**3GPP TSG RAN WG1 Meeting #114 R1-230xxxx**

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

**Agenda item: 9.17**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Summary on email discussion on Sidelink enhancements**

**Document for: Discussion and Decision**

# 1 Introduction

This thread will discuss the draft CR to 38.214 for the Sidelink enhancements.

First checkpoint for this discussion: **September 5, 6:00 UTC**!

# 2 Discussion – first round

The comments in this section are based on version 0 of the the draft CR available in the **Post RAN1#114 discussion.**

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| Company | Comments | Editor reply/Notes |
| LGE | On Section 8.1.2.1, there is some typo. For operation with shared spectrum channel access in frequency range 1, for the first ~~U~~SL transmission to initiate a channel occupancy Moreover, according to the following WA, the above scheme is applied for the case when UE performs Type 2A to transmit PSCCH/PSSCH within the shared COT as well. Working assumptionWhen UE performs Type 2 channel access to transmit PSCCH/PSSCH within a COT:* By default, only one value is (pre-)configured for the set of CPE starting position for inside COT
	+ The value is the default CPE starting position
	+ UE only use the (pre-)configured default CPE starting position
* When more than one values are (pre-)configured for the set of CPE starting position for inside COT
	+ One of these values is the default CPE starting position
	+ UE use the same method for using CPE for the case when UE performs Type 1 channel access to initiate a COT for PSCCH/PSSCH transmission
* FFS: whether to support that CPE can be transmitted between any two consecutive SL transmissions between COT initiator and responder, to reduce the gap between two transmissions so that it does not exceed 16us, the CPE is selected from the CPE(s) (pre-)configured for PSCCH/PSSCH within a COT

In addition, Scheme 1 also needs to be captured as well as Scheme 2 in this part. **Agreement**When UE performs Type 1 channel access to initiate a COT for PSCCH/PSSCH transmission:* Scheme 1: The UE selects the (pre-)configured default CPE starting position.
* Scheme 2: A CPE starting position is randomly selected among one or multiple CPE starting candidate positions (pre-)configured per priority of the PSCCH/PSSCH transmission
	+ The mapping one or multiple CPE starting positions per priority can be up to (pre-)configuration.
	+ FFS: whether the priority should be the L1 priority or CAPC (to be down-selected in RAN1#114)
* For partial and full RB set resource allocations
	+ If a resource reservation is transmitted or resource reservations is detected for the slot and the RB set(s) of the intended PSCCH/PSSCH transmission, Scheme 1 is applied; otherwise, Scheme 2 is applied
	+ FFS: other conditions to determine whether to use scheme 1 or scheme 2
	+ FFS: further enhancements for the full RB set case

In those points of views, we suggest following text:For operation with shared spectrum channel access in frequency range 1, for the first SL transmission to initiate a channel occupancy or within a shared channel occupancy 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 to be default value provided by the higher layer parameter *CPEStartingPositionsPSCCH-PSSCH-InitiateCOT* if the resource for the SL transmission is indicated by a SCI format 1-A of the UE or if the SL transmission is in a slot where it is assumed that SL transmission of another UE occurs or be chosen randomly from a set of values for the priority of the SL transmission configured by the higher layer parameter *CPEStartingPositionsPSCCH-PSSCH-InitiateCOT, otherwise*.On the section 8.1.4, it would be necessary to consider RB set concepts as well including the number of consecutive RB sets and the update on the definition of candidate resource. MCSt also needs to be captured. Working assumptionIn Mode 2 resource allocation:* Alt. 1: (rectangular shaped)
	+ For contiguous RB based
		- A candidate multi-slots resource is defined as a set of contiguous sub-channels starting from sub-channel in consecutive slots starting from slot .
	+ For interlaced RB based
		- A candidate multi-slots resource is defined as a set of contiguous sub-channels starting from sub-channel in consecutive slots starting from slot in contiguous RB sets starting from RB set z.
		- A candidate single-slot resource is defined as a set of contiguous sub-channels starting from sub-channel in slot in contiguous RB sets starting from RB set z.
* Note, different candidate multi-slot resources can overlap in time.

