**3GPP TSG RAN WG1 Meeting #100bis-E R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Source: Moderator (Intel Corporation)**

**Title: FL summary#2 of critical 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 critical issues in Mode-2 sidelink resource allocation for NR-V2X communication, based on review of the submitted contributions [1]-[27].

Identification of email discussions

Based on the review of identified critical issues in section 4, the following table is composed to collect views and provide initial FL’s assessment. My intention is to pick at least issues #2-#4 which have cross-WG impact to RAN2. One more issue needs to be selected among #1 and #5, where the preference is to leave processing times for next time again due to its isolated nature. There is no certainty on the need of discussing #6. Further, #7 can be handled as a TP email. Finally, #8 is assumed to be handled in the procedures AI.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Comments |
| Feature Lead |  | a, b | b, d, e, f, g | a, b, c | a, c, d |   |   |   | The intention is to pick at least issues #2-4 which have potential cross-WG impact to RAN2. One more issue needs to be selected among #1 and #5, where the preference could be to leave processing times for next time again due to its isolated nature. There is no certainty on the need of discussing #6. Further, #7 can be handled as a TP email. Finally, #8 is assumed to be handled in the procedures AI. |
| Panasonic |   | a, b | a, b, g | a, b, c | a, b, c, d |   |   |   |   |
| NEC |   | a, b | b, g | a, c | a, c |   |   |   | #7 can be handled as a TP email |
| Intel |   | a, b | b, d, e, f, g | a, b, c | a, b, c, d |   |   |   | We think it is important to discuss 5b as well, especially if we assume variation of packet statistics and QoS at packet level |
| NTT DOCOMO |   | a, b |   | a, b | a |   | b (as TP discussion) |   | #7 can be handled as a TP email |
| Fujitsu |   | a, b | a, b, g | a, b, c | a, c, d |   |   |   | Issue #2 and #4 worth to be continued based on the discussions we had in the last meeting. Considering the workload, 3 sub-topics are prioritized for issue #3 and #5. |
| TCL |   | a, b | b, f, g | a, c | a, c |   |   |   |   |
| Huawei/HiSilicon | a, b | a | b, f, g |   | a, d |   |   |   | As mentioned by other companies, the workload might be too much, especially for #2. To keep the workload of April reasonable, we suggest limiting #2 to only #2a). And for the points in #2b), if they are essential, may be considered in May. #4 seems to be non-essential, and the specification can work well without #4. And it seems the spec impact would be very much mainly in RAN2, and there will be no RRC impact. So we suggest to split the workload between WGs.On the other hand, #1 is important for the completeness of the whole feature.So #4 is given lower priority than #1, and #4 is not suggested for this meeting due to the 4 email thread budget. #7 can be handled as a TP email |
| Ericsson |   | a, b | b, f, g | a, b, c | a |   |   |   |   |
| Futurewei | a, b | a, b | b, g | a |   |   |   |   | #2 is the most important issue to complete. #1 is also critical and should be addressed this meeting to ensure timely completion of the feature. |
| Qualcomm |   | a, b | b, d, f, g (followed by e if scope is expanded) | a, b (followed by c if scope is expanded) | c, d, (followed by a then b if scope is expanded) |   |   |   | We agree in general with the FL prioritization and provide our view on additional ordering within some issues if the scope of the email is to be further expanded.Issue 8 is important to resolve, but we’re ok with addressing it in the Procedure AI (or here) |
| InterDigital |   | a, b | a, b, g | a, b, c | a, c |   |  |  |  |
| Samsung | b | b |   |   | a, c |   |   |   | We think that Issue#1 is a critical issue and need to discuss at this time (FL's comment that it is isolated issue does not make sense). According to Chairman's guidance for down-scoping issue per email thread, we select only 4 sub issues as prioritized issues. |
| Sharp | b | a, b | b, d | a, b, c |   |   |   |   |   |
| Apple | a, b | a, b | b, f | a, c |   |   |   |   | Issue #7 can be handled in TP phase.Since it is already been discussed in last RAN1 meeting, Issue #5 can be delayed to the next meeting so that Issue #1 can be discussed in this meeting.    |
| Xiaomi |  | a, b |  | c | c |  |  |  |  |
| OPPO |  | a, b | c, e | b | c |  |  |  | Within Issue #2, component a) and b) should have individual email discussion thread. |
| CATT |  | a and b are discussed in individual email thread | b, d, g |  | a, c |  |  |  | We also think there is too many components in #2, it is better to separate it into 2 individual email thread to keep reasonable workload. |
| LG Electronics |  | a, b |  | a | a |  |  |  | As commented by OPPO, in terms of keeping manageable load, we also prefer to have separate email discussion between a) and b) in Issue 2. In addition, considering the importance for the specification completeness, we suggest to focus on only the following topics for b) of Issue 2.* *Finalization of the RRC parameter for pre-emption configuration per resource pool (still TBD in the RRC list)*
* *Relation of pre-emption RSRP threshold and Step 1 checking*
* *Which resources can be re-selected – only ones to be transmitted or to be signaled*

For Issue 4, we think that a) should be concluded in this meeting, but as already discussed in the last meeting, it seems better to avoid bringing b) up again.For Issue 5, from our perspective, the decision on a) would be important, which has also an impact on, e.g., SCI design.We assume that Issue 8 will be handled in PHY procedure agenda.In summary, 4 email discussion threads could be allocated to a) of Issue 2, b) of Issue 2 with the modified scope, a) of Issue 4, and a) of Issue 5, respectively. |
| vivo |  | a, b | a, c, f | a, c |  | a, b, c |  |  |  |
| Nokia, NSB |  | a, b |  | a | c, a, d |  |  |  | Agree with others that issue #2 should be split into two threads |
| Bosch |  | a, b | b, f, g, h | a | b, a, c |  |  |  | We agree with intel that issue 5b is very important to consider. This will be useful for some V2X applications. For example, if the packet generation time can be periodic, it may still have fluctuating packet sizes to be transmitted on each period. |
| Total | a: 3b: 5c: 0 | a: 20+FLb: 20+FL | a: 4b: 14+FLc: 2d: 4+FLe: 3+FLf: 8+FLg: 12+FLh: 1 | a: 16+FLb: 9+FLc: 12+FL | a: 15+FLb: 4c: 13+FLd: 6+FL | a: 1b: 1c: 1 |  |  |  |

There is also a separate email budget for TPs. It is proposed to open TP discussion on issues listed in sections 5.1 and 5.3.

Based on the inputs to the scoping discussion, the following distribution of topics among four email discussions is proposed:

1. Re-evaluation and pre-emption
	1. Whether/how to ensure the timing restrictions in re-evaluation, including potential change of pre-selected resources
	2. Finalization of the RRC parameter for pre-emption configuration per resource pool (still TBD in the RRC list)
	3. Relation of pre-emption RSRP threshold and Step 1 checking
	4. Whether to mandate every slot re-evaluation
	5. Which resources can be re-selected after pre-emption condition – only ones to be transmitted or to be signalled
2. Step 1
	1. X%
	2. Additional exclusion conditions for unicast/groupcast reception
	3. Additional handling of reserved but unused resources
3. Step 2
	1. Whether to support HARQ retransmissions on unreserved resources
	2. Early in time initial resource selection
	3. Relation of selected number of resources and signalled number of resources, including number of outstanding reservations
4. Periodic reservation
	1. Backward signalling option
	2. Periods for exclusion if a slot is not monitored in a sensing window

As there is a separate email budget for TPs for agreements not captured after RAN1#100e, the following TP threads are proposed:

1. TP – capture time and frequency indication in SCI agreed as part of [100e-NR-5G\_V2X\_NRSL-RA\_Mode2-03]
2. [Potential thread] TP – fix PSSCH RSRP and capture exclusion of TTIs in the same period / aperiodic reservations

Identified critical issues list

1. **Processing times**
2. General processing times related
3. Values for Tproc,0, Tproc,1, T3
4. Whether/how to introduce an upper bound for ‘b’ (PSFCH processing plus retransmission preparation)
5. **Pre-emption and re-evaluation finalization**
6. Finalization of capturing re-evaluation in specification
	* Every slot re-evaluation
	* Ensure the timing restrictions or not
	* Change of pre-selected resources
	* Changing of periodically reserved resources based on re-evaluation
7. Finalization of capturing pre-emption in specification
	* Finalization of the RRC parameter for pre-emption configuration per resource pool (still TBD in the RRC list)
	* Relation of pre-emption RSRP threshold and Step 1 checking
	* Which resources can be re-selected – only ones to be transmitted or to be signalled
	* Additional conditions, e.g. CBR
	* Power reduction/boosting
8. **Step 1 finalization**
9. Max RSRP threshold
10. X%
11. RSRP based ranking to obtain 20%
12. RSRP threshold adaptation triggering issue due to selection window > 32 slots
13. RSRP for 2-port PSSCH DMRS
14. Additional exclusion conditions for unicast/groupcast reception
15. Additional handling of reserved but unused resources
16. Priority only resource identification
17. **Step 2 finalization**
18. Whether to support HARQ retransmissions on unreserved resources
19. Early in time initial resource selection
20. Relation of selected number of resources and signalled number of resources, including number of outstanding reservations
21. **Periodic transmission finalization**
22. Backward signalling option
23. Dynamic indication whether the period is applied to all indicated resources or a sub-set
24. Periods for exclusion if a slot is not monitored in a sensing window
25. Handling of UL-DL configurations in periodic transmissions projection
26. **Additional resource re-selection triggers**
27. NACK/DTX
28. Consecutive packet loss
29. CSI report reception
30. **Spec corrections**
31. PSSCH DMRS
32. Capturing exclusion of TTIs in the same period / aperiodic reservations
33. Configurable T2min parameter value should actually be T2min - T1
34. L1 priority for pre-emption, not L2 priority (inform RAN2)
35. **Procedural**
36. Mix of blind and feedback-based

