**3GPP TSG RAN WG1 Meeting #102-E R1-** **200xxxx**

**e-Meeting, August 17th – 28th, 2020**

**Source: Moderator (Intel Corporation)**

**Title: FL summary#1 of issues for 7.2.4.2.2 – V2X Mode 2**

**Agenda item: 7.2.4.2.2**

**Document for:** **Discussion and Decision**

Introduction

This contribution provides a summary of issues in Mode-2 sidelink resource allocation for NR-V2X communication, based on review of the submitted contributions [1]-[18].

Identification of email discussions

## Initial FL input and companies’ inputs template

The initial FL input is based on the list of identified issues in section 3. It is noted that the list does not capture every issue mentioned in tdocs, while section 4 has more aspects listed. Some of the issues are not mentioned in the list due to one or multiple of the following criteria: (1) the issue does seem an enhancement to the already working specification; (2) the issue was previously touched but was far from resolution; (3) the issue is alignment-level that can be resolved in TP phase or within some other discussion.

It is proposed to select 2-3 components per thread with some logical linkage between the combined topics, if possible.

|  |  |  |
| --- | --- | --- |
| **Source** | **List of prioritized topics** | **Comments** |
| FL | {1a, 2a}  {4a, 4b}  {5a, 5b, 7a} | Prioritize topics which require technical discussions. |
| NTT DOCOMO | {1a, 2a}  {4a~~, 4b~~}  {6a} | For TP, whether “MAC/L1 should capture pre-emption & re-evaluation triggering conditions” or not needs to be discussed in our view, while not included in the list. |
| Samsung | 3a, 4a, 6a | > For 1a, 2a, 2b, these issues were discussed in the previous meeting already and in our understanding there was no consensus on these issues.  > For 3a, this issue was discussed in LTE sidelink and finally this was introduced in LTE sidelink. In order to keep the same performance of sensing as in LTE, the same principle should be applied in NR V2X.  > For 4a, since RAN2 LS (R1-2005206) includes this issue, we need discussion to provide feedback on this issue.  > For 4b, current spec description is enough and we do not think that further clarification is necessary.  > For 5a, 5b, we do not think that further specification is necessary on this issues.  > For 6a, this issue need to be discussed considering short periods are included as a candidate period.  > For 7a, we do not think this is necessary.  > For 8a, 8b, 8c, 8d, 8e, we think that editorial fixes have the second priority considering limited email discussion budget. |
| OPPO | 1a, 2a, 5a, 6a, 8a |  |
| Panasonic | {1a, 2a}  {4a}  {5a, 5b} |  |
| Sharp | {3a}  {4a, 8c}  {6a, 8b} | We share similar thought on 3a.  Regarding the issue 4a brought up in LS from RAN2, we think 8c can be regarded as part of 4a discussion, in which reveals that the retransmission of a MAC PDU within a reserved period is indicated by TDRA, the initial transmission of another MAC PDU is indicated by the reserved period and accordingly discuss the relation between them. In 4a, if it is not allowed, then TDRA indication would be within a period and overlapping case in 8c won’t happen.  We think 6a and 8b both are issues on exclusion due to slots not monitored. |
| LG Electronics | {1a, 2a},  {4a},  {6a} | First of all, we should avoid having an email discussion on the issue that is not critical in supporting Rel-16 NR V2X operation. In this sense, from our perspective, separate email threads can be allocated for each of {1a, 2a}, {4a}, and {6a}. When more issues are needed to be added, some of 3a, 8a, and 8e (marked with M priority) can be considered. |
| CATT | {1a,2a}  {4a,4b}  {6a,backward indication} | We think backward indication should be discussed which is related to the SCI design. |
| Ericsson | {1a, 2a}  {3a}  {8c} | As expressed in the table, there are a few corrections in issue 8 that are necessary but not urgent. We think that 8c is the only urgent topic given that the LS R1-2005206 sent by RAN2 states that “*RAN2 expects that RAN1 will discuss whether ReTX resources of a MAC PDU are reserved neither right on nor after new TX resource of the next MAC PDU for a configured sidelink grant reserved for a particular Sidelink process*.”  None of the other issues looks particularly critical, so we would be fine with modifying the order of discussion (for those marked as M below). |
| Nokia, NSB | 1a, 2a, 4a, 5a |  |
| Futurewei | 1a, 2a, 4a, 5a, {6a as 2nd priority} |  |
| Qualcomm | {1a, 2a, 8d}  {4a, 4b}  {5a, 6a, 7a} | 8d is SCI signalling aspect related to 1a, 2a, so it should be discussed in conjunction with 1a, 2a. |
| Apple | {1a, 2a}, {4a}, {8c} | We are also fine to discuss 3a or 5a. |
| Huawei/HiSilicon | {1a, 2a}  {Section 4.12 r), 8c}  {Section 4.5 c), Section 4.8} | 1a, 2a: Leftovers of last meeting, and should be discussed for the completeness of the whole feature.  Section 4.12 r), 8c: We think these two issues are similar that two transmissions cannot overlap in time domain. This should be discussed otherwise such collisions may happen.  Section 4.5 c): For the HARQ feedback based retransmission in unicast, if the sensing UE have already decoded the PSSCH/PSCCH transmission successfully, it means the reserved resources for retransmissions will not be used by the Tx UE, so such resources should not be excluded even if the conditions of RSRP measurement and resources overlapping in TS 38.214 are met.  Section 4.8 (backward indication): This aims to solve the missing SCI issue, and is critical to satisfy high reliability requirement for NR-V2X. |
| ZTE, Sanechips | {1a,2a}, {4a}, {8a} | For 3a, there seems no obvious problem in the current protocol. In addition, the modification proposed by proponent company is not essentially different from the current protocol.  For 5a, we think the problem can be solved in Step2 resource selection, which can be discussed in RAN2. We do not think that further specification is necessary from RAN1 perspective.  For 6a, it is our understanding that RAN1 has quite some pending issues that are more critical than “change the current specification”. |
| vivo | {1a, 2a,2b,}  {4a}  {5a, 5b} | We are generally fine with FL’s proposal. Additionally, issue# 2b is one of the remaining FFS should be addressed. |

Please also assign your priorities to the list of topics, that can help for down-selection in case there is no consensus on topic prioritization:

* H – high priority, better to resolve this meeting
* M – important, can be resolved this meeting or later in maintenance
* L – unimportant in Release 16, better not to discuss this meeting and next meeting

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **1a** | **2a** | **2b** | **3a** | **4a** | **4b** | **5a** | **5b** | **6a** | **7a** | **8a** | **8b** | **8c** | **8d** | **8e** |
| FL example | H | H | L | M | H | H | H | M | L | H | M | M | M | L | M |
| NTT DOCOMO | H | H | L | M | H | L~~H~~ | M | L~~M~~ | H | L | M | L | L~~M~~ | L | M |
| Samsung | L | L | L | H | H | L | L | L | H | L | L | L | L | L | L |
| OPPO | H | H | L | M | M | L | H | L | H | L | H | L | M | L | M |
| Panasonic | H | H | L | M | H | M | H | H | L | M | M | M | M | M | M |
| Sharp | L | L | M | H | H | L | M | M | H | L | M | H | H | M | M |
| LG Electronics | H | H | L | M | H | L | L | L | H | L | M | L | L | L | M |
| CATT | H | H | L | M | H | H | L | M | H | L | M | L | M | L | M |
| Ericsson | M | M | L | M | M | L | L | L | L | L | M | L | H | M | M |
| Nokia, NSB | H | H | L | M | H | L | M | L | M | L | M | L | M | L | M |
| Futurewei | H | M | L | L | H | L | M | L | M | L | M | L | M | M | M |
| Qualcomm | M | M | L | L | H | M | H | L | H | H | L | L | L | H | M |
| Apple | H | H | L | M | H | M | M | L | L | L | M | L | M | M | M |
| Huawei/HiSilicon | H | H | L | M | M | L | L | L | M | L | M | L | H | M | M |
| ZTE, Sanechips | H | H | L | L | H | L | L | L | L | L | H | L | L | M | M |
| vivo | H | H | H | L | H | M | H | H | L | L | M | L | L | M | L |