AgreementIn Mode 2 resource allocation,* The higher layer can indicate a “number of consecutive slots for MCSt” () larger than 1 for L1 reporting multi-slots candidates to the higher layer. The candidate multi-slots resource definition is applied.
	+ Otherwise, the candidate single-slot resource definition is applied (same as R16/17).
* The higher layer selects resources from the reported according to one of the following based on UE implementation:
	+ Random selection as per R16/17
	+ Higher layer is not restricted to select resources at random, and can select in consecutive slots
		- It is up to RAN2 to define detailed behaviour as needed
	+ It is RAN1 intention that, once the higher layer selects a multi-slots candidate from the set , it will use all the single-slot resources of the selected multi-slots candidate for transmission. This RAN1 agreement has no intention on potential RAN2 discussion about how SL resource selection processes are defined in MCSt.
* Note, the above is intended to support Approach 1 and 2 only.
* Send an LS to RAN2 informing that it is up to RAN2 to decide in regards to the HARQ RTT timing (minimum time gap)
	+ whether a single TB transmitted over consecutive slots is supported in a resource pool configured with PSFCH resource

So, we suggest to add following text.In the parameters provided by higher layer - Optionally, a number of consecutive slots for multi-consecutive slot transmission, In step 1:If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’, A candidate single-slot resource for transmission is defined as a set of contiguous sub-channels with sub-channel *x+j* within a set of contiguous RB sets with RB set *z+k* in slot where and .If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘contiguousRB’ and if is provided, A candidate multi-slot resource for transmission is defined as a set of contiguous sub-channels with sub-channel *x+j* within a set of contiguous RB sets in consecutive slots starting from slot where .If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘interlaceRB’ and if is provided, A candidate multi-slot resource for transmission is defined as a set of contiguous sub-channels with sub-channel *x+j* within a set of contiguous RB sets with RB set *z+k* in consecutive slots starting from slot where and .For the remaining parts, it can be considered to replace “candidate single slot resource R\_x,y” with “candidate resource R\_x,y or R\_x,y,z”. On Section 8.1.2.2, the lowest sub-channel needs to be clarified as per the following agreement. According to NR-U interlace definition, it is possible that the subchannel with lowest index does not occupy the actual lowest frequency region. **Agreement**For interlace RB-based PSCCH/PSSCH transmission in SL-U, support the following:* Option 1: lowest sub-channel is the sub-channel with smallest sub-channel index

The lowest sub-channel index for sidelink transmission is the sub-channel on which the lowest PRB of the associated PSCCH is transmitted.On section 8, the definition of subchannel for interlaced RB-based transmission would need to be more clarified as per the following agreement.**Agreement**For interlace RB-based PSCCH/PSSCH transmission in SL-U:* Regarding mapping between sub-channel and interlace, 1 sub-channel is defined and indexed within 1 RB set, and is periodically indexed across different RB sets within the resource pool
* 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 ~~is given by the higher layer parameter~~ consists of *numInterlacePerSubchannel* contiguous interlace indices ~~interlaces~~.
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| CATT/GH | Thanks the editor for the great efforts on drafting the CR! Please find our comments below.* **Comment 1 (**Clause 8.1):
	+ “COT sharing cast type” is missed as one of the fields in SCI format 2-A.

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

* **Comment 2 (**Clause 8.1):
	+ In order to align with TS 38.212, the newly added fields in SCI format 2-B and SCI format 2-C should be deleted.
* **Comment 3 (**Clause 8.1.2.1):
	+ CPE determination agreements for PSCCH/PSSCH transmission should be captured.

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| **Agreement**When UE performs Type 1 channel access to initiate a COT for PSCCH/PSSCH transmission:* Scheme 1: The UE selects the (pre-)configured default CPE starting position.
* Scheme 2: A CPE starting position is randomly selected among one or multiple CPE starting candidate positions (pre-)configured per priority of the PSCCH/PSSCH transmission
	+ The mapping one or multiple CPE starting positions per priority can be up to (pre-)configuration.
	+ FFS: whether the priority should be the L1 priority or CAPC (to be down-selected in RAN1#114)
* For partial and full RB set resource allocations
	+ If a resource reservation is transmitted or resource reservations is detected for the slot and the RB set(s) of the intended PSCCH/PSSCH transmission, Scheme 1 is applied; otherwise, Scheme 2 is applied
	+ FFS: other conditions to determine whether to use scheme 1 or scheme 2
	+ FFS: further enhancements for the full RB set case

Working assumptionWhen UE performs Type 2 channel access to transmit PSCCH/PSSCH within a COT:* By default, only one value is (pre-)configured for the set of CPE starting position for inside COT
	+ The value is the default CPE starting position
	+ UE only use the (pre-)configured default CPE starting position
* When more than one values are (pre-)configured for the set of CPE starting position for inside COT
	+ One of these values is the default CPE starting position
	+ UE use the same method for using CPE for the case when UE performs Type 1 channel access to initiate a COT for PSCCH/PSSCH transmission
* FFS: whether to support that CPE can be transmitted between any two consecutive SL transmissions between COT initiator and responder, to reduce the gap between two transmissions so that it does not exceed 16us, the CPE is selected from the CPE(s) (pre-)configured for PSCCH/PSSCH within a COT
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* **Comment 4 (**Clause 8.1.2.1):
	+ Regarding the candidate starting symbol(s), the case that only one candidate starting symbol is supported for slot with PSFCH symbols, as following agreement, is not captured.