Initial summary of proposals on the critical issues

## Processing times

Almost all companies expressed views on processing time values and their relations. The following issues are open:

1. General processing times related
	* Weather defined in symbols or in slots
	* Relation of Tproc,0, Tproc,1, and T3
	* Dependency on SCS
2. Values for Tproc,0, Tproc,1, T3
3. Whether/how to introduce an upper bound for ‘b’ (PSFCH processing plus retransmission preparation)
	* otherwise, leaving the upper bound up to implementation may lead to excessively large time gap between resources

## Pre-emption and re-evaluation finalization

Finalization of re-evaluation and pre-emption requires closure of the following items, where some issues have contribution sources listed:

1. Finalization of capturing re-evaluation in specification
	* Every slot re-evaluation
		+ Up to UE implementation: OPPO, Panasonic, ZTE/Sanechips, MediaTek, Lenovo/MotM, Samsung, Ericsson, Spreadtrum, InterDigital, NEC, NTT DOCOMO
		+ Mandatory: Huawei/HiSilicon, Nokia/NSB, Intel, CATT, Qualcomm
			- Intel and Qualcomm show results in support if it
	* Ensure the timing restrictions or not
		+ Supported: Nokia/NSB, LGE, Intel, Samsung
		+ Not supported: Lenovo/MotM, Spreadtrum
	* Change of pre-selected resources
		+ Supported: Huawei/HiSilicon, Nokia/NSB, Fujitsu, LGE, Intel, Ericsson, InterDigital (only for FB-based), NTT DOCOMO
		+ Not supported: OPPO, Spreadtrum
	* Changing of periodically reserved resources based on re-evaluation
		+ Supported: Huawei/HiSilicon, OPPO, CATT, Sharp
		+ Not supported: Lenovo/MotM, Ericsson, Spreadtrum, NEC
2. Finalization of capturing pre-emption in specification
	* Finalization of the RRC parameter for pre-emption configuration per resource pool (still TBD in the RRC list)
		+ Priority dependent configuration: OPPO, Intel, Apple, Qualcomm
			- Intel and Qualcomm show SLS evaluation in support of it
		+ Not priority dependent configuration: Fujitsu, TCL, FR, CATT, Samsung, NTT DOCOMO
	* Relation of pre-emption RSRP threshold and Step 1 checking
		+ Intel, Samsung, Qualcomm
	* Which resources can be re-selected – only ones to be transmitted or to be signalled
		+ Vivo, Nokia/NSB, LGE, MediaTek, Intel, Samsung, Ericsson, NEC, Sharp
	* Additional conditions, e.g. CBR
		+ OPPO, Nokia/NSB, TCL
	* Power reduction/boosting
		+ Supported: TCL
		+ Not supported: Panasonic, Fujitsu, CATT

## Step 1 finalization

Step 1 issues were deprioritised last time. This time, the following issues are identified based on contributions:

1. Max RSRP threshold
	* Supported: vivo, Panasonic, InterDigital
	* Not supported: Intel, Apple
2. X%
	* Depending on SCI signalling: Huawei/HiSilicon
	* Configured: Panasonic, Lenovo/MotM, Intel, CATT, ITL
	* Function of T2 and CBR: Lenovo/MotM
	* Function of total number ReTX: CATT
		+ Note: CATT shows different X provides gains in different situations
	* Fixed to 20: Apple
3. RSRP based ranking to obtain 20%
	* OPPO
4. RSRP threshold adaptation triggering issue due to selection window > 32 slots
	* CATT, Qualcomm
		+ Note: Qualcomm shows results in support if it
5. 2-port PSSCH DMRS
	* vivo, OPPO
6. Additional exclusion conditions for unicast/groupcast reception
	* vivo, Intel, Apple, ITL, Qualcomm
7. Additional handling of reserved but unused resources
	* Different RSRP thresholds
		+ Different associated priorities for FB and blind: Huawei/HiSilicon
		+ Different between initial TX and ReTX: TCL, Ericsson
	* Prioritize retransmission resources: Panasonic
	* PSFCH monitoring: Fujitsu, TCL, InterDigital, NEC, Qualcomm
	* No handling: Spreadtrum
	* Restriction on number of reservations in a pool or in SCI: vivo (by pre-configured number), Intel, NEC, Xiaomi
	* Release indication in PSSCH: ASUSTeK
8. Priority only resource identification
	* vivo

## Step 2 finalization

Although Step 2 was discussed last, there still remaining issues identified as follows:

1. Whether to support HARQ retransmissions on unreserved resources
	* Allowed w/o conditions: InterDigital
	* Allowed if chain is broken: ZTE/Sanechips, Samsung
		+ Note: ZTE/Sanechips shows results that HARQ process dropping is worse than unreserved retransmissions
	* Not allowed with exceptions
		+ Formulated using HARQ retransmissions: Panasonic, TCL (or no proposal), NTT DOCOMO, Qualcomm
		+ Formulated using resource selection: Nokia/NSB, Fujitsu, Intel, CATT, NEC
		+ Note: Intel and Qualcomm show results in support if it
2. Early in time initial resource selection
	* OPPO, Intel, CATT, DOCOMO, Qualcomm
		+ Note: Intel and Qualcomm show results in support if it
3. Relation of selected number of resources and signalled number of resources, including number of outstanding reservations
	* Fujitsu, Intel, Ericsson, NEC, Xiaomi

## Periodic transmission finalization

Last time the backward indication issue and periods for exclusion of slots not monitored in the sensing window were discussed. The following issues are still open based on tdoc review:

1. Backward signalling option
	* Option 1: OPPO, Nokia/NSB, ZTE/Sanechips, MediaTek, Spreadtrum, Apple, Sharp
	* Option 2: Ericsson, NTT DOCOMO
	* Option 3: Huawei/HiSilicon, LGE, TCL, Intel, NTT DOCOMO
		+ Note: Intel shows results in support if it
2. Dynamic indication whether the period is applied to all indicated resources or a sub-set
	* Intel
3. Periods for exclusion if a slot is not monitored in a sensing window
	* All configured, as in LTE: Ericsson
	* The one used for selection: InterDigital, Qualcomm
		+ Note: Qualcomm shows results in support if it
	* No exclusion: Samsung
	* Separate set / sub-set / handling
		+ Intel (separate set)
		+ OPPO, CATT, ASUSTeK - (mechanisms to reduce exclusions for small periods)
4. Handling of UL-DL configurations in periodic transmissions projection
	* Huawei/HiSilicon, OPPO, Spreadtrum

## Additional resource re-selection triggers

1. NACK/DTX
	* Vivo, Apple
2. Consecutive packet loss
	* Vivo
3. CSI report reception
	* vivo

## Spec corrections

1. PSSCH DMRS
	* Alignment correction: ZTE/Sanechips, NEC
2. Capturing exclusion of TTIs in the same period / aperiodic reservations
	* NTT DOCOMO, ASUSTeK, Qualcomm
3. Configurable T2min parameter value should actually be T2min - T1
	* Ericsson
4. L1 priority for pre-emption, not L2 priority (inform RAN2)
	* Ericsson

## Procedural

1. Mix of blind and feedback-based
	* Supported: OPPO, CATT, Qualcomm
	* Not supported: InterDigital

TPs for Previous Agreements

## Time and frequency resource indication

There are a few tdocs proposing how to capture the agreements from RAN1#100-E on “Time resource assignment” and “Frequency resource assignment”, thus the discussion could be based on these draft TPs.

## Re-evaluation and pre-emption

In FL’s understanding, most of the re-evaluation and pre-emption procedure is transparent to L1 specification, while L2/MAC handles it by invoking the Step 1 of resource identification. Based on further discussion on exact value of processing time T3 and its relation to Tproc,0 and Tproc,1, additional capturing of the processing time may be needed.

On the other side, current MAC specification may not fully capture RAN1 intention of some of the agreements on re-evaluation and pre-emption. This could be handled by LS exchange or by companies’ contributions in RAN2.

## Corrections to implementation of previous agreements

In section 4.7, there are TPs which are not classified as issues resolved in 100-E, but still require specification correction or TP. Those can be handled by a standalone email discussion as a TP.