Identified critical issues list

1. **Re-evaluation**
2. Handling of re-evaluation with periodic reservations
3. **Pre-emption**
4. Handling of pre-emption with periodic reservations
5. Whether to prohibit pre-emption check other than at ‘m-T3’
6. **Sensing window**
7. Whether to change current specification and use logical slots for sensing window definition
8. **HARQ retransmissions aspects**
9. Whether to allow reservation of HARQ retransmission resources periodically (related to RAN2 decisions)
10. Specify maximum value ‘b’ from HARQ RTT time gap
11. **Parallel selection processes**
12. Whether to specify L1 handling of parallel resource selections (supported from RAN2 perspective)
13. Whether to limit the maximum number of reserved resources due to parallel selections
14. **Exclusions due to slots not monitored in the sensing window**
15. Whether to change current specification where all allowed periods are used for exclusion
16. **Number of resources for single selection**
17. Whether to lower bound the number of selected resources in a single resource selection
18. **Specification fixes based on existing agreements**
19. Capturing multi-port PSSCH-DMRS in L1 specification based on RAN4 agreement
20. In step 5), the hypothetical SCI 1-A should be assumed with N=1
21. Restrict overlaps of TDRA field resource and periodic resources
22. Capture the cases of setting the period to 0 in SCI format 1-A
23. Miscellaneous alignments for 38.214, 8.1.4 (RRC parameter names and usage)

Initial summary of proposals on the issues

## Re-evaluation

1. Handling re-evaluation with periodic reservations
   * vivo, LGE, Huawei/HiSilicon, Intel, OPPO, Spreadtrum
2. Clarify that Prsvp\_tx is the same as for initial selection
   * InterDigital

## Pre-emption

1. Handling of pre-emption with periodic reservations
   * LGE, Huawei/HiSilicon, Intel, OPPO, InterDigital, Spreadtrum
2. Do not run pre-emption earlier than ‘m-T3’
   * vivo
3. CBR as a triggering condition
   * OPPO
4. Do not apply Prsvp\_tx in pre-emption check
   * InterDigital

## Sensing window definition

1. Use logical slots
   1. Samsung
2. Window size should be “max allowed period + 100 ms”
   1. Spreadtrum

## HARQ retransmission on periodic resources

1. Whether to allow reservation of HARQ retransmission resources periodically
   1. LGE (do not allow), DOCOMO, vivo (allow and add ‘Z’ restriction)
2. Maximum ‘b’ should be specified
   1. Intel

## Enhanced exclusions

1. Exclude broadcast transmissions
   1. Vivo
2. Adjust priority of feedback-based retransmission resources
   1. Huawei/HiSilicon
3. Exclusion of resources based on PSSCH decoding
   1. Huawei/HiSilicon
4. Exclude all resources in FDM with the pre-empted
   1. OPPO
5. Exclusion of slots where UE expects data
   1. InterDigital

## Parallel selections of resources

1. Use priority to define order of selection; exclude already selected resource from the candidate set
   1. Intel
2. Limit the maximum number of resources to 16, i.e. the number of parallel reservations
   1. Vivo

## Number of resources for single selection

1. The number of resources for single selection is >= min(Nmax, M)
   1. Intel

## Backward indication

1. Support
   1. Fujitsu, CATT, Huawei/HiSilicon, ETRI
2. Do not support
   1. Futurewei

## RSRP threshold increment restrictions

1. In case of pre-emption, only allow increments for low priorities
   1. CATT
2. Specify max RSRP increments
   1. DOCOMO

## Release of unused resources

1. Release reserved resources if ACK received before, and allow HARQ feedback monitoring of other links
   1. Fujitsu, InterDigital

## Exclusions related to slots not monitored in the sensing window

1. CATT, OPPO, InterDigital, Samsung, ETRI, DOCOMO, ASUSTeK

## Fixes and alignment of specifications based on existing agreements

1. Align resource pool notations
   1. ZTE/Sanechips
2. Resource sets for pre-emption and re-evaluation may not be provided simultaneously
   1. ZTE/Sanechips
3. Align pre-emption activation condition with the agreement
   1. ZTE/Sanechips
4. MAC/L1 should capture pre-emption & re-evaluation triggering conditions
   1. Vivo, DOCOMO
5. Capturing multi-port PSSCH-DMRS in specification based on RAN4 agreement
   1. Vivo, Futurewei
6. Uncertain whether conversion of ms to logical slots can result in usage of slots outside of RP
   1. Vivo
7. Align “configured grant” term with RAN2 decisions
   1. Vivo
8. Clarification on the usage of the first resource in re-evaluation and pre-emption
   1. Fujitsu
9. MAC should capture 32 slots restriction between resources
   1. CATT
10. RSRP threshold as a function of priority needs specification fixes
    1. Huawei/HiSilicon
11. N/20ms x Prsvp should be an integer
    1. Spreadtrum
12. Correct references in SCI format 1-A and 2-A
    1. Ericsson
13. Align ‘resource reservation period’ and ‘resource reservation interval’ in specs
    1. Ericsson
14. In step 5), the hypothetical SCI 1-A should be assumed with N=1
    1. Sharp
15. Restrict overlaps of TDRA field and period
    1. Sharp
16. Miscellaneous RRC parameters name alignment
    1. Qualcomm
17. Capture the cases of setting the period to 0
    1. Qualcomm
18. Capture that resources cannot be selected in the same slot
    1. Qualcomm

References & Companies Proposals

## [R1-2005318](file:///C:\\Users\\wanshic\\OneDrive%20-%20Qualcomm\\Documents\\Standards\\3GPP%20Standards\\Meeting%20Documents\\TSGR1_102\\Docs\\R1-2005318.zip) ZTE, Sanechips Remaining issues in mode 2

Proposal 1: Confirm the following working assumptions:

• Tproc,0 is 4 physical slots for 120 kHz sub-carrier spacing

• Tproc,1 is 2 ms converted to physical slots+ 1 slot, i.e. {3, 5, 9, 17} for {15, 30, 60, 120} kHz sub-carrier spacing respectively

Proposal 2: To adopt the following 38.214 TP for preemption.

|  |
| --- |
| 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 **<Unchanged parts are omitted>**  If a resource from the set is not a member of due to exclusion in step 6 above by comparison with the RSRP measurement for the received SCI format 1-A with an associated priority ~~and and~~ , and satisfy one of the following conditions, then the UE shall report pre-emption of the resource to higher layers.  - Pre-emption is configured to be enabled without a priority threshold .  - Pre-emption is configured to be enabled with a priority level threshold , and and  **<Unchanged parts are omitted>** |

Proposal 3: To adopt the following description in section 8.1.4 in TS 38.214.

|  |
| --- |
| 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 **<Unchanged parts are omitted>**  - 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~~ or 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 , if any provided, and is equal to , whereis defined in slots in Table 8.1.4-2 whereis the SCS configuration of the SL BWP.  **<Unchanged parts are omitted>** |

Proposal 4: To adopt the following TP for TS 38.213.

|  |
| --- |
| 16.4 UE procedure for transmitting PSCCH **<Unchanged parts are omitted>**  - the values of the frequency resource assignment field and the time resource assignment field as described in [6, TS 38.214] to indicate resources from a set of resources selected by higher layers as described in [11, TS 38.321] with smallest slot indices for such that , where:  - , where is a number of resources in the set with slot indices , , such that , and is provided by *sl-MaxNumPerReserve*  - each resource, from the set of resources, corresponds to contiguous sub-channels and a slot in a set of slots assigned to the resource pool [6, TS 38.214], where is the number of sub-channels available for PSSCH/PSCCH transmission in a slot  ~~- is a set of slots in a sidelink resource pool [6, TS 38.214]~~  - is an index of a slot where the PSCCH with SCI format 1-A is transmitted.  **<Unchanged parts are omitted>** |

## [R1-2005340](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2005340.zip) vivo Remaining issues on mode 2 resource allocation mechanism

Observation 1: The converted reservation periodicity based on P\_rsvp^'=⌈N/(20 ms)×P\_rsvp ⌉ is pool independent, thus the derived reserved resources based on the converted reservation periodicity may be outside the resource pool associated with the SCI indicating the reserved resources or even collide with an S-SSB.

Proposal 1: Do not extend re-evaluation and preemption operation to the periodic reservation.

Proposal 2: The procedure to check whether a reserved resource to be signaled in slot ‘m’ should be re-selected due to pre-emption is performed only at the moment ‘m-T3’.

Proposal 3: Send LS to RAN2 to inform RAN2 to capture resource re-selection check triggers for the purpose of resource re-evaluation and pre-emption in clause 5.22.1.2 of TS 38.321.

Proposal 4: In clause 8.1.4 TS38.213, add restrictions to the resource sets (r\_0,r\_1,r\_2,…) and (r\_0^',r\_1^',r\_2^',…) which are subject to re-evaluation and pre-emption check, respectively.

Proposal 5: Capture the TP for clause 8.1.4 TS38.214.

Proposal 6: Capture the agreements that PSSCH-RSRP shall be calculated by the sum of all transmission antenna ports.

Proposal 7: The resources reserved for broadcast are excluded from candidate resource set.

