assignment" which is equal to a frequency RIV (FRIV) where.

If *sl-MaxNumPerReserve* is 2 then

If *sl-MaxNumPerReserve* is3 then

where

- denotes the starting sub-channel index for the second resource

- denotes the starting sub-channel index for the third resource

- is the number of sub-channels in a resource pool, or if the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’, the number of sub-channels in each RB set, provided according to the higher layer parameter *sl-NumSubchannel*

If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’, the applied interlace index(s) in different RB sets are the same.

The starting RB set of the first resource is determined according to the clause [ABCDE]. The number of contiguously allocated RB sets for each of the N RB sets LRBset>1 and the starting RB set indexes of resources indicated by the received SCI format 1-A, except the resource in the slot where SCI format 1-A was received, are determined from "Frequency resource assignment" which is equal to a frequency RIV (FRIV) where.

If sl-MaxNumPerReserve is 2 then

If sl-MaxNumPerReserve is 3 then

where

* denotes the starting RB set index for the second resource
* denotes the starting RB set index for the third resource
* is the number of RB sets in a resource pool
* is the number of RB sets for each of the indicated resources

If TRIV indicates *N* < *sl-MaxNumPerReserve*, the starting sub-channel indexes corresponding to *sl-MaxNumPerReserve* minus N last resources are not used.

The number of slots in one set of the time and frequency resources for transmission opportunities of PSSCH is given by where = 10\*SL\_RESOURCE\_RESELECTION\_COUNTER [10, TS 38.321] if configured else is set to 1.

If a set of sub-channels in slot is determined as the time and frequency resource for PSSCH transmission corresponding to the selected sidelink grant (described in [10, TS 38.321]), the same set of sub-channels in slots are also determined for PSSCH transmissions corresponding to the same sidelink grant where *j=*1, 2,*…,* , , if provided, is converted from units of msec to units of logical slots, resulting in according to clause 8.1.7, and is determined by Clause 8. Here, is the resource reservation interval indicated by higher layers.

<omitted text>