References & Companies Proposals

## R1-2001552 Huawei, HiSilicon Remaining details of sidelink resource allocation mode 2

**Observation 1**: The SCI which indicates resource collision could occur before the moment .

**Observation 2**: The procedure of re-evaluation for re-selected resource could be repeated.

**Observation 3**: The earlier the re-selection is triggered, the smaller latency can be achieved, and the more retransmission chances can be guaranteed which can ensure the successful delivery of the packet in a given PDB.

**Observation 4**: It is possible that the resource which has 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**: Whether HARQ feedback is used or not for the corresponding PSSCH transmission is indicated in 1st stage SCI

**Proposal 2**: 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.

**Proposal 3**: The logical interval in NR-V2X can be formulated as , where denotes the periodicity of DL-UL pattern, provided by higher layer parameter dl-UL-TransmissionPeriodicity, denotes the number of configured slots for sidelink in the pattern, and is equal to the number of pattern within the physical interval .

**Proposal 4**: 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 is supported.

**Proposal 5**: For the sub-carrier spacing of 15/30/60/120kHz, is 1/1/2/2 slots, respectively.

**Proposal 6**: For the sub-carrier spacing of 15/30/60/120kHz, is 4 ms for all SCS.

**Proposal 7**: The step 1 of resource (re)-selection shall be performed at every slot before (and including) m-T3.

**Proposal 8**: Selection of T3 is up to UE implementation under .

**Proposal 9** : One candidate resource will be excluded from the identified candidate resource set reported to higher layer if it is not regarded as an identified candidate resource in any resource selection window from [) to [).

**Proposal 10**: For the purposes of re-evaluation, do not specify any restriction on which resources the UE re-selects, i.e. UE can re-select full or partial resources.

**Proposal 11**: For the case of enabled periodic reservation, already reserved resources in upcoming periods should be re-evaluated before each reserved period.

**Proposal 12**: 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 13**: 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 14**: The procedure of resource re-evaluation is performed the same for both blind and feedback-based retransmission.

**Proposal 15**: The value of X is derived depending on the maximum number of SL resources indicated by one SCI for the same TB.

**Proposal 16**: 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.

## [R1-2001661](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001661.zip) vivo Remaining issues on mode 2 resource allocation mechanism

**Proposal 1**: T3 ≤ Tproc,0 + Tproc,1, and determination of T3 value is up to UE implementation.

**Proposal 2**: (Re-)selection procedure for an already reserved but pre-empted resource(s) to be used for transmission in a slot ‘k’ is triggered at least at the moment ‘k – T3’.

**Proposal 3**: If two-port DMRS is indicated, the measurement results from two ports are combined to derive PSSCH-RSRP.

**Proposal 4**: For RSRP threshold increment in the procedure of candidate resource identification, the upper bound(s) of RSRP threshold should be restricted.

**Proposal 5**: Additional procedure of candidate resource identification based on priority only once it reaches the upper bound of RSRP threshold should be supported.

**Proposal 6**: Transmission type of unicast, groupcast and broadcast should be taken into consideration in sensing procedure to reduce the half-duplex conflict.

**Proposal 7**: Tproc,0 and Tproc,1 are defined in absolute time (i.e. Tc), where the value is depending on the SCS.

**Proposal 8**: The maximum number of reserved resources for a UE is (pre-)configured in the resource pool.

**Proposal 9**: If the periodic resource reservation is disabled, the number of the resource granted but not used should not be larger than the (pre-)configured maximum number.

**Proposal 10**: If the periodic resource reservation is enabled, the number of the resource granted but not used in a pre-defined window should not larger that the (pre-)configured maximum number.

**Proposal 11**: Resource selection for a given TB can be triggered by DTX/NACK status received from RX UE.

**Proposal 12**: Resource selection can be triggered, if consecutive packet loss occur is detected by TX UE, e.g., via detection of consecutive DTX/NACK feedback.

**Proposal 13**: Resource (re-)selection is triggered, when TX UE receives CSI feedback from RX UE.

## [R1-2001749](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001749.zip) OPPO Discussion on remaining open issue for mode 2

**Proposal 1**: It is recommended to support HARQ (re)transmission for a TB to allow mixed blind and feedback-based approach.

**Proposal 2**: It is recommended the set of values to be [2, 3, 4, 8, 16, 32] that can be (pre-)configured and this should be resource-pool specific.

**Proposal 3**: TX UE selects resource for initial transmission in [n+T1, n+P], P ≤ 32 slots.

**Proposal 4**: Tproc,0 and Tproc,1 should be defined separately, as in LTE V2X.

**Proposal 5**: T3 should be equal to Tproc,0 + Tproc,1

**Proposal 6:** If PSSCH RSRP measurement is (pre-)configured and "Number of DMRS ports" field in a received SCI is equal with 1, sensing UE decreases 3dB of SL-RSRP threshold or increases 3dB of SL-RSRP.

**Proposal 7**: A subset of all configured periodicity values is utilized to exclude resources when some slots are not monitored by sensing UE.

**Proposal 8**: should be align with resource selection window determined by sensing UE, = T2 or PDB.

**Proposal 9**: = β\* T2 or β\*PDB, β is a linear factor relevant to .

**Proposal 10**: is converted to by the formula , where is the reservation interval provided by higher layer divided by 100, and is the number of UL slots within 100ms.

**Proposal 11** (Resource selection / exclusion enhancement): Avoid selecting 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 12** (Resource selection / exclusion enhancement): No support of backward signalling in NR sidelink.

**Proposal 13** (pre-emption Rx side): Re-selection window to find a replacement resource for a pre-empted resource should be within the time bounds that can be indicated by the “time resource assignment” field in the SCI from other reserved but non-pre-empted resources.

* The lower time bound should be max(m+Tproc,1, B-W+1) from the last reserved but not pre-empted resource, and
* The upper time bound should be min(remaining PDB, m+W-1) from the first reserved but not pre-empted and not used resource after m,

where m is the slot when resource re-selection is triggered and B is the slot of the last reserved but not pre-empted resource for the same TB.

**Proposal 14** (pre-emption Rx side): Within the re-selection window, any resource that is in the same slot as previously reserved/signaled resource(s) made by the same pre-empted UE should be excluded from the candidate resource set.

**Proposal 15** (pre-emption Rx side): Re-selection of the already-reserved, but pre-empted resource applies not only to the resource transmitted in slot ‘m’, but also to other already-reserved and pre-empted resource(s) signalled in the SCI in slot ’m’ as well.

**Proposal 16** (pre-emption Tx side): 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%
* a pre-empting UE (with higher priority packet) should not pre-empt / take over more than 50% of already signaled resources from another UE to minimize negative impacts to the pre-empted UE
* The time gap between the first pre-empting SCI and the pre-empted resource shall be larger than T3

**Proposal 17** (pre-emption Tx side): 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).

**Proposal 18** (pre-emption Tx side): Pre-emption is allowed (enabled / disabled) at a per resource pool level by (pre-)configuration and only for packet TBs at a certain priority level and below (e.g. level 4 and below).

**Proposal 19** (pre-emption Tx side): SL-RSRP threshold should be not incremented during resource exclusion procedure for UEs who perform resource pre-emption.

**Proposal 20** (pre-emption Tx side): In NR-V2X, the reporting of 20% of SA resources from a candidate resource set (SB) to the upper layer should continue to be supported, and the ranking can be based on the measured SL-RSRP level, instead of SL-RSSI in LTE-V2X.

* For any non-reserved resources (i.e. resource without a successful decoded SCI), their measured SL-RSRP levels should be set as small as possible (e.g. zero or negative infinity).

**Proposal 21** (re-evaluation): A UE should not be mandated to perform Step 1 checking every slot before ‘m-T3’.

**Proposal 22** (re-evaluation): No re-selection for resources still in candidate set during Step 2 of re-evaluation and it is up to UE’s best effort to satisfy a 32-slot time restriction between pre-selected and re-selected resources.

**Proposal 23** (re-evaluation): For the case of enabled periodic reservation, already reserved resources in upcoming periods can be re-evaluated.

## [R1-2001793](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001793.zip) Panasonic Corporation Remaining Issues on Sidelink Mode 2 Resource Allocation

**Proposal 1**: It’s not necessary to mandate re-evaluation for every slot before ‘m-T3’ and the UE behaviour before the moment ‘m’ can be up to implementation.

**Proposal 2**: The pre-emption is carried out solely based on the priority field on the SCI regardless whether the corresponding PSSCH is correctly received or not.

**Proposal 3**: Power boosting/reduction related to pre-emption is not required.

**Proposal 4**: Sensing and resource selection procedure are applied regardless of initial transmission or re-transmission.

**Observation**: Tx UE of the original resource in unicast/groupcast can know the future reserved resource can be released by PSFCH. Rx UE(s) of the original resource in unicast/groupcast can know the future reserved resource can be released by BSR and PSFCH.

**Proposal 5**: The released resource should be preferably selected during the Step 2 of the resource (re-)selection procedure, if the released resource is not excluded from the identified candidate resources in Step 1. The released resource can be partially used, solely used, or used conjugately with other contiguous resources.

**Proposal 6**: The reservation right for “reserved but unused resource” can be one of the following operations or configurable.