Proposal 8: For resource selection for a MAC PDU with enabled HARQ feedback, a UE should ensure a minimum time gap Z = a + b between any two periodically reserved resources for a TB transmission.

Proposal 9: Confirm the description regarding the HARQ RTT timing restriction in clause 5.22.1.1 TS38.321.

Proposal 10: The maximum number of reserved resources for a UE is 16.

Proposal 11: If the periodic resource reservation is disabled, the number of the resource granted but not used should not be larger than the 16.

Proposal 12: If the periodic resource reservation is enabled, the number of the resource granted but not used in a pre-defined window (e.g., the maximum period value configured in the resource pool) should not larger that 16.

Proposal 13: If some of the reserved resources based on 38.321 are not located in the associated resource pool or collides with S-SSB resources, they are treated as invalid resources which should be dropped.

Proposal 14: Agree the TP to clarify that the configured sidelink grant in 8.1.5 of 38.214 refers to a configured sidelink grant or a dynamic grant or a selected sidelink grant defined in 38.321.

## [R1-2005540](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2005540.zip) Fujitsu Remaining details on mode 2 resource allocation for NR V2X

Proposal 1: For resource re-selection of a pre-selected resource contained in a slot *‘k’* to be first time signaled in a slot *‘m’* triggered by re-evaluation,

* For a resource which is in the same slot and indicated by the corresponding PSCCH in slot ‘m’, if it has been reserved and signaled by a previous SCI, it should be regarded as the 1st selected resource during the resource re-selection procedure;
* Else, the 1st resource is randomly selected in the selection window of the resource re-selection triggered by the re-evaluation.

Proposal 2: For resource re-selection of a pre-empted resource contained in a slot ‘m’,

* If there is another signaled and non-preempted resource which has not been used for transmission this resource should be regarded as the 1st selected resource for the resource re-selection procedure;
* Else, the 1st resource is randomly selected in the selection window of the resource re-selection triggered by the pre-emption.

Proposal 3: The resources that have previously been reserved for the UE(s) can be used or released by using HARQ feedback. The released resource could be used by other UEs after the other UEs monitoring the HARQ of the reserved UE(s).

Proposal 4: The other UEs need to monitor the HARQ ACK/NACK feedback when perform their own resource selection.

* If the feedback to the sending UE is ACK, the other UEs can start to use the released resource.
* If the feedback to the sending UE is NACK, the other UEs can avoid selecting the reserved resource.

## [R1-2005593](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2005593.zip) FUTUREWEI Remaining details on mode-2 resource allocation

Proposal 1: In step 1, when computing the PSSCH RSRP when two-layer transmission is used, the power of the two DMRSs is added

Proposal 2: Backward indication is not supported in Rel-16

## [R1-2005669](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2005669.zip) CATT Remaining issues on Mode 2 resource allocation in NR V2X

Observation 1: Re-evaluation is performed for the pre-selected but not signaled resources. Considering periodic service transmissions, after performing resource (re)selection:

* For transmissions of the first TB, re-evaluation should be performed for all the upcoming transmission resources of the first TB which are not signaled.
* For transmissions of the following TBs, the resources would not be re-evaluated except for reselected resources which are triggered by pre-emption and not signaled.

Proposal 1: For pre-emption, when performing resource exclusion operations, restrictions of SL-RSRP threshold increment should be supported.

* Only for resource(s) reserved by lower priority packet transmission(s) which cannot trigger pre-emption operations, SL-RSRP threshold can be increased.

Proposal 2: The power boosting or reduction for the pre-emption scheme should not be supported.

Proposal 3: When selecting two or more transmission resources for the same TB, restrictions should be specified that maximum time gap between two consecutive selected resources is 32 logical slots, except for cases that no resource can be found for reservation and reservation is not available due to transmission drop.

* It should be captured in specification.
* Send LS to RAN 2 to consider Text Proposal for TS 38.321 Section 5.22.1.1.

Proposal 4: The reservation period of resource (re)selection UE should be supported to be applied in performing skip slot handling.

Proposal 5: In non-monitored slot handling procedure, resource exclusion only based on UE's reservation period should be supported.

Proposal 6: Backward indication should be supported, in order to provide reservation information as enough as possible and make resource exclusion more accurate for the sensing UEs.

Proposal 7: Option 3 of backward indication should be supported and the payload should be ceil(log2(Nmax)).

## [R1-2005742](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2005742.zip) LG Electronics Discussion on essential corrections in resource allocation for Mode 2

Proposal 1: In case of periodic reservation, it is not allowed to reserve the retransmission resources of a MAC PDU (or perform the retransmission of a MAC PDU) over multiple periods.

Proposal 2: When performing the periodic reservation, the re-evaluation procedure is applied only before transmitting “first” SCI which provide the information of periodically reserved resources.

Proposal 3: In case of periodic reservation, the pre-emption check for the reserved resources within the future periods is allowed when the relevant MAC PDUs to be transmitted are available.

Proposal 4: The remaining details of resource re-selection due to the pre-emption are up to UE implementation, including whether/how to set the reservation period in the re-selected resource.

## [R1-2005798](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2005798.zip) Huawei, HiSilicon Remaining details of sidelink resource allocation mode 2

**Observation 1**: The backward indication is needed when a group of consecutive SCIs are missed due to the fluctuation of the channel condition.

**Observation 2**: It is possible that the resource which has already been excluded in the previous resource selection window would be considered as the identified candidate resource again when the sensing window is changed.

**Proposal 1**: In step 1 of sensing procedure, UE shall adjust the received priorityin SCI by applying a different priority coefficient associated with blind and HARQ-feedback based retransmissions reservation, or adjust the SL-RSRP resource exclusion threshold by applying a delta-threshold for HARQ feedback based retransmission reservation.

**Proposal 2**: Support full backward indication, i.e., support Proposal 1b (full) in the FL summary R1-2003038.

**Proposal 3**: A candidate resource will be excluded from the identified candidate resource set reported to higher layer if, in any one or more resource selection window associated with the re-evaluation or pre-emption check for a pre-selected or reserved resource, it is not regarded as an identified candidate resource.

**Proposal 4**: When SCI in slot ‘k’ signals resource reservation with “Resource reservation period” set to P, re-evaluation for resource(s) in logical slots of a resource pool corresponding to occasions k+P, k+2\*P,…, k+Cresel\*P is not triggered before the slot ‘k’.

**Proposal 5**: When SCI in slot ‘k’ signals resource reservation with “Resource reservation period” set to P, pre-emption check for resource(s) in logical slots of a resource pool corresponding to occasions k+2\*P,…, k+Cresel\*P is not triggered before the slot ‘k+P’.

**Proposal 6**: When periodic reservation is in use, when an SCI is detected which indicates collision on the resources in the next one period of the reservation, resource reselection is triggered for that period only.

**Proposal 7**: In the SCI scheduling the re-selected resources, the “resource reservation period” field is set to zero, to indicate it is used only once.

**Proposal 8**: The pre-selected but not reserved resources are considered in the resource exclusion procedure.

**Proposal 9**: A sensing UE is allowed to exclude the resources based on its PSSCH decoding results.

**Proposal 10**: For exclusion of slots in the selection window which correspond to slots not monitored in the sensing window, do not change current procedure, i.e., apply all the periods configured for a UE.

**Proposal 11**: For specification purposes, the RSRP threshold should be expressed as a function of the priority received in SCI format 0-1 and the priority of the UE selecting the transmission resource.

## [R1-2005848](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2005848.zip) Intel Corporation Remaining opens for NR-V2X sidelink resource allocation Mode 2

Proposal 1

* In case of multiple parallel resource selection processes in a slot, resource selection order starts from the process that serves transmission with highest priority and continues according to sidelink priority
  + Sidelink resource selection for transmissions with the higher priority always precedes resource selection for transmissions with lower priority
  + Sidelink resource selection for transmissions with the lower priority is executed on remaining resources – i.e. resources not selected for higher priority transmissions (higher priority resources are excluded)

Proposal 2

* In the minimum time gap Z = a + b for the case of HARQ RTT aware resource selection, the value of the component ‘b’ is not larger than
  + Tproc.2 = Tprep + Y where:
    - Tprep is the PSFCH-to-PUCCH preparation time with assumption of μ\_UL = μ\_SL
    - Y = 7 symbols

Proposal 3

* In a single iteration of resource (re)-selection/(re)-evaluation, UE can select up to *N* resources for sidelink transmission, where min(*M, NMAX*) ≤ *N* ≤ *M*, here *M* is number of remaining transmissions intended by UE
  + The actual number *N* applied by UE in each iteration is not specified, i.e. it is left up to UE implementation

Proposal 4

* In case of semi-persistent reservations, re-evaluation of candidate resources is performed only for selection of resources in the first semi-persistent period (initial semi-persistent reservations)
* Re-evaluation of semi-persistent resources is not applied for subsequent periods unless new resource reselection is triggered

Proposal 5

* For pre-emption in application to periodic reservations, down-select from the following two options
  + Option 1: A UE is not expected to be configured with pre-emption enabled and periodic reservations enabled in the same resource pool
  + Option 2: A UE checks pre-emption condition for the resources in current reservation period, and is not expected to reserve more periodic resources after reselection triggered by pre-emption

## [R1-2006004](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006004.zip) OPPO Discussion on remaining open issues in mode 2

Proposal 1: A subset of the (pre-)configured periodicities for reservation should be used to exclude resources in slots not monitored during sensing.