**Agreement**Slots with PSFCH symbols only have 1 candidate starting symbol for PSCCH/PSSCH.* **Comment 5 (**Clause 8.1.4):
	+ The legacy description on *LsubCH* can be removed.

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

* **Comment 6 (**Clause 8.1.4):
	+ The wording should be aligned with RAN2, where “consecutive LBT failure” should be changed to “consistent LBT failure”
* **Comment 7 (**Clause 8.1.4):
	+ The following highlight part is redundant and may cause some ambiguity, which can be removed.

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| 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*. |

AgreementRegarding “*For contiguous RB-based PSCCH/PSSCH transmission in SL-U, regarding sub-channel(s) which include intra-cell guardband PRBs, support only option 3*” and “*Option 3: Such sub-channel(s) cannot be used for PSCCH transmission, and can be used for PSSCH transmission*”:* Candidate resource, whose lowest sub-channel includes intra-cell guardband PRBs, is excluded
	+ Such exclusion is performed in PHY layer, and such candidate resource is excluded in Step 1
* **Comment 8 (**Clause 8.1.4):
	+ The detail designs on enhancements for resource selection procedure considering C-LBT need further discussion, such as which step is applied, the following parts should be removed.

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

* **Comment 9 (**Clause 8.1.4):
	+ the following agreements regarding candidate multi-slots resources should **also** be captured in clause 8.1.4.

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| Working assumptionIn Mode 2 resource allocation:* Alt. 1: (rectangular shaped)
	+ For contiguous RB based
		- A candidate multi-slots resource is defined as a set of contiguous sub-channels starting from sub-channel in consecutive slots starting from slot .
	+ For interlaced RB based
		- A candidate multi-slots resource is defined as a set of contiguous sub-channels starting from sub-channel in consecutive slots starting from slot in contiguous RB sets starting from RB set z.
		- A candidate single-slot resource is defined as a set of contiguous sub-channels starting from sub-channel in slot in contiguous RB sets starting from RB set z.
* Note, different candidate multi-slot resources can overlap in time.

AgreementIn Mode 2 resource allocation,* The higher layer can indicate a “number of consecutive slots for MCSt” () larger than 1 for L1 reporting multi-slots candidates to the higher layer. The candidate multi-slots resource definition is applied.
	+ Otherwise, the candidate single-slot resource definition is applied (same as R16/17).
* The higher layer selects resources from the reported according to one of the following based on UE implementation:
	+ Random selection as per R16/17
	+ Higher layer is not restricted to select resources at random, and can select in consecutive slots
		- It is up to RAN2 to define detailed behaviour as needed
	+ It is RAN1 intention that, once the higher layer selects a multi-slots candidate from the set , it will use all the single-slot resources of the selected multi-slots candidate for transmission. This RAN1 agreement has no intention on potential RAN2 discussion about how SL resource selection processes are defined in MCSt.
* Note, the above is intended to support Approach 1 and 2 only.
* Send an LS to RAN2 informing that it is up to RAN2 to decide in regards to the HARQ RTT timing (minimum time gap)
	+ whether a single TB transmitted over consecutive slots is supported in a resource pool configured with PSFCH resource
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| Sharp | * **Comment #1, on 8:**

Add “the UE” that performs channel access procedure for clarity.

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| 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. |

* **Comment #2, on 8.1.2.1:**

Typo.

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| - For operation with shared spectrum channel access in frequency range 1, for the first SL transmission to initiate a channel occupancy 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 by the higher layer parameter *CPEStartingPositionsPSCCH-PSSCH-InitiateCOT*. |

* **Comment #3, on 8.1.2.1:**

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| **Agreement**When UE performs Type 1 channel access to initiate a COT for PSCCH/PSSCH transmission:* Scheme 1: The UE selects the (pre-)configured default CPE starting position.
* Scheme 2: A CPE starting position is randomly selected among one or multiple CPE starting candidate positions (pre-)configured per priority of the PSCCH/PSSCH transmission
	+ The mapping one or multiple CPE starting positions per priority can be up to (pre-)configuration.
	+ FFS: whether the priority should be the L1 priority or CAPC (to be down-selected in RAN1#114)
* For partial and full RB set resource allocations
	+ If a resource reservation is transmitted or resource reservations is detected for the slot and the RB set(s) of the intended PSCCH/PSSCH transmission, Scheme 1 is applied; otherwise, Scheme 2 is applied
	+ FFS: other conditions to determine whether to use scheme 1 or scheme 2
	+ FFS: further enhancements for the full RB set case

AgreementWhen UE performs Type 1 channel access to initiate a COT for PSCCH/PSSCH transmission, in the agreed Scheme 2 from RAN1#113, a CPE starting position is randomly selected among one or multiple CPE starting candidate positions (pre-)configured per priority of the PSCCH/PSSCH transmission. The priority level is based on the L1 priority. |

According to above agreements, scheme 2 is applied when resource reservations is detected. Otherwise, scheme 1 is applied. To reflect the agreements (above yellow highlight), the followings are proposed.