* Operation 1: The reservation right for “reserved but unused resource” will be lost if the previous transmission is successfully received. Any UE is aware of the “reserved but unused resource” will not exclude the resource as reserved resource during the sensing or (re-)evaluation procedure
* Operation 2: The reservation right for “reserved but unused resource” is exclusive to the Tx UE. The resource will be used by the Tx UE if it has more data to transmit as a new TB, and the resource will be unused if the Tx UE has no more data.
* Operation 3: The reservation right for “reserved but unused resource” is prioritized to the Tx UE. The resource will be used by the Tx UE if it has more data to transmit as a new TB, and the resource can be used by other UE(s) only if the Tx UE has no more data.

**Proposal 7**: The step 1 of the resource (re-)selection procedure is either of following principles.

- when priority ‘A’ transmission is intended, trying to obtain the resource indicated by priority ‘A’ or lower priority SCI as much as possible until reaching X% or reaching the maximum allowed SL-RSRP threshold.

- when priority ‘A’ transmission is intended, trying to obtain the resource indicated by priority ‘A’ or lower priority SCI as much as possible until reaching X% or reaching the maximum allowed number of SL-RSRP threshold increments for priority ‘A’ SCI.

**Proposal 8**: For the PDB limited case, a larger X% should be adopted to identify candidates resource comparing with the non-PDB limited case. The X% for PDB-limited case could be (pre-)configured/specified or scaled by a ratio

**Proposal 9**: A UE should reserve a sidelink resource for a TB by a prior SCI.

Exceptions are at least due to pre-emption, Uu-SL priority competition, congestion control

It is up to UE implementation how to select initial or retransmission resource(s), subject to agreed sensing and resource selection procedure

## [R1-2001805](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001805.zip) Nokia, Nokia Shanghai Bell Remaining details of Resource allocation for sidelink - Mode 2

**Proposal 1**: Consider the following choice for Tproc,0 and Tproc,1: Tproc,0 is defined as 1 slot for 15 kHz and 30 kHz and 2 slots for 60 kHz and 120 kHz. Tproc,1 is 2 slots for 15 kHz and 30 kHz, 3 slots for 60 kHz, and 4 slots for 120 kHz.

**Proposal 2**: T3 is defined as the sum of Tproc,0 and Tproc,1.

**Proposal 3**: Consider mandating a UE to perform Step 1 checking every slot before ‘m-T3’.

**Proposal 4**: Consider mandating evaluation of Step 2 ensuring any introduced timing restrictions between pre-selected and re-selected resources when re-evaluation is triggered.

**Proposal 5**: Consider allowing a UE changing the pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the timing restrictions.

**Proposal 6**: Re-selection of the already-reserved, but pre-empted resource applies to the resource transmitted in slot ‘m’.

Re-selection may also apply to other already-reserved resources (remove ‘pre-empted’) signaled in the SCI transmitted in slot ‘m’.

**Proposal 7**: The two selected consecutive resources (with the distance less than 32 and larger than 0) are any two resources in a given selection.

**Proposal 8**: Consider a UE reduces the number of transmissions or even stops transmissions if there are not available resource or not enough resources due to preemption or congestion control.

**Proposal 9**: Consider Option 1: backward indication is not supported.

## [R1-2001877](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001877.zip) Fujitsu Remaining details on mode 2 resource allocation for NR V2X

**Observation 1**: In NR V2X, when the determined number of the HARQ (re-)transmissions is not larger than 2, the LTE V2X step 2 mechanism can be reused.

**Proposal 1**: In the case where the determined number of the HARQ (re-)transmissions is not larger than 2, the LTE V2X step 2 mechanism should be reused in NR V2X, and only the limited range in the condition should be expanded to [-31, 31] slots.

**Proposal 2**: In the case where the determined number of HARQ (re-)transmissions is larger than 2, the resources for the HARQ (re-)transmissions should be randomly selected one by one from the identified candidate resources in NR V2X.

**Proposal 3**: A chain should be formed during the step 2 in resource selection procedure, i.e. the selected resource for a retransmission of a TB should be reserved at least once by an SCI corresponding to a previous (re)transmission.

**Proposal 4**: When starting the *nth* resource selection to select resource *Rn*, all already selected resources {*R1*, *R2* ... *Rn-1*}, and all the candidate resources which are in the same slot with {*R1*, *R2* ... *Rn-1*}, should be precluded from the identified candidate resource set.

**Proposal 5**: The selected resource *Rn*should be within [-32, 32] slots of at least one resource from {*R1*, *R2* ... *Rn-1*}.

**Proposal 6**: The step 2 of the resource selection procedure stops and can be regarded as completed when the number of the already selected resources has reached *Mtarget* or.

**Proposal 7**:

* In the case where *Nmax=2*,
	+ For an *mth* (*1≤m≤M-1*) transmission opportunity in time,
		- The corresponding SCI of the *m*th opportunity indicates the resource for itself and the reservation resource of the *(m+1)th* opportunity;
	+ The last (*Mth*) opportunity only indicates the resource for itself.

**Proposal 8**:

* In the case where *Nmax=3*,
	+ For an *mth* (*1≤m≤M-2*) transmission opportunity in time,
		- If the gap b/w the opportunity *m* and *m+2* is larger than 31, the corresponding SCI of the *mth* opportunity indicates the resource for itself and the reservation resource of the *(m+1)th* opportunity;
		- Else, the corresponding SCI of the *mth* opportunity indicates the resource for itself and the reservation resource of the *(m+1)th*opportunity and *(m+2)th* opportunity;
	+ The last (*Mth*) opportunity only indicates the resource for itself, the (*M-1*)th opportunity indicates the resources for itself and the *Mth* opportunity.

**Proposal 9**: 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,

* The resource which is in the same slot and indicated by the corresponding PSCCH in slot ‘m’ should be regarded as the 1st selected resource;
* Whether other pre-selected but not reserved resources which are still in the candidate resource set is changed depends on UE implementation.

**Proposal 10**: For resource re-selection of a pre-empted resource contained in a slot ‘m’,

* If there is another resource is signaled by a same SCI with the pre-empted resource in case of *Nmax=3*, this “another 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 11**: The resource re-selection procedure should be triggered by MAC layer, on the basis of the reporting contents from physical layer.

**Proposal 12**: 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 13**: 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.

**Proposal 14**: The power reduction/boosting during the pre-emption operation is not supported.

**Proposal 15**: The preemption is trigged to the low priority UE by the SCI of higher priority UE.

## [R1-2001886](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001886.zip) LG Electronics Discussion on resource allocation for Mode 2

**Proposal 1**: Allow to change other pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the necessary timing restriction.

**Proposal 2**: When (re-)selection procedure for an already reserved but pre-empted resource to be used for transmission in a slot ‘m’ is triggered, re-selection of the already-reserved but pre-empted resource applies only to the resource transmitted in slot ‘m’.

**Proposal 3**: Support 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.

**Proposal 4**: For time resource assignment, when is 2,

* If TRIV is 0,
	+ 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
* Else if ,
	+ If resource index is 0,
		- 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
		- 2nd PSSCH resource is transmitted after slots from the 1st PSSCH transmission slot.
	+ Else if resource index is 1,
		- 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
		- 2nd PSSCH resource is transmitted before slots from the 1st PSSCH transmission slot

**Proposal 5**: For time resource assignment, when is 3,

* If the value is ,
	+ 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
* Else if value is
	+ If resource index is 0,
		- 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
		- 2nd PSSCH resource is transmitted after slots from the 1st PSSCH transmission slot.
	+ Else if resource index is 1,
		- 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
		- 2nd PSSCH resource is transmitted before slots from the 1st PSSCH transmission slot
* Else
	+ if resource index is 0,
		- 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
		- 2nd PSSCH resource is transmitted after slots from the 1st PSSCH transmission slot.
		- 3rd PSSCH resource is transmitted after slots from the 1st PSSCH transmission slot.
	+ Else if resource index is 1,
		- 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
		- 2nd PSSCH resource is transmitted before slots from the 1st PSSCH transmission slot.
		- 3rd PSSCH resource is transmitted after slots from the 2nd PSSCH transmission slot.
			* In other words, 3rd PSSCH resource is transmitted after slots from the 1st PSSCH transmission slot
	+ Else if "Transmission order" in the SCI format 0-1 is 2,
		- 1st PSSCH is transmitted in the same slot where the UE detects the associated SCI format 0\_1 on PSCCH.
		- 2nd PSSCH resource is transmitted before slots from the 1st PSSCH transmission slot.
		- 3rd PSSCH resource is transmitted after slots from the 2nd PSSCH transmission slot.
			* In other words, 3rd PSSCH resource is transmitted before slots from the 1st PSSCH transmission slot.