Proposal 2: Replace with to avoid excessive exclusion.

Proposal 3: If the number of resources in is already less than after step 5), UE will report the current to high layers immediately and not perform other steps.

Proposal 4: Avoid selecting / exclude resources with a large difference between target Tx power and measured RSRP of adjacent resources, or Tx-UE should select resource(s) that are adjacent to resources with similar power level to avoid creating interference.

Proposal 5: For the case of enabled periodic reservation, already reserved resources in upcoming periods should NOT be re-evaluated.

Proposal 6: Resources in upcoming periods cannot be re-evaluated at the moment ‘m-T3’ in current period due to resource selection window covers only the current period.

Proposal 7: The j in step 6) of mode 2 resource selection procedure in TS 38.214 should be equal to 0, when UE is performing pre-emption check.

Proposal 8: For the case of enabled periodic reservation, if a resource is reselected due to re-evaluation or pre-emption in the current period,

* its original corresponding pre-selected / reserved resource(s) in upcoming periods are considered as “released” at least by the Tx (resource reselecting) UE, and
* new corresponding periodic resource(s) should be re-selected in the upcoming periods and signalled in the SCI in slot ‘m’.

Proposal 9: Within the re-selection window of pre-emption, any resource that is in the same slot(s) as reserved but not pre-empted resource(s) should be excluded from the candidate resource set.

Proposal 10: Pre-emption triggering conditions should include the followings:

* Resource pre-emption is allowed when the measured CBR ≥ X%, where X is (pre-)configurable between [60, 70, 80] or when the candidate resource set is less than 20%
* The time gap between the first pre-empting SCI and the pre-empted resource shall be larger than T3

Proposal 11: Resource for the initial transmission of a TB ought to be selected among the “empty resources” that has not been previously reserved/indicated by others. Pre-emption is only allowed for the re-transmission(s).

## [R1-2006076](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006076.zip) InterDigital, Inc. Remaining Issues on NR Sidelink Mode 2 Resource Allocation

**Proposal 1:** The reserved HARQ retransmission resource can be reused by other UEs based on HARQ-ACK detection.

**Proposal 2:** For the resource re-evaluation, the UE uses the same reservation period (i.e. ) as the initial resource selection of the TB.

**Proposal 3:** For pre-emption, no reservation period (i.e. ) is used.

**Proposal 4:** For resource re-selection of a (pre-)empted resource with periodic reservations

* If the resource is pre-empted by a dynamic reservation, the UE reselects the (pre-)empted resource only.
* If the resource is pre-empted by a periodic reservation, the UE reselects all the periodic reserved resources

**Proposal 5:** For the resource exclusion procedure, the UE only excludes the period to be indicated in the SCI of the TB.

**Proposal 6:** In Step 1 of the resource selection procedure, the UE excludes all the resources in a slot it expects to receive data and the priority of the transmission data is lower than that of the reception data.

## [R1-2006101](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006101.zip) Samsung On Mode 2 for NR Sidelink

**Proposal 1:** Adopt the below TP to correct the definition of sensing window as logical slots in Section 8.1.4 of TS 38.214.

|  |
| --- |
| 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 …  2) ~~The sensing window is defined by the range of slots [)~~ The UE shall monitor slots , , …,except for those in which its transmission occur, where if slot n belongs to the set , otherwise slot is the first slot after slot n belonging to the set 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 can belong 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.  \*\*\* Unchanged text is omitted \*\*\* |

**Proposal 2:** Adopt the below TP to remove Step 5 in Section 8.1.4 of TS 38.214.

|  |
| --- |
| 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 …  ~~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.~~  ~~6~~5) 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 slot n belongs to the set , otherwise slot is the first slot after slot n belonging to the set ; otherwise . is set to selection window size *T2* converted to units of *ms*.  ~~7~~6) If the number of candidate single-slot resources remaining in the set is smaller than , then is increased by 3 dB for each priority value and the procedure continues with step 4.  \*\*\* Unchanged text is omitted \*\*\* |

## [R1-2006264](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006264.zip) Spreadtrum Communications Remaining issues in NR sidelink mode 2 resource allocation

Proposal 1: Re-evaluation of periodically reserved resources is not supported.

Proposal 2: Pre-emption of periodically reserved resource in the next upcoming period is supported, and it is up to UE implementation whether the re-selected resource is periodically reserved or not.

Proposal 3: Ensure N/20ms × Prsvp is an integer for valid conversion of Prsvp\_TX and Prsvp\_RX measured in ms to P’rsvp\_TX and P’rsvp\_RX in logical slots.

Proposal 4: When periodic reservation is enabled in a resource pool, T0 should be (pre)-configured as Pm+100 ms, where Pm is the maximum period value (pre)-configured in the resource pool.

Proposal 5: candidates should be selected and reported to higher layers, and adopt TP #1 in subsection 2.4.

## [R1-2006353](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006353.zip) ETRI Resource allocation mode 2 for NR V2X

Proposal 1: Propose to support backward indication with full flexibility, that is separate field of ceil(log2(Nmax)) bits in SCI format 1-A

Proposal 2: Propose to apply separate (pre-)configured sub-set (including empty and full set possibilities) of periodicities for exclusion of slots in the selection window which correspond to slots not monitored in the sensing window

## [R1-2006435](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006435.zip) Ericsson Open issues and corrections on Mode 2 resource allocation

Proposal 1 Correct the references in the description of the fields for SCI format 1-A.

Proposal 2 Align the terminology ‘resource reservation period’ (TS 38.212) and ‘resource reservation interval’ (TS 38.214)

Proposal 3 Correct the references in the description of the fields for SCI format 2-A.

## [R1-2006559](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006559.zip) Sharp Remaining issues on resource allocation mode 2 for NR sidelink

**Proposal 1:** Further clarify that the hypothetical SCI format 1-A indicates N=1 actual resource in step 5 of sensing procedure.

**Proposal 2:** The higher layers shall ensure the periodical reserved resources are not overlapping with any resource reserved by TDRA field in SCI.

## [R1-2006695](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006695.zip) NTT DOCOMO, INC. Maintenance for resource allocation mechanism mode 2

**Proposal 1:**

* Whether to allow a retransmission of a TB right on or after an initial transmission of the next TB corresponding to a single periodic chain is up to the number of HARQ processes available for the chain, i.e. up to higher layers.
  + If only one HARQ process is available, then it cannot be allowed
  + Otherwise, it is possible.

**Proposal 2:**

* In identification of candidates resources for resource selection, RSRP threshold increment is terminated in case of either of the following:
  + RSRP threshold is over maximum value, which is specified.
  + The number of RSRP threshold increment is over maximum number, which is specified.

**Proposal 3:**

* Support exclusion of “subset” of (pre-)configured periodic resource(s) considering unmonitored slots
* The subset is determined by the following:
  + A UE does not receive any PSCCH at slot n due to e.g. half duplex (i.e. unmonitored slot), then:
    - If one or more slots of later period(s), which are determined based on the periodicity, are included in the same sensing window, and if the UE is able to receive SCI at least one of the slots, the periodicity is not included in the subset.
    - Otherwise, the periodicity is included in the subset.

**Proposal 4:**

* the following TP is proposed.

|  |
| --- |
| 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:  - …  - 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.  - the subset of resources as part of re-evaluation or pre-emption procedure is determined at least at - , and 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. |

## [R1-2006770](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_102\Docs\R1-2006770.zip) Qualcomm Incorporated Sidelink Resource Allocation Mode 2

Observation 1: There is a naming mismatch between TS 38.331 and TS 38.214 for the higher layer parameter used to define T2min

Proposal 1: Adopt the following TP to correct the higher layer parameter used to define T2min in TS 36.214.

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

Observation 2: The procedure to set reservation period value by higher layer has not been captured

Proposal 2: Adopt the following TP to set "Resource reservation period" field in SCI-1A in TS 36.213, section 16.4.