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| - For operation with shared spectrum channel access in frequency range 1, for the first UL transmission to initiate a channel occupancy 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 by the higher layer parameter *CPEStartingPositionsPSCCH-PSSCH-InitiateCOT* for associated L1 priority of the intended PSCCH/PSSCH transmission if a resource reservation is transmitted or resource reservations is detected for a slot and RB set(s) of the intended PSCCH/PSSCH transmission, or is chosen from a default value otherwise. |

* **Comment #4, on 8.1.4:**

Regarding the last but two paragraph of Step 1), an example on why “of a RB set” should be removed: if a candidate resource corresponds to sub-channels in two consecutive RB sets, and if only the lowest sub-channel of the 2nd RB set includes GB PRBs, this candidate resource should not be excluded.

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| If the higher layer parameter *transmissionStructureForPSCCHandPSSCH* is set to ‘contiguousRB', the UE shall exclude candidate single-slot resources with the lowest sub-channel includeing resource block(s) of the intra-cell guardband PRBs, configured by higher layer parameter, *intraCellGuardBandsSL-List*. |

* **Comment #5, on 8.1.4:**

Regarding the last but one paragraph of Step 1), none of the RB sets of a candidate resource should be within those with C-BLT.

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| If *rbSetsWithConsecutiveLBTFailure* is provided, the UE shall exclude candidate single-slot resources with one or more associated RB sets included in the *rbSetsWithConsecutiveLBTFailure* parameter. |

* **Comment #6, on 8.1.4:**

Regarding the last paragraph of Step 1), now with exclusion of some candidate resources in Step 1), it is unclear what “the total number of candidate single-slot resources” actually means.

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

* **Comment #7, on 8.1.4:**

The agreement about that the higher layer can indicate the number of consecutive slots for MCSt to the physical layer has not been captured.

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| AgreementIn Mode 2 resource allocation,* The higher layer can indicate a “number of consecutive slots for MCSt” () larger than 1 for L1 reporting multi-slots candidates to the higher layer. The candidate multi-slots resource definition is applied.
	+ Otherwise, the candidate single-slot resource definition is applied (same as R16/17).
* The higher layer selects resources from the reported according to one of the following based on UE implementation:
	+ Random selection as per R16/17
	+ Higher layer is not restricted to select resources at random, and can select in consecutive slots
		- It is up to RAN2 to define detailed behaviour as needed
	+ It is RAN1 intention that, once the higher layer selects a multi-slots candidate from the set , it will use all the single-slot resources of the selected multi-slots candidate for transmission. This RAN1 agreement has no intention on potential RAN2 discussion about how SL resource selection processes are defined in MCSt.
* Note, the above is intended to support Approach 1 and 2 only.
* Send an LS to RAN2 informing that it is up to RAN2 to decide in regards to the HARQ RTT timing (minimum time gap)
	+ whether a single TB transmitted over consecutive slots is supported in a resource pool configured with PSFCH resource
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Therefore, the following is proposed to capture the parameter provided by the higher layer.

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| - Optionally, the indication of resource selection mechanism.- *rbSetsWithConsecutiveLBTFailure*, which indicates the RB sets where consecutive LBT failure has been indicated.- , which indicates the number of consecutive slots for MCSt. |

* **Comment #8, on 8.1.4:**

The following agreement regarding how to define candidate multi-slots resource has not been captured in the step 1 in resource selection procedure for Mode 2.

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| Working assumptionIn Mode 2 resource allocation:* Alt. 1: (rectangular shaped)
	+ For contiguous RB based
		- A candidate multi-slots resource is defined as a set of contiguous sub-channels starting from sub-channel in consecutive slots starting from slot .

* + For interlaced RB based
		- A candidate multi-slots resource is defined as a set of contiguous sub-channels starting from sub-channel in consecutive slots starting from slot in contiguous RB sets starting from RB set z.

* + - A candidate single-slot resource is defined as a set of contiguous sub-channels starting from sub-channel in slot in contiguous RB sets starting from RB set z.

* Note, different candidate multi-slot resources can overlap in time.
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* **Comment #9, on 8.1.5:**

“N RB sets” should be the “N resources”. In addition, the number of contiguously allocated RB sets LRBset can be equal to 1. Therefore, following corrections are proposed.

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| 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 resources 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. |

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