**Proposal 6**: Adopt Text Proposal in section 4.

## [R1-2001896](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001896.zip) ZTE, Sanechips Remaining issues of mode 2 operation on sidelink

**Proposal 1**: To adopt following TP for correction in TS 38.214 section 8.4.2.1.

|  |
| --- |
| 8.4.2.1 RSRP for resource selection in sidelink resource allocation mode 2In sidelink resource allocation mode 2, the UE measures RSRP for resource selection as follows: - PSSCH-RSRP over the DM-RS resource elements for ~~the PSCCH carrying the received SCI format 0-1~~ the PSSCH according to the received SCI format 0-1 if higher layer parameter *RSforSensing* is set to “*PSSCH DM RS*”, and - PSCCH-RSRP over the DM-RS resource elements for ~~the PSSCH according to the received SCI format 0-1~~ the PSCCH carrying the received SCI format 0-1 if higher layer parameter *RSforSensing* is set to “*PSCCH DM RS*”. |

**Proposal 2**: It is up to UE implementation whether to perform step-1 checking in every slot before m-T3.

**Proposal 3**: It is allowed that the same mechanism is used for both resource re-selection in the re-evaluation and the initial resource selection.

**Proposal 4**: In resource re-selection triggered by pre-emption, the resources already-reserved by SCI, regardless whether pre-empted or not, can be re-selected.

**Proposal 5:** To adopt following TP for correction in TS 38.214 section 8.1.4.

|  |
| --- |
| 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...The following steps are used:...2）The sensing window is defined by the range of slots [) where is defined aboveand ~~is TBD~~ is up to UE implementation. 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.... |

**Proposal 6**: In TS 38.214 section 8.1.4, the following text should be added:

• Tproc,1 is 3, 3, 4, 5 slots respectively for µ = 0,1,2,3 ,where µ = 0,1,2,3 for SCS 15,30,60,120 respectively.

**Proposal 7**: In TS 38.214 section 8.1.4, the following text should be added:

• T3 is 3, 3, 4, 5 slots respectively for µ = 0,1,2,3, where µ = 0,1,2,3 for SCS 15, 30, 60, 120 respectively.

**Proposal 8**: Backward indication is not supported.

**Proposal 9**: The breaking of chain reservation by itself does not terminate the HARQ re-transmissions. A HARQ re-transmission using unreserved resource is allowed.

## [R1-2001907](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001907.zip) MediaTek Inc. Sidelink mode-2 resource allocation

**Proposal 1**: It is left to UE implementation whether to perform Step 1 checking in slots before the moment ‘m-T3’.

**Proposal 2**: It is left to UE implementation whether to trigger re-selection only for the resource transmitted in slot ‘m’ or for other reserved but pre-empted resources as well.

**Proposal 3**: Option-1 is preferred. No support for backward indication.

## [R1-2001964](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001964.zip) TCL Communication Ltd. Resource allocation for NR sidelink Mode 2

**Proposal 1**: We support either No proposal, i.e. up to UE implementation, or Support option 1 with specified exceptions where retransmissions can be sent without reservations.

**Proposal 2**: we support Option 3, as the index position should be clear when doing periodic reservation to avoid that a missed SCI reservation would mean that the reservation for all further periods would be corrupted.

**Proposal 3**: Support a reduced transmit power transmission for the user that detects a situation of overlap of an already reserved resource by a reservation from a higher priority transmission.

FFS on how to precisely compute the power reduction factor.

**Proposal 4**: A user that already transmitted a reservation signal can reuse that reserved resource for different TB than the one originally planned. The transmitted TB can be destined to the same user as originally intended or another user.

**Proposal 5**: Pre-emption mechanisms can be enabled or disabled per resource pool. It can also be (de)activated based on ongoing traffic and CBR.

**Proposal 6**: When enabled in a resource pool, how a user react to pre-emption can vary depending on UE feature capabilities and these are exchanged between users. User should take other users’ capability into the decision process of pre-empting resources.

**Proposal 7**: Further study mechanisms for location-based Mode-2 resource allocation, including zone granularity, definition of zone patterns and resource pool configured for several zones.

**Proposal 8**: In the case of multiple retransmission booking, the SL-RSRP thresholds used to consider a resource as candidate are also defined based on the retransmission index and the type of retransmission.

**Proposal 9**: NR V2X Mode-2 HARQ-feedback based retransmissions supports, at least in some cases, monitoring the feedback of other users.

**Proposal 10**: NR V2X Mode-2 HARQ-feedback based retransmissions supports that retransmissions resources that are not used due to successful reception are released and available for other users.

## [R1-2001969](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001969.zip) Lenovo, Motorola Mobility Discussion on resource allocation for NR sidelink Mode 2

**Proposal 1**: A UE does not need to perform Step 1 checking every slot before ‘m-T3’

**Proposal 2**: There is no need to introduce timing restrictions between pre-selected and re-selected resources when re-evaluation is triggered, and no need to allow to change the pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the timing restrictions.

**Proposal 3**: Re-evaluating the reserved resource is not needed.

**Proposal 4**: The reporting percentage (X%) of and increment (Y) can be (pre)configured by network corresponding to .

**Proposal 5**: UE physical layer can determine the reporting percentage (X%) of and increment (Y) corresponding to and measured channel busy ratio.

**Proposal 6**: For pre-emption mechanism, no additional behavior is needed at pre-empting UE side, it can assume that the pre-empted UE will drop its transmission on overlapped resource.

**Proposal 7**: The pre-empting UE can transmit an ACK/NACK type pre-emption indicator in PSFCH occasion.

**Proposal 8**: Half duplex for groupcast transmission can be detected if more than one TX UE(s) transmit SCI with the same destination group id and in the same time slot

* For groupcast option-1, RX UE(s) feedback NACK
* Otherwise, RX UE (re)transmit the data to TX UE(s)

**Proposal 9**: Discuss enhancement mechanisms to improve utilization efficiency of reserved resource and conditional resource reservation mechanism

**Proposal 10**: R16 should support Zone configuration of larger size (e.g. 300 to 500 meters) for transmitting BSM in NR-V2X

* Two Zone configurations should be considered where the smaller zones could be used for TX-RX distance based SL-HARQ feedback to avoid inaccuracies and larger zone for resource pool selection

## [R1-2001978](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2001978.zip) Fraunhofer HHI, Fraunhofer IIS Remaining Issues in Resource Allocation for Mode 2 NR V2X

**Proposal 1**: We propose that if a UE receives an SCI on a resource that indicates a priority that is equal to or higher than the priority of the intended transmission by the UE, the UE will carry out reselection of resources to avoid collisions.

**Proposal 2**: If a UE receives an SCI on a resource that indicates a priority that is equal to or higher than the priority of the intended transmission by the UE, the resource is excluded from the resource set reported to the higher layers.

**Proposal 3**: We propose to update Section 8.1.4 of TS 38.214, as depicted in Section 2.1 of this document.

## [R1-2001994](file:///C%3A%5C%5CMy_documents%5C%5C3gppDocs%5C%5CRAN1_100e-bis%5C%5CDocs%5C%5CR1-2001994.zip) Intel Corporation Solutions to remaining opens of resource allocation mode-2 for NR V2X sidelink design

**Proposal 1**

* Two resources dynamically signalled by SCI (NMAX ≤ 3):
	+ If any given SCI reserves one future resource - R1, the next SCI transmission, associated with the same resource selection process, should occur in the reserved resource - R1, subject to congestion control, in-device coexistence, HARQ feedback conditions
* Three resources dynamically signalled by SCI (NMAX = 3):
	+ If any given SCI reserves two future resources R1 and R2, the next SCI transmission, associated with the same resource selection process, should occur in the first in time reserved resource - R1, indicate the second reserved resource – R2 and possibly new resource reservation - R3 following the second reserved resource – R2, subject to congestion control, in-device coexistence, HARQ feedback conditions

**Proposal 2**

* In a single iteration of resource (re)-selection/(re)-evaluation, UE can select up to *N* resources for potential sidelink transmission, where 1 ≤ *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 3**

* For a given resource selection, within a resource selection window, the distance in logical slots between any two selected consecutive resources for SL transmission is less than 32 and larger than 0

**Proposal 4**

* In Step 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
	+ [3] slots for SCS 15 kHz
	+ [3] slots for SCS 30 kHz
	+ [4] slots for SCS 60 kHz
	+ [5] slots for SCS 120 kHz

**Proposal 5**

* Define Tproc,0, Tproc,1, and T3 as in the table below
	+ Tproc,0 = 1 slot
	+ Tproc,1 = T3 measured in slots and defined by the following table below

**Proposal 6**

* In (re)-evaluation of Step 1 and Step 2,
	+ Support on of the following options:
		- Option 1: Re-evaluation of Step 1 is mandated to be performed every slot
		- Option 2: Re-evaluation of Step 1 every slot is up to UE implementation and Step 2 supports selection of an early initial transmission from the identified resource set
* In re-evaluation of Step 1 and Step 2,
	+ Evaluation of Step 2 must ensure any introduced timing restrictions of pre-selected and re-selected resources when re-evaluation is triggered
		- Option 1: UE can change the pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the timing restrictions imposed by SCI signalling
		- Option 2: UE can keep the resource which is not in the candidate set in order to ensure the timing restrictions imposed by SCI signalling