- If the UE is provided *sl-MultiReserveResource-r16,* "Resource reservation period" as an index in *sl-ResourceReservePeriod-r16* corresponding to

- a reservation period provided by higher layers [11, TS 38.321] if the resource in the next period will be used to transmit the next TB

- 0 otherwise.

Proposal 3: Adopt the following TP to prevent overlap in time between two selected resources

----------------------------------------------------begin text proposal for 38.214----------------------------------------------------

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

<<<unchanged text omitted>>>

7) The UE shall exclude any candidate single-slot resource from the set if slot contains a resource selected for transmission of another transport block.

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

-----------------------------------------------------end text proposal for 38.214-----------------------------------------------------

## [R1-2006864](file:///C:\\Users\\wanshic\\OneDrive%20-%20Qualcomm\\Documents\\Standards\\3GPP%20Standards\\Meeting%20Documents\\TSGR1_102\\Docs\\R1-2006864.zip) ASUSTeK Remaining issues for Mode 2 resource allocation in NR V2X

Observation: For short reserved period (e.g., 1~9ms), it may cause dense resource reservation which may make other UE hard for identify and select resource.

Proposal 1: For a short reserved period, indicated by SCI received in slot , UE excludes a candidate resource if the condition in TS 38.214, section 8.1.4 bullet (6) are all met with update that Q is determined in the following

* + - Alt 1: , where and is 20ms specified in specification
    - Alt 2 : , where and is 20ms specified in specification

Proposal 2: Adopt Text proposal 1 or Text proposal 2 in updating of TS 38.214 section 8.1.4

Prior Agreements on Resource Allocation

## RAN1 101-e

|  |  |  |
| --- | --- | --- |
| Agreements:   * Tproc,0 is {1, 1, 2, [2 or 4]} physical slots for {15, 30, 60, 120} kHz sub-carrier spacing respectively   Agreements:   * Confirm that sensing window size parameter T0 is (pre)-configured between two values: 1100 ms and 100 ms   Working assumption:   * Tproc,0 is 4 physical slots for 120 kHz sub-carrier spacing   Agreements   * T3 = Tproc,1, where the UE is only required to include sensing information from time earlier than ‘m – T3 – Tproc,0’ for pre-emption and re-evaluation check at time ‘m – T3’   Working assumption:   * Tproc,1 is 2 ms converted to physical slots+ 1 slot, i.e. {3, 5, 9, 17} for {15, 30, 60, 120} kHz sub-carrier spacing respectively   Agreements:   * For a reserved resource to be signalled in slot ‘m’, the procedure to check whether it is re-selected due to pre-emption, the UE follows the same behavior in terms of the timing of checking as in that of the re-evaluation case.   + Further discussion regarding any potential issue related to pre-emtption application timing   Agreements:   * In case a UE cannot find a resource in the identified candidate resource set fulfilling the minimum HARQ RTT time gap, it is up to UE implementation how to handle it but without violating the HARQ RTT minimum time gap   **Conclusion:**         For re-evaluation of a pre-selected resource contained in a slot ‘k’ to be first time signaled in a slot ‘m’, where k ≥ m, a UE is not mandated to perform Step 1 checking every slot before ‘m-T3’  Agreements:  X% is is (pre-)configured per pool per L1 priority from a set of {20, 35, 50} %,   * + - RSRP threshold adaptation triggering issue is not further discussed in Rel-16   Agreements:   |  | | --- | | Agreements:   * In Step 2, a UE ~~should/~~shall select resources so that HARQ retransmission resources can be reserved by a prior SCI, except that   + In case no resource can be found for reservation (e.g., based on the identified candidate set after Step 1) for a retransmission of a TB, the re-transmission can be transmitted on a resource that is not reserved   + After the resource selection is performed, HARQ retransmission on a resource not reserved by a prior SCI is allowed due to transmission dropping caused by prioritization, pre-emption and congestion control   + ~~To discuss and conclude “should vs. shall” in RAN1#101~~ |  * Send an LS to RAN2 informing the above agreement (the updated agreement without the change marks), and indicating that the agreement is not intended to be in conflict with the corresponding QoS requirements. If the requirements can not be met, up to RAN2 to address accordingly   Agreements:   * Confirm the following working assumption from RAN1#100bis-e with "shall”:  |  | | --- | | ~~Working assumption:~~ Agreements:   * The UE ~~should/~~shall indicate min(Nselected, N) first-in-time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1, where   + Nselected is the number of resources selected by MAC within 32 slots (including the current one)   + N is the maximum number of resources that can be signalled in one SCI   + ~~To discuss and conclude “should vs. shall” in RAN1#101~~ |  * To also add the above agreements (without change marks) to the RAN2 LS, indicating that the agreement is not intended to be in conflict with the corresponding QoS requirements. If RAN2 sees any issues, please inform RAN1 accordingly.   Agreements:   * A UE is expected to be (pre-)configured with a set *sl-ResourceReservePeriod* containing value of 0 ms   Agreements:   * For conversion of *Prsvp\_TX* and *Prsvp\_RX* measured in ms to *P’rsvp\_TX* and *P’rsvp\_RX* in logical slots, LTE principle is reused by the following formula:   + *P’rsvp* = ceiling(N/20ms × *Prsvp*) where N is the number of slots that can be used for SL transmission within 20 ms of the configured UL-DL configuration   Agreements:   * In 38.214, section 8.1.4, Tscal is set   + the selection window length in ms   Agreements:   * Reuse LTE rule to calculate C\_resel from SL\_RESOURCE\_RESELECTION\_COUNTER:   + C\_resel=10\*SL\_RESOURCE\_RESELECTION\_COUNTER * Introduce the following scaling to SL\_RESOURCE\_RESELECTION\_COUNTER range and inform RAN2 about this decision:   + SL\_RESOURCE\_RESELECTION\_COUNTER is the value randomly selected from the range   (the range as a working assumption)   * Note: this intends to capture details of the RAN1#99 agreement which are still missing in specifications   Agreements:   * A UE sets “Resource reservation period” in SCI 1-A to correspond to value of the period provided by higher layers from (pre-)configured set *sl-ResourceReservePeriod*   + RAN1 assumes that at least in cases if higher layer decides not to keep the resource for the transmission in the next period or there is no associated period, then higher layer provides 0 ms periodicity     - Send LS to RAN2 to inform this decision |

## RAN1 100bis-e

|  |
| --- |
| Agreements:   * It is up to UE implementation to reselect any pre-selected but not reserved resource which is still in the identified resource set after Step 1 in order to ensure the timing restrictions during reselection triggered by re-evaluation and/or pre-emption   + The timing restrictions at least include the HARQ RTT related minimum gap Z agreed in RAN1#100e   + FFS how to handle the case that there is no resources satisfying the timing restrictions in the identified resource set after Step 1   Agreements:   * The procedure to check whether a reserved resource to be signaled in slot ‘m’ should be re-selected due to pre-emption:   + A regular Step 1 (as in 8.1.4 in 38.214) of the resource (re-)selection procedure is performed   + If the reserved resource is still in the identified candidate resource set after the Step 1 execution, then Step 2 for reselection of the reserved resource(s) is not triggered   + If the reserved resource is NOT in the identified candidate resource set after the Step 1 execution     - If the resource is excluded by comparison with the RSRP measurement for an SCI associated with a priority which can trigger pre-emption, then Step 2 for reselection of the reserved resource(s) is triggered     - If the resource is excluded by comparison with the RSRP measurement for an SCI associated with a priority which cannot trigger pre-emption, then Step 2 for reselection of the reserved resource(s) is not triggered   Agreements:   * Once pre-emption re-selection condition is met at the UE, re-selection is performed for all resources which satisfy the pre-emption re-selection condition   + A UE ensures the HARQ RTT related minimum time gap Z agreed in RAN1#100-e, between re-selected and non-preempted resources during the re-selection triggered by pre-emption   + FFS cases when timing restriction could not be met   + FFS whether/how to extend it to periodic reservations   Agreements: Finalize the RRC parameter for pre-emption activation per resource pool by   * Disabled * Enabled. Default is without a priority level (i.e., pre-emption is applicable to all levels).   + Can optionally configuring a priority level p\_preemption {1…8} (the value range is a working assumption), and (as a working assumption regarding “<”) if prioRX < p\_preemption, and prioTX > prioRX, then pre-emption can be triggered     - Note: In the inequalities it is assumed that the lowest priority value corresponds to the highest priority/importance traffic     - prioRX is the priority associated with the resource indicated in SCI, as per 8.1.4 in 38.214     - prioTX is L1 priority within a UE associated with the reserved resources, as per 8.1.4 in 38.214   Agreements:   * In Step 2, a UE should/shall select resources so that HARQ retransmission resources can be reserved by a prior SCI, except that   + In case no resource can be found for reservation (e.g., based on the identified candidate set after Step 1) for a retransmission of a TB, the re-transmission can be transmitted on a resource that is not reserved   + After the resource selection is performed, HARQ retransmission on a resource not reserved by a prior SCI is allowed due to transmission dropping caused by prioritization, pre-emption and congestion control   + To discuss and conclude “should vs. shall” in RAN1#101   Working assumption:   * The UE should/shall indicate min(Nselected, N) first-in-time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1, where   + Nselected is the number of resources selected by MAC within 32 slots (including the current one)   + N is the maximum number of resources that can be signalled in one SCI   + To discuss and conclude “should vs. shall” in RAN1#101   **Conclusion:**   * Prioritization of earlier resources for the initial resource selection is not specified in Rel-16   + No additional spec update is expected |