**Proposal 7**

* Transmission in the same slot on orthogonal/different sub-channel(s) is subject to pre-emption
* Per resource pool configure a priority level p\_preemption, and if priority p\_SCI associated with the resource indicated in SCI is higher than p\_preemption and prioTX, then pre-emption can be triggered
* Pre-emption condition for a resource contained in a slot ‘k’ to be signalled in a slot ‘m’, where k ≥ m, is the following:
	+ When step 1 of the resource (re-)selection procedure is performed at least at the moment ‘m-T3’, and if the reserved resource is not in the identified candidate resource set and fulfils pre-emption triggering condition, Step 2 is triggered for reselection of the resource
* When pre-emption is triggered,
	+ The minimum time gap for HARQ RTT is respected by the reselection of the pre-empted resource
	+ The timing restriction for signalling/chain window integrity is not required to be respected by the reselection of the pre-empted resource
	+ Pre-empted resources are excluded from the list of the identified candidate resources according to pre-configured pre-emption type
		- Type-1 Pre-emption: whole slot is excluded in case of partial or full overlap with pre-empting transmission
		- Type-2 Pre-emption: only pre-empted resource is excluded from candidate resource for selection

**Proposal 8**

* Irrespective of NMAX settings (2 or 3), SCI transmission reserves only one resource for potential transmission, when HARQ feedback request is enabled and activated

**Proposal 9**

* Resource exclusion in case of half-duplex is based one of the following options
	+ Option 1: UE selecting the resource applies its current TX period
	+ Option 2: UE selecting the resource applies a separately (pre-)configured set of periods specifically for exclusion due to half-duplex, including empty set of periods (i.e. no exclusion due to half-duplex)

**Proposal 10**

* Different sidelink transmission priorities are associated with different *NMAX* values
* For a given resource selection or HARQ process, the actual number of resources (1, 2 or 3) indicated by each SCI is up to UE implementation and is subject to configuration of *NMAX* parameters per resource pool and transmission priority

**Proposal 11**

* In Step 2, initial transmission is selected randomly from earlier in time candidate resources
	+ ME ≤ M earliest resources from the identified resource set M are used to randomly select the initial transmission
	+ ME = max(1, floor(M/MT)), where MT – the total number of resources selected by a UE in a given selection window in Step 2
* Early in time selection is applied only to resource selection for initial transmission

**Proposal 12**

* In case of multiple parallel resource selection processes in 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 13**

* In Step 1 (identification of candidate resources),
	+ if a UE expects to receive non-broadcast transmissions in a set of future resources, a separately configured RSRP threshold associated with a priority pair is applied to these resources
		- If the RSRP threshold is exceeded, the whole slot containing this resource is excluded from candidate resources

**Proposal 14**

* Regarding backward signalling, select Option 3, i.e. SCI backward signalling for 1 and 2 resources is supported subject to NMAX configuration

**Proposal 15**

* When periodic reservations are enabled, 1 bit is carried in SCI 0-1 to indicate to which resource(s) the period is applied
	+ For the number of actually signalled resources N = 2
		- 0 – to both resources
		- 1 – only to the first of these resources
	+ For the number of actually signalled resources N = 3
		- 0 – to all three resources
		- 1 – to the first two of these resources

**Proposal 16**

* Sensing window duration T0 is configured within a range [100, 1100] ms

**Proposal 17**

* Do not introduce maximum RSRP threshold in Step 1 processing of resource selection procedure

**Proposal 18**

* X is (pre)-configured per resource pool from the set of values {5, 10, 15, 20}%

## [R1-2002041](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002041.zip) Futurewei Remaining details on mode-2 resource allocation

**Proposal 1**: the values for T3, Tproc,0, Tproc,1 are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| SCS, kHz | Tproc,0, slots | Tproc,1, slots | T3, slots |
| 15 | 1 | 1 | 2 |
| 30 | 1 | 1 | 2 |
| 60 | 2 | 2 | 4 |
| 120 | 2 | 3 | 5 |

## [R1-2002078](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002078.zip) CATT Remaining issues on Mode 2 resource allocation in NR V2X

**Observation 1**: When pre-emption scheme was used with the aperiodic traffic model in TR 37.885 in the system level simulation, X% = 30% can achieve best PRR performance and lowest TB collision probability than X% = 20%.

**Proposal 1**: The X% should be (pre)configurable to provide sufficient flexibility for different deployment scenarios.

**Proposal 2**:

* The value of X can be changed according to the number of resources selected for potential transmissions for one TB.
* K% can be configured from the high layer for one resource per resource pool, and n\*K% for n resources.

**Proposal 3**: In Step 1, when the ratio of identified candidate resources to the total number of resources in the window [T1, min((31-Tproc0), T2)] is less than X%, all configured S-RSRP thresholds are increased by Y dB and the resource identification procedure is repeated.

**Proposal 4**: In Step2, initial transmission is selected randomly from the candidate resources in the sub-window [T1, T1+(T2-T1)/N], where N refers to the total number of resources selected for one TB.

**Observation 2**: The number of slots excluded in the skipping resources procedure depends on whether the period values in [1:99] have the multiple or LCM (least common multiple) relationship.

**Observation 3**: The number of slots excluded in the skipping resources procedure depends on the greatest common divisor and least common multiple of the period value of UE in [1:99] and 100.

**Proposal 5**: Taking into account the following two principles to configure the period values in [1:99]:

* The period values are derived from multiply or LCM relationship between two values in the set.
* The period values are derived from maximizing the GCD of the period value and 100 and minimizing the LCM of the period value and 100.

**Proposal 6**: For each transmission in the sensing window of the UE, a random number 0≤R≤1 is generated. Only if R ≤ K, skipping resources procedure is triggered to exclude the corresponding NR-V2X slot, where K is (pre)-configured per resource pool. When K=1, the legacy skipping resources procedure is fully triggered; when K=0, the skipping resources procedure is not conducted.

**Proposal 7**: Two potential schemes for releasing resource excluded in the skipping resources procedure are provided as follows:

* Option1: Exclude resources corresponding to one of the transmissions of the selecting UE, which is randomly selected and the resources to release corresponding to the other transmissions by the same UE.
* Option2: Collect the number of SCI for each period monitored in sensing window, and prioritize releasing the resources corresponding to the period with smaller value.

**Proposal 8**: Tproc,1 is related to the transmitting processing timing according to the UE’s capability, and Tproc,1 is measured in slots.

**Proposal 9**: T3 should be considered as the sum of the receiving time (Tproc,0) and transmitting time (Tproc,1).

**Proposal 10**: Tproc,0 and Tproc,1­ are defined separately.

**Proposal 11**: The timeline of resource re-selection should align with that of the resource selection.

**Proposal 12**: It is not necessary to handle the resource exclusion and re-evaluation differently for blind and feedback-based retransmission resources.

**Proposal 13**: Re-evaluation of a pre-selected resource contained in a slot ‘k’ to be first time signaled in a slot ‘m’ (k ≥ m), Step 1 of the resource (re-)selection procedure is performed every slot before ‘m-T3’ and if the re-evaluated resource is not in the identified candidate resource set, Step 2 is triggered for reselection of the resource(s) which are not in the candidate resource set.

**Proposal 14**: Already reserved resources in upcoming periods can be re-evaluated for periodic services.

**Proposal 15**: It is not necessary to handle the resource exclusion and re-evaluation differently for the resources for blind and HARQ-based retransmission.

**Proposal 16**: Re-selection procedure for already reserved and pre-empted resource(s) signaled in the SCI in slot ‘m’ is not required to be triggered at moment > ‘m-T3’.

**Proposal 17**: To enable or disable the pre-emption scheme in the resource pool is based on the requirements of the supported services. To enable or disable pre-emption of the resource pool can be configured by the high layer or pre-configured.

**Proposal 18**: RRC signaling of pre-emption enabling in a resource pool does not support priority dependent pre-emption activation

* For a given priority prioTX within a UE, any priority level pi associated with the resource indicated in SCI, pi > prioTX, can trigger pre-emption

**Observation 4**: Comparing only supporting reselection of low priority UEs at 300m, the pre-emption scheme supporting reselections of both higher priority UEs and lower priority UEs for periodic services can achieve the 6.43% gain for lower priority and 2.19% for the evaluated system. Meanwhile, the degradation of PRR of higher priority is only about 1.98% which can be acceptable.

**Proposal 19**: The reselection of both higher priority and lower priority UEs in pre-emption scheme should be supported.

**Proposal 20**: The power boosting or reduction for pre-emption scheme is not supported.

**Proposal 21**: Option3 should be supported: 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.

**Proposal 22**: For a given resource selection within slots of resource pool, within a resource selection window, the distance in logical slots between any two selected resources among any <= N selected neighboring resources for potential SL transmission is less than 32:

* N is 2 if NMAX = 2
* N is 3 if NMAX = 3, N is not (pre-)configured per priority and should not be up to UE implementation.

**Proposal 23**: The mixed blind and feedback-based scheme should be supported and the counter of the maximum retransmissions applies to the combined total number.

**Proposal 24**: In the mixed blind and feedback-based scheme at the TX UE, the blind retransmission scheme utilizing HARQ feedback should be used firstly, and the HARQ-based retransmission should be after blind retransmissions.

* The number of blind retransmissions can be based on the QoS requirements, CBR, interference impact.
* Besides the issues for blind retransmissions, the number of the HARQ-based retransmission can be restricted with the upper limit latency.

## [R1-2002126](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002126.zip) Samsung On Mode 2 for NR Sidelink

**Proposal 1:** The followings are proposed for T0 and Tproc,0:

* T0 is (pre-)configured between 1000ms and 100ms.
* T0 is converted from units of ms to units of logical slots before slot n.
* Tproc,0 is defined as 1 slot for SCS {15, 30}kHz and (pre-)configured between {1, 2} slots for SCS {60, 120} kHz.

**Proposal 2:** Tproc,1­ defined as physical slots where is obtained from the higher-layer parameter subcarrierSpacing-SL.

**Proposal 3:** For the FFS points on resource re-evaluation procedure in RAN1#100-e meeting,

* Every slot Step 1 checking before ‘m-T3’ should not be mandated for re-evaluation procedure since this requires increased UE processing burden.
* Re-evaluation of Step 2 has to ensure a minimum time gap Z = a + b between any two selected resources of a TB for HARQ RTT as agreed in RAN1#100-e meeting.
* Re-evaluation for periodically reserved resources is not supported because pre-emption procedure can be used for this purpose.

**Proposal 4:** In resource re-evaluation procedure, T3 is T1 +1 slots where T1 is the selected processing time for resource selection by UE within upper bound Tproc,1.

**Proposal 5:** The followings are proposed for Step 1 resource (re-)selection procedure:

* Working assumption for reusing LTE step 5 from TS 36.213 is not applied in NR. Remove Step 5 in section 8.1.4 of TS 38.214.
* In order to handle the overlapped slots in the Step 1 resource identification procedure, Tscal is defined as remaining packet delay budget.

**Proposal 6:** A sidelink resource for a retransmission of a TB should be reserved by a prior SCI if the prior SCI is within distance of 32 logical slots from the resource for the retransmission.

**Proposal 7:** The followings are proposed for resource pre-emption procedure:

* If a resource pre-emption is enabled in resource pool and the pre-emption is triggered, UE behaviour follows Mode-2 resource (re-)selection and re-evaluation procedure with separate RSRP threshold for pre-emption.
* Priority dependent pre-emption activation is not supported.
* Re-selection of the already-reserved, but pre-empted resource applies to other already-reserved and pre-empted resource(s) signaled in the SCI in slot ’m’ as well.

## [R1-2002234](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002234.zip) Ericsson Resource allocation Mode 2 for NR SL

**Observation 1** Some of the smallest values agreed for T2min result in an empty selection window.

**Observation 2** The current specification allows a UE to reserve two resources with each SCI, without any restriction on the total number of reserved resources. This may lead to server resource underutilization in the case of early termination (e.g., due to ACK being received).

**Proposal 1** Tproc,0 is defined as 1 slot for 15 kHz and 30 kHz and 2 slots for 60 kHz and 120 kHz.

**Proposal 2** Modify the definition of the parameter so that it corresponds to T2min – T1 and inform RAN2.

**Proposal 3** Tproc,1 is 2 slots for 15 kHz and 30 kHz, 3 slots for 60 kHz, and 4 slots for 120 kHz.

**Proposal 4** T3 = Tproc,0 + 1, measured in slots.

**Proposal 5** In mode 2, for transmission of a TB the UE can have at most two outstanding reservations at a time.

**Proposal 6** Support Option 2.

**Proposal 7** No changes to the exclusion procedure.

**Proposal 8** The specification does not require a UE to perform Step 1 checking in every slot before ‘m-T3’.

**Proposal 9** We re-evaluating Step 1 and Step 2, the UE may reselect any resource that is selected (for the TB) but that has not been reserved by an SCI.

**Proposal 10** Re-evaluation of periodic reservations is not supported after the reserving SCI has been transmitted.

**Proposal 11** In the evaluation of the condition for determining reselection due to pre-emption, SCI priorities are used.

**Proposal 12** A UE with a reservation for transmission in slot n does not expect a pre-emptying SCI to arrive outside the sensing window [n – T0, n – Tproc,0).

**Proposal 13** It is up to UE implementation to select new resources after being pre-empted.

**Proposal 14** RSRP thresholds are (pre-)configured for each TX-RX priority pair for initial transmission and retransmission.

**Proposal 15** Pre-emption only applies to the resources in slot ‘m’

## [R1-2002267](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002267.zip) Spreadtrum Communications Remaining issues in NR sidelink mode 2 resource allocation

**Proposal 1**: Mandating a UE to perform Step 1 checking every slot before ‘m-T3’ is not supported.

**Proposal 2**: Not support to ensure any introduced timing restrictions between pre-selected and re-selected resources when re-evaluation is triggered by evaluation of Step 2.

**Proposal 3**: Not support to change the pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the timing restrictions.

**Proposal 4**: For the case of enabled periodic reservation, re-evaluating already reserved resources in upcoming periods is not supported.

**Proposal 5**: Support 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.

**Proposal 6**: For sensing and resource selection window:

* Tproc,0 and Tproc,1­ are defined separately.
* Tproc,0 and Tproc,1­ are measured in slots.
* T3=Tproc,1.

**Proposal 7**: Usage of the unused resource by the associated RX UE(s) and other UEs is not supported.

**Proposal 8**: The total number of (re)transmissions of a TB is not indicated in SCI.

**Proposal 9**: Support the formula to convert the physical interval to logical slots in NR V2X:

where is the period of configured DL-UL pattern(s) in NR Uu , is the total number of slots that can be used for SL transmission in period , and denotes the reservation interval.

**Proposal 10**: Resource identification procedure should consider the case where is not provided.

**Proposal 11**: candidates should be selected and reported to higher layers.

## [R1-2002301](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002301.zip) InterDigital, Inc. Remaining Issues on NR Sidelink Mode 2 Resource Allocation

**Proposal 1:** A mixture of blind and HARQ-based retransmission is not supported for Mode 2.

**Proposal 2:** HARQ feedback-based PSSCH retransmissions is also supported without resource reservation from the prior transmission of the same TB.

**Proposal 3:** When HARQ feedback-based PSSCH retransmission without resource reservation is used, the resource selection for retransmission after receiving HARQ NACK is the same as that for the initial transmission.

**Proposal 4:** The reserved HARQ retransmission resource can be reused by other UEs based on HARQ-ACK detection.

**Proposal 5:** Support the maximum number of RSRP threshold increment.

**Proposal 6:** The UE selects the transmission resource from the candidate resources when RSRP threshold increment is greater than a configured value.

**Proposal 7:** It is up to UE implementation when to trigger Step 1 of resource re-evaluation.

**Proposal 8:** For HARQ feedback disabled TB, the UE changes the resource from the previous iteration to the resource from current iteration if the resource from the previous iteration is not in the set SA of the current iteration.

**Proposal 9:** For HARQ feedback enabled TB, the UE changes all the resource(s) from the previous iteration to the resource(s) from current iteration if at least one of the resource(s) from the previous iteration is not in set 𝑆𝐴 of the current iteration.

**Proposal 10:** The UE is not required to perform re-evaluation for resource reservation signaled at slot ‘m’ if the time gap between slot ‘m’ and the maximum delay slot is small.

**Proposal 11:** For the resource exclusion procedure, the UE only excludes the period to be indicated in the SCI of the TB.

## [R1-2002325](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002325.zip) Apple On Remaining Details of Mode 2 Resource Allocation

**Proposal 1:** The processing time parameters of Tproc,0 and Tproc,1­ are separately defined. Tproc,0 is 1 slot for 15/30 kHz SCS; 2 slots for 60/120 kHz SCS. Tproc,1 is equal to CR/CBR processing time based on UE capability.

**Proposal 2:** In resource reselection procedure, T3 is set as the sum of Tproc,0 and Tproc,1­.

**Proposal 3:** In step 1 of resource selection procedure, the threshold X is fixed to 20.

**Proposal 4:** In step 1 of resource selection procedure, no maximum RSRP threshold is introduced.

**Proposal 5:** In Step 1 of the resource selection procedure, all the resources in a time slot should be excluded if the selecting UE has unicast or groupcast data reception in that time slot, and the priority of transmission data is lower than that of reception data.

**Proposal 6:** Rel 16 NR V2X does not support backward resource indication and signaling in SCI.

**Proposal 7:** The pre-emption mechanism is applied only if the pre-empting data have very high priority (i.e., higher than a threshold) and the pre-empted data have very low priority (i.e., lower than a threshold).

**Proposal 8:** For feedback based HARQ retransmission, one triggering condition of resource reselection procedure is the reception of NACK of each transmission or the reception of NACK of the last reserved transmission, while the maximum number of retransmissions of the TB has not been reached.

**Proposal 9:** One triggering condition of resource reselection procedure is that the selected resources are not used due to NR UL/SL transmission prioritization, LTE SL/NR SL transmission prioritization, or congestion control.