## RAN1 100-e

|  |
| --- |
| Agreements:   * For re-evaluation of a pre-selected resource contained in a slot ‘k’ to be first time signaled in a slot ‘m’, where k ≥ m,   + Step 1 of the resource (re-)selection procedure is performed at least at the moment ‘m-T3’, and if the pre-selected resource is not in the identified candidate resource set, Step 2 is triggered for reselection of the resource     - Re-evaluations before the moment ‘m-T3’ or after ‘m-T3’ but before ‘m’ are not precluded and are up to UE implementation       * FFS whether to mandate a UE to perform Step 1 checking every slot before ‘m-T3’     - FFS whether evaluation of Step 2 has to ensure any introduced timing restrictions between pre-selected and re-selected resources when re-evaluation is triggered, and whether it is allowed to change the pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the timing restrictions * FFS whether for the case of enabled periodic reservation, already reserved resources in upcoming periods can be re-evaluated   Agreements:   * For pre-emption, both full and partial frequency domain overlap in the same slot are considered as the overlapping condition to trigger resource reselection, wherein the whole resource is reselected even if the partial overlap happened * (Re-)selection procedure for an already reserved but pre-empted resource to be used for transmission in a slot ‘m’ is not required to be triggered at moment > ‘m – T3’   + T3 here is identical to T3 introduced for the re-evaluation * FFS whether re-selection of the already-reserved, but pre-empted resource applies only to the resource transmitted in slot ‘m’ or to other already-reserved and pre-empted resource(s) signaled in the SCI in slot ’m’ as well   Agreements:   * In Step 2, a UE ensures a minimum time gap Z = a + b between any two selected resources of a TB where a HARQ feedback for the first of these resources is expected   + ‘a’ is a time gap between the end of the last symbol of the PSSCH transmission of the first resource and the start of the first symbol of the corresponding PSFCH reception determined by resource pool configuration and higher layer parameters of *MinTimeGapPSFCH* and *periodPSFCHresource*   + ‘b’ is a time required for PSFCH reception and processing plus sidelink retransmission preparation including multiplexing of necessary physical channels and any TX-RX/RX-TX switching time and is determined by UE implementation   Agreements:   * Time resource assignment in SCI uses an extended time domain RIV mechanism as follows:   if    elseif    else  if    else    end if  end if  where   * N denotes the actual number of resources indicated * Ti denotes i-th resource time offset   + for N=2,   + for N=3, ,   Agreements:   * For frequency resource indication, the following resource index calculation is used   + For Nmax = 2,   + For Nmax = 3,   + where     - f2 denotes lowest sub-channel index for the second resource, if any     - f3 denotes lowest sub-channel index for the third resource, if any     - m denotes number of sub-channels in a frequency resource allocation   + If time domain allocation indicates N < Nmax, the decoded lowest sub-channel indexes corresponding to Nmax minus N last resources are not used   Agreements:   * Down-select in the next meeting one of the following options   + Option 1: There is no separate field in the first stage SCI indicating a resource index for the purpose of backward indication, i.e., backward indication is not supported   + Option 2: When periodic reservations are enabled in a resource pool, a separate field of 1 bit in the first stage SCI indicates a resource index for the purpose of backward indication   + Option 3: When periodic reservations are enabled in a resource pool, a separate field of ceil(log2(Nmax)) bit in the first stage SCI indicates a resource index for the purpose of backward indication   Agreements:   * On a per resource pool basis, when reservation of a sidelink resource for an initial transmission of a TB at least by an SCI associated with a different TB is enabled:   + A set of possible period values additionally includes all integer values from 1 to 99 ms   **Conclusion**   * Evaluate till the next meeting whether given the agreed set of configurable reservation periodicities, the change to the exclusion procedure is necessary, wherein currently all configured period values are used for exclusion as inherited from LTE |

## RAN1 99

|  |
| --- |
| Agreements:   * Support W to be equal to 32 slots   Agreements:   * The first proposal under Wed. session in R1-1913450 is agreed, with one clarification that S is the number of sub-channels in the resource pool   Agreements:   * On a per resource pool basis, when reservation of a sidelink resource for an initial transmission of a TB at least by an SCI associated with a different TB is enabled:   + A period is additionally signalled in SCI and the same reservation is applied with respect to resources indicated within NMAX within window W at subsequent periods   + A set of possible period values is the following: 0, [1:99], 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000 ms     - <= 4 bits are used in SCI to indicate a period     - An actual set of values is (pre-)configured   + Regarding the number of periods     - The number of remaining periodic reservations is not explicitly indicated in SCI   + (working assumption) Procedure of mapping of periodic semi-persistent resources into the resource selection window is reused from LTE     - By reusing TS 36.213, section 14.1.1.6, steps 5 and 6 of non-partial sensing, as applicable   + (working assumption) Procedure of triggering periodic semi-persistent resources reselection based on reselection counter and keep probability is reused from LTE     - By reusing definition and procedure of Cresel defined in TS 36.213, as applicable       * Send an LS to RAN2 asking them to implement accordingly for TS38.321 based on TS36.321, R1-1913458 – Sergey (Intel)   + Procedure of using sidelink RSSI for ranking of resources is not applied   Agreements**:**   * T2min is (pre-)configured per priority indicated in SCI from the following set of values:   + {1, 5, 10, 20}\*2µ, where µ = 0,1,2,3 for SCS 15,30,60,120 respectively   Agreements:   * In Step 2, randomized resource selection from the identified candidate resources in the selection window is supported   + FFS if CSI can be used for resources selection   Agreements:   * T0 is (pre)-configured between: 1000+[100]ms and [100]ms   Agreements:  Support (pre)-configuration per resource pool between:   * L1 SL-RSRP measured on DMRS of PSSCH after decoding of associated 1st stage SCI, or * L1 SL-RSRP measured on DMRS of PSCCH for 1st SCI after decoding of associated 1st stage SCI * Note: L1 SL-RSRP is measured only based on one of the above, but not both |

## RAN1 98bis

|  |
| --- |
| Agreements**:**   * Maximum number of HARQ (re-)transmissions is (pre-)configured per priority per CBR range per transmission resource pool   + The priority is the one signaled in SCI   + This includes both blind and feedback-based HARQ (re)-transmission * The value range is any value from 1 to 32   + If the HARQ (re)transmissions for a TB can have a mixed blind and feedback-based approached (FFS whether or not to support this case), the counter applies to the combined total   Agreements:   * Resource (re-)selection procedure supports re-evaluation of Step 1 and Step 2 before transmission of SCI with reservation   + The re-evaluation of the (re-)selection procedure for a resource reservation signalled in a moment ‘m’ is not required to be triggered at moment > ‘m – T3’ (i.e. resource reselection processing time needs to be ensured)   + FFS condition to change resource(s) from previous iteration to resource(s) from current iteration   + FFS relationship of T1 and T3, if any   + FFS whether to handle it differently for blind and feedback-based retransmission resources   Agreements:   * In Step 1, initial L1 SL-RSRP threshold for each combination of pi and pj is (pre-)configured, where pi - priority indication associated with the resource indicated in SCI and pj - priority of the transmission in the UE selecting resources   Agreements:   * In Step 1, when the ratio of identified candidate resources to the total number of resources in a resource selection window, is less than X%, all configured thresholds are increased by Y dB and the resource identification procedure is repeated   + FFS value(s)/configurability of X     - At least one value of X=20   + Y=3 * FFS other conditions to stop RSRP threshold increment, if any   Agreements**:**   * Support a resource pre-emption mechanism for Mode-2   + A UE triggers reselection of already signaled resource(s) as a resource reservation in case of overlap with resource(s) of a higher priority reservation from a different UE and, SL-RSRP measurement associated with the resource reserved by that different UE is larger than an associated SL-RSRP threshold     - Only the overlapped resource(s) is/are reselected     - FFS       * the timeline for reselection       * other details     - FFS whether or not to support other potential UE behaviour (e.g, power boosting/reduction)   + This mechanism can be enabled or disabled, per resource pool     - FFS details   Agreements:   * Support at least an initial transmission and reservation of the resource(s) for retransmission(s) to have the same number of sub-channels * To down-select in the early week of RAN1#99 one of the following:   + Alt. 1-1: Support a single sub-channel PSCCH+PSSCH reserving resource(s) for retransmission(s) of a TB with a larger number of sub-channels, where PSSCH REs are occupied by 2nd stage SCI and by SCH     - 1 bit indication is carried in 1st stage SCI to distinguish the single sub-channel     - TBS is determined based on number of sub-channels indicated for reserved resource(s)     - RV is determined based on explicit field in 2nd stage SCI (as agreed)   + Alt. 1-2: Support a single sub-channel PSCCH+PSSCH reserving resource(s) for the initial transmission and possibly retransmission(s) of a TB with a larger number of sub-channels, where all available PSSCH REs in the single sub-channel PSCCH+PSSCH are occupied only by 2nd stage SCI     - 1st stage SCI indicates that PSSCH REs are occupied by 2nd stage SCI   + Alt. 2: Do not support the different number of sub-channels between initial transmission and reservation of resource(s) for retransmission(s)     - Alt 1 is not supported in this case   + Companies are encouraged to provide more analysis and evaluations for the above 3 alternatives   Agreements:   * When reservation of a sidelink resource for an initial transmission of a TB at least by an SCI associated with a different TB is disabled, NMAX is 3   + SCI signaling is designed to allow to indicate 1 or 2 or 3 resources at least of the same number of sub-channels with full flexibility in time and frequency position in a window W of a resource pool     - FFS: if full flexibility is limited in some cases   + Value 2 or 3 is (pre-)configured per resource pool   + FFS size of window W   Agreements:   * When reservation of a sidelink resource for an initial transmission of a TB at least by an SCI associated with a different TB is enabled, select in RAN1#99 from the following:   + Option. 1-a. A period > W is additionally signaled in SCI and the same reservation is applied with respect to resources indicated within NMAX within window W at subsequent periods     - FFS number of subsequent reservation periods     - FFS NMAX is always same regardless if a period > W is additionally signaled or not for SCI size perspective.   + Option. 1-b. A time gap > W is additionally signaled in SCI and the same reservation is applied with respect to resources indicated within NMAX within window W at resources indicated by the time gap     - FFS NMAX is always same regardless if a time gap > W is additionally signaled or not for SCI size perspective.   + Option. 2. There is no additional field (NDI and HARQ ID are used at the moment of SCI reception) to distinguish reservation for another TB, and at least one of NMAX resources can be signaled beyond window W   Agreements:   * For a given time instance n when resource (re-)selection and re-evaluation procedure is triggered   + The resource selection window starts at time instance (n + T1), T1 ≥ 0 and ends at time instance (n + T2)     - The start of selection window T1 is up to UE implementation subject to T1 ≤ Tproc,1     - T2 is up to UE implementation with the following details as a working assumption:       * T2 ≥ T2min       * If T2min > Remaining PDB, then T2min is modified to be equal to Remaining PDB       * FFS other details of T2min including whether the minimum window duration T2min - T1 is a function of priority     - UE selection of T2 shall fulfil the latency requirement, i.e. T2 ≤ Remaining PDB   + A sensing window is defined by time interval [n – T0, n – Tproc,0)     - T0 is (pre-)configured, T0 > Tproc,0 FFS further details   + FFS, if Tproc,0 and Tproc,1­ are defined separately or as a sum   + FFS relation of T3, Tproc,0, Tproc,1   + Time instances n, T0, T1, T2, T2min are measured in slots, FFS Tproc,0 and Tproc,1   Agreements:   * A UE is expected to select resources for all intended (re-)transmissions within the PDB, i.e. the number of intended (re-)transmissions is an input to the resource (re-)selection procedure |

## RAN1 98

|  |
| --- |
| Agreements:   * At least for mode 2, The maximum number of SL resources NMAX reserved by one transmission including current transmission is [2 or 3 or 4]   + Aim to select the particular number in RAN1#98 * NMAX is the same regardless of whether HARQ feedback is enabled or disabled   Agreements:   * At least for mode 2, (Pre-)configuration can limit the maximum number of HARQ (re-)transmissions of a TB   + Up to 32   + FFS the set of values   + FFS signaling details (UE-specific, resource pool specific, QoS specific, etc.)   + If no (pre)configuration, the maximum number is not specified   + Note: this (pre-)configuration information is NOT intended for the Rx UE   Agreements:   * In Mode-2, SCI payload indicates sub-channel(s) and slot(s) used by a UE and/or reserved by a UE for PSSCH (re-)transmission(s) * SL minimum resource allocation unit is a slot * FFS whether when the resource allocation is multiple slots, the slots can be aggregated * FFS whether in case of multiple slots, the indicated slots are contiguous or not   Working assumption:   * An indication of a priority of a sidelink transmission is carried by SCI payload   + This indication is used for sensing and resource (re)selection procedures   + This priority is not necessarily the higher layer priority   Agreements:   * The resource (re-)selection procedure includes the following steps   + Step 1: Identification of candidate resources within the resource selection window     - FFS details   + Step 2: Resource selection for (re-)transmission(s) from the identified candidate resources     - FFS details   Agreements:   * In Step 1 of the resource (re-)selection procedure, a resource is not considered as a candidate resource if:   + The resource is indicated in a received SCI and the associated L1 SL-RSRP measurement is above an SL-RSRP threshold     - The SL-RSRP threshold is at least a function of the priority of the SL transmission indicated in the received SCI and the priority of the transmission for which resources are being selected by the UE   + FFS details |

## RAN1 97

|  |
| --- |
| Agreements**:**   * NR V2X Mode-2 supports resource reservation for feedback-based PSSCH retransmissions by signaling associated with a prior transmission of the same TB   + FFS impact on subsequent sensing and resource selection procedures   + At least from the transmitter perspective of this TB, usage of HARQ feedback for release of unused resource(s) is supported     - No additional signaling is defined for the purpose of release of unused resources by the transmitting UE     - FFS the behavior of the receiver UE(s) of this TB and other UEs   **Conclusion:**   * RAN1 to discuss further the following   + Maximum number of blind retransmissions supported for one TB   + Maximum number of reserved blind retransmission   + Maximum number of HARQ feedback-based retransmissions supported for one TB   + Maximum number of reserved HARQ feedback-based retransmission   Agreements:   * RAN1 to further select between the following options of sidelink resource reservation for blind retransmissions:   + Option 1: A transmission can reserve resources for none, one, or more than one blind retransmission   + Option 2: A transmission can reserve resource for none or one blind retransmission   Agreements:   * Resource selection window is defined as a time interval where a UE selects sidelink resources for transmission   + The resource selection window starts T1 ≥ 0 after a resource (re-)selection trigger and is bounded by at least a remaining packet delay budget   + FFS T1 value, whether it is measured in slots, symbols, ms, etc.   + FFS other conditions   Agreements:   * Support a sub-channel as the minimum granularity in frequency domain for the sensing for PSSCH resource selection   + No additional sensing for other channels |

## RAN1 96bis

|  |
| --- |
| Agreements**:**   * NR V2X supports an initial transmission of a TB without reservation, based on sensing and resource selection procedure * NR V2X supports reservation of a sidelink resource for an initial transmission of a TB at least by an SCI associated with a different TB, based on sensing and resource selection procedure   + This functionality can be enabled/disabled by (pre-)configuration * FFS Standalone PSCCH transmissions for resource reservations are supported in NR V2X |

## RAN1 96

|  |
| --- |
| Agreements:   * Blind retransmissions of a TB are supported for SL by NR-V2X   + Details are for the WI phase   Agreements:   * NR V2X Mode-2 supports reservation of sidelink resources at least for blind retransmission of a TB   + Whether reservation is supported for initial transmission of a TB is to be discussed in the WI phase   + Whether reservation is supported for potential retransmissions based on HARQ feedback is for the WI phase   Agreements:   * Mode-2 sensing procedure utilizes the following sidelink measurement   + L1 SL-RSRP based on sidelink DMRS when the corresponding SCI is decoded     - FFS whether/which measurement is used if the corresponding SCI is not decoded e.g. SL-RSRP after blind DMRS detection, SL-RSSI   Agreements:  In the context of Mode-2(d), NR V2X supports the following functionality:   * A UE informs gNB about group members and gNB provides individual resource pool configuration and/or individual resource configuration through the same UE to each group member UE within the same group. It does not require connection between member UE and gNB   + The UE cannot modify the configuration provided by gNB   + Higher layer signaling is to be used to provide the configuration. No physical layer signaling is used * FFS if one or both options are supported (i.e. resource pool configuration(s) or resource configuration) * FFS which functionality defined as a part of Mode-2 is applicable for this feature * This functionality is up to UE capability(ies) |

## RAN1 AH1901

|  |
| --- |
| Agreements:   * Mode-2 supports the sensing and resource (re)-selection procedures according to the previously agreed definitions.   + FFS resource granularity for sensing & resource (re)-selection, e.g., PRB(s), slots, resource patterns (when applicable), etc.   + FFS detailed conditions when these procedures can apply   Agreements:   * For the purpose of performance evaluation for Mode-2(c), the following Mode-2(c) transmission pattern selection is used when a UE is configured with a pool of patterns:   + Sensing based pattern selection (e.g. UE selects unused pattern based on sensing results)     - Additional information to assist pattern selection is not precluded, e.g., by using UE geographical location information   Agreements:   * Sub-channel based resource allocation is supported for PSSCH   + FFS details for sub-channels   + FFS other use cases for sub-channel (e.g., measurement, interaction with PSCCH, etc.)   Agreements:   * SCI decoding applied during sensing procedure provides at least information on sidelink resources indicated by the UE transmitting the SCI   Agreements:   * At least for the purpose of evaluation, in Mode-2(d), at least for group operation, a member UE transmits on resources configured by another UE (S-UE) within the same group   + High layer signaling is assumed between S-UE and a member UE |

## RAN1 95

|  |
| --- |
| Agreements:   * Sensing procedure is defined as SCI decoding from other UEs and/or sidelink measurements   + FFS information extracted from SCI decoding   + FFS sidelink measurements used   + FFS UE behavior and timescale of sensing procedure   + Note: It is up to further discussion whether SFCI is to be used in sensing procedure   + Note: Sensing procedure can be discussed in the context of other modes * Resource (re)-selection procedure uses results of sensing procedure to determine resource(s) for sidelink transmission   + FFS timescale and conditions for resource selection or re-selection   + FFS resource selection / re-selection details for PSCCH and PSSCH transmissions   + FFS details for PSFCH (e.g. whether resource (re)-selection procedure based on sensing is used or there is a dependency/association b/w PSCCH/PSSCH and PSFCH resource)   + FFS impact of sidelink QoS attributes on resource selection / re-selection procedure * For Mode-2(a), the following schemes for resource selection are evaluated, including   + Semi-persistent scheme: resource(s) are selected for multiple transmissions of different TBs   + Dynamic scheme: resource(s) are selected for each TB transmission   Agreements:   * Mode-2(b) to be studied as a functionality that can be a part of Mode-2(a)(c)(d) operation, when one UE assists sidelink resource selection for other UE(s) * Note: Mode-2(b) is not supported/studied as a standalone sidelink resource allocation mode   Agreements:   * For out of coverage operation, Mode-2(c) assumes (pre)-configuration of single or multiple sidelink transmission patterns (patterns are defined on each sidelink resource pool). * For in-coverage operation, Mode-2(c) assumes that gNB configuration indicates single or multiple sidelink transmission patterns (patterns are defined on each sidelink resource pool) * FFS pattern design in time and frequency for periodic and aperiodic traffic * If single pattern is configured to transmitting UE there is no sensing procedure executed by UE * If multiple patterns are configured to transmitting UE there is a possibility of sensing procedure executed by UE * Pattern is defined as follows   + Size of the resource in time and frequency   + Position(s) of the resource in time and frequency   + Number of resources * FFS pattern selection procedure by UE   Agreements:   * For Mode-2(d) operation, further study the following potential radio-layer procedures including at least the following   + Procedures to become/serve as a scheduling UE for in-coverage and out-of-coverage scenarios     - The following options are identified for further study:       * Scheduling UE is configured by gNB       * Application layer or pre-configuration selects scheduling UE       * Receiver UE schedules transmissions of the transmitter UE during the session       * Scheduling UE is decided by multiple UEs including the one that is finally selected         + UE may autonomously decide to serve as a scheduling UE (self-nomination) / offer scheduling UE functions   Agreements:   * Initialization of Mode-2(d) operation is FFS * For Mode-2(d) operation, further study the following potential radio-layer procedures including at least the following   + Procedure to determine a set of sidelink resources a scheduling UE can use for scheduling of other UEs     - The following options are identified:       * Based on sensing procedure by scheduling UE       * Configured by gNB if scheduling UE is in-coverage       * Pre-configured if scheduling UE is out of coverage       * Transmitting UE provides information about sidelink resources to scheduling UE   + FFS behavior/algorithm of scheduling UE   + Behavior of scheduling UE to signal scheduling decisions for transmission/reception of other UEs     - The following options are identified:       * Physical layer signaling       * Higher layer signaling   + UE behavior to (re)-select scheduling UE(s)   + UE behavior to associate to scheduling UE(s)   + UE behavior when scheduling UE stop scheduling   + Resource management to address collision/interference and half-duplex issues b/w UEs scheduled by different scheduling UEs   + Relationship between scheduling UE and UE groups from upper layer perspective     - Whether UEs from the same upper layer group are served by the same scheduling UE   + Resources used for communication before UE is associated with a scheduling UE   + Procedures to switch between Mode-2(d) from/to other sub-modes |

## RAN1 94bis

|  |
| --- |
| Agreements:   * Sidelink sensing and resource selection procedures are studied for Mode-2(a)   + The following techniques are studied to identify occupied sidelink resources     - decoding of sidelink control channel transmissions     - sidelink measurements     - detection of sidelink transmissions     - other options are not precluded, including combination of the above options   + The following aspects are studied for sidelink resource selection     - how a UE selects resource for PSCCH and PSSCH transmission (or other sidelink physical channel/signal, if it is introduced)     - which information is used by UE for resource selection procedure   Agreements:   * The following aspects about assistance information are studied for Mode 2(b)   + Which assistance information is used and how it is acquired   + Which UE sends assistance information   + How to deliver assistance information, including physical channel and UE behavior   + How assistance information is taken into account in determination of sidelink resource for transmission * RAN1 to further study whether some or all of Mode-2(b) functionality is a part of Mode-2(a)(c)(d)   Agreements:   * The following aspects are studied for Mode 2(c)   + How to assign resource(s) for UE sidelink transmission to mitigate collisions and half-duplex impacts   + Whether any sensing or resource selection procedure is used on top of configured grant(s)   + Whether and how to use any granted but unused resources   + How to adapt to traffic variation   + How it is different from Mode-1 operation for in-coverage scenario   + How it is different from Mode-2(a), when Mode-2(a) uses dedicated resource pool with dedicated sidelink resource pool configuration   + Whether and how this mode operates out of network coverage * RAN1 to further study whether some or all of Mode-2(c) functionality is a part of Mode-2(a)(b)(d)   Agreements:   * The following aspects are studied for Mode 2(d)   + In which use cases/scenarios this mode is applicable   + What is the overall architecture for Mode-2(d) operation   + How to decide which UE schedules which other UE(s) and how to maintain this relationship   + What is the procedure of UE(s) when the scheduling UE disappears   + What is the scheduling UE behavior and signaling mechanism to schedule sidelink resources for transmission/reception for other UEs   + Which resources can be used to schedule other UEs   + Inter- and intra-UE collision handling and sidelink resource allocation mechanisms across groups * RAN1 to further study whether or not some or all of the above aspects are applicable to 2(b) |

## RAN1 94

|  |
| --- |
| Agreements:   * At least two sidelink resource allocation modes are defined for NR-V2X sidelink communication   + Mode 1: Base station schedules sidelink resource(s) to be used by UE for sidelink transmission(s)   + Mode 2: UE determines (i.e. base station does not schedule) sidelink transmission resource(s) within sidelink resources configured by base station/network or pre-configured sidelink resources   Notes:   * + eNB control of NR sidelink and gNB control of LTE sidelink resources will be separately considered in corresponding agenda items.   + Mode-2 definition covers potential sidelink radio-layer functionality or resource allocation sub-modes (subject to further refinement including merging of some or all of them) where     1. UE autonomously selects sidelink resource for transmission     2. UE assists sidelink resource selection for other UE(s)     3. UE is configured with NR configured grant (type-1 like) for sidelink transmission     4. UE schedules sidelink transmissions of other UEs * RAN1 to continue study details of resource allocation modes for NR-V2X sidelink communication |