## [R1-2002362](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002362.zip) NEC Remaining issues on resource allocation Mode 2

**Text proposal 1:**

===============start================

8.4.2.1 RSRP for resource selection in sidelink resource allocation mode 2

In sidelink resource allocation mode 2, the UE measures RSRP for resource selection as follows:

- PSSCH-RSRP over the DM-RS resource elements for the PSSCH according to the received SCI format 0-1 if higher layer parameter *sl-RS-ForSensing* is set to " *pssch* ", and

- PSCCH-RSRP over the DM-RS resource elements for the PSCCH carrying the received SCI format 0-1 if higher layer parameter *sl-RS-ForSensing* is set to " *pscch* ".

===============end================

**Proposal 1:** Don't mandate a UE to perform step 1 checking every slot before ‘m-T3’.

**Proposal 2:** Evaluation of step 2 has to ensure a timing restrictions (e.g., within 32 slots window) between pre-selected and re-selected resources when re-evaluation is triggered and it is NOT allowed to change the pre-selected but not reserved resources which are still in the candidate resource.

**Proposal 3:** UE should signal the remaining pre-selected resources except the occupied resources identified in the step 1 re-evaluation if there is no resource could be selected to satisfy the timing restriction.

**Proposal 4:** More study are needed for the re-evaluated of already reserved periodic resources.

**Proposal 5:** Re-selection of the already-reserved, but pre-empted resource applies only to the resource transmitted in slot ‘m’.

**Proposal 6:** Introduce restrictions for TX UE to determine whether to reserve retransmission resources.

**Proposal 7:** Support PSFCH monitoring for the release of unused resources.

**Proposal 8:** For a given resource selection, within a resource selection window, the distance in logical slots between any two selected consecutive resources for SL transmission is less than 32 and larger than 0.

## [R1-2002388](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002388.zip) Sharp Remaining issues on resource allocation mode 2 for NR sidelink

**Proposal 1:** Adopt “Option 1” for backward indication:

* 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

**Proposal 2:** For re-evaluation of a pre-selected resource, and in case periodic reservation is enabled, already reserved resources in upcoming periods are also re-evaluated.

**Proposal 3:** For pre-emption of resource transmitted in slot ‘m’, re-selection of the already-reserved, but pre-empted resource applies only to the resource transmitted in slot ‘m’.

## [R1-2002402](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002402.zip) Xiaomi Communications On resource reservation in Mode 2 resource allocation

**Proposal 1:**

* The maximum number of unused reserved resource for retransmission of a single TB should be (pre)-configured.
* The maximum number of unused reserved resource for transmission in the consequent period should be (pre)-configured.

## [R1-2002439](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002439.zip) NTT DOCOMO, INC. Remaining issues on resource allocation mechanism mode 2

**Proposal 1:**

* Resource reservation for a different TB by Time/Frequency resource assignment fields is supported.
	+ Whether the reserved resource is used for the same TB or a different TB is up to UE implementation.

**Proposal 2:**

* A UE shall reserve a sidelink resource for a retransmission of a TB by a prior SCI associated with the TB.
* The following exceptions of above are specified.
	+ Pre-emption, Uu-SL priority competition and congestion control.

**Observation 1:**

* For HARQ-based retransmission, resource selection mechanism should be updated.

**Proposal 3:**

* In Step 2, to select earlier resources should be supported for feedback-based HARQ retransmission.

**Proposal 4:**

* To mandate to perform Step 1 checking every slot before ‘m-T3’ is NOT necessary.

**Proposal 5:**

* From re-selected resource perspective, pre-selected resource is not considered in time domain.
* It is allowed to change the pre-selected but not reserved resources which are still in the candidate resource set to ensure the timing restriction.

**Proposal 6:**

* Re-evaluation of already reserved resource in upcoming periods is supported.

**Proposal 7:**

* We support Option 2, i.e. NOT support priority-dependent pre-emption.

**Proposal 8:**

* In addition to “Resource reservation period” field, resources corresponding to “Time resource assignment” field in SCI are excluded.
* Apply the following TP to 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[…]The following steps are used:[…]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 *reservationPeriodAllowed* and a hypothetical SCI format 0-1 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) 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 0-1 in slot , and "Resource reservation period" field, if present, and "Priority" field in the received SCI format 0-1 indicate the values and , respectively according to Clause [TBD] in [6, TS 38.213];b) the RSRP measurement performed, according to clause 8.4.2.1 for the received SCI format 0-1, 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 0-1, is assumed to be received in slot(s) determines according to clause [TBD] in [6, TS 38.213] 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, 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 FFS7) 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 0-1 in slot , and "Priority" field in the received SCI format 0-1 indicate the values and , respectively according to Clause [TBD] in [6, TS 38.213];b) the RSRP measurement performed, according to clause 8.4.2.1 for the received SCI format 0-1, is higher than ;c) the SCI format received in slot or the same SCI format 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 . Here, and are indicated by "Time resource assignment" field and "Frequency resource assignment" field in the SCI format, respectively.~~7~~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.The UE shall report set to higher layers. |

**Proposal 9:**

* Backward indication is supported.
	+ i.e. support option 2 or 3 identified in the last e-meeting

## [R1-2002487](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002487.zip) ITL Remain details on mode-2 resource allocation for NR V2X

**Proposal 1:**

For Tproc,0, Tproc,1 and T3,

- Tproc,0: Not defined, instead [n –T0, n – Tproc,0) is replaced by [n –T0, n – 1]

- Tproc,1: 3 slots for µ=0, 3 slots for µ=1, 4 slots for µ=2, 4(or 5) slots for µ=3

- T3= Tproc,1, i.e., T3 is no need to specify

**Proposal 2:**

For remaining resource ratio X, following option should be supported.

- Option 2: (Pre-)configure X per resource pool from the set of {10, 20, [30]}%

**Proposal 3:**

For the step of resource exclusion in sensing procedure,

- the resource overlapping by resource reservation for retransmission of the same TB from received SCI at slot m should be additionally considered.

## [R1-2002489](file:///C%3A%5CMy_documents%5C3gppDocs%5CRAN1_100e-bis%5CDocs%5CR1-2002489.zip) ASUSTeK Remaining issue for Mode 2 resource allocation in NR V2X

**Proposal 1**: Adopt the text proposal in updating of TS 38.212 section 8.3.1.1.

**Observation 1**: When *sl-MultiReserveResource-r16* is enabled, it may have an issue if there is no code-point associated to reserved period value 0ms in SCI.

**Proposal 2**: RAN1 adopts either alt1 or alt2 to capture one code-point of reserved period value 0 ms is indicated by a SCI when *sl-MultiReserveResource-r16* is enabled.

* Alt1: The actual set configured in RRC shall include a value 0ms
* Alt2: One fixed code point indicated by resource reservation period field in SCI is associated to 0ms, and a value 0ms is excluded from possible period value in RRC

**Observation 2**: 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 3**: For avoiding dense resource reservation, RAN1 specify a relaxed number of reserved slots () associated to a short reserved period ().

* + - , is 100ms
		- could be configured by RRC signaling (if RRC impact is allowed) or specified in specification

**Proposal 4**: In response of receiving ACK, the transmitter retransmit the TB on a reserved PSSCH resource, wherein associated scheduling PSCCH indicates release of unused resource reservation or indicates no resource reservation.

|  |
| --- |
| 8.3.1.1 SCI format 0-1SCI format 0-1 is used for the scheduling of PSSCH and 2nd-stage-SCI on PSSCH The following information is transmitted by means of the SCI format 0-1:- Priority – 3 bits as defined in subclause x.x.x of [6, TS 38.214].- Frequency resource assignment – bits when the value of the higher layer parameter *maxNumResource* is configured to 2; otherwise bits when the value of the higher layer parameter *maxNumResource* is configured to 3, as defined in subclause x.x.x of [6, TS 38.214].- Time resource assignment – 5 bits when the value of the higher layer parameter *maxNumResource* is configured to 2; otherwise 9 bits when the value of the higher layer parameter *maxNumResource* is configured to 3, as defined in subclause x.x.x of [6, TS 38.214].- Resource reservation period – bits as defined in subclause x.x.x of [6, TS 38.214], where is the number of entries in the higher layer parameter *sl-ResourceReservePeriodList-r16* if higher parameter *sl-MultiReserveResource* is enabled; 0 bit otherwise. |

## R1-2002539 Qualcomm Incorporated Sidelink Resource Allocation Mechanism for NR V2X

**Proposal 1**: is set to the equivalent of 0.5ms in slots of the corresponding sub-carrier spacing. slots for sub-carrier spacing 15kHz, 30kHz, 60kHz, and 120kHz, respectively.

**Proposal 2:** is set to the equivalent of 1ms and any additional time needed to align to the upcoming slot boundary in the current sub-carrier spacing: slots, where for sub-carrier spacing 15 kHz, 30kHz, 60 kHz, and 120 kHz, respectively.

**Proposal 3**: is set to 1.5ms.

**Proposal 4:** Adopt the following text proposal to capture and timeline requirements in TS 38.214

----------------------------------------------------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>>>

The following steps are used:

1) A candidate single-slot resource for transmission is defined as a set of contiguous sub-channels with sub-channel *x+j* in slot where . The UE shall assume that any set of contiguous sub-channels included in the corresponding resource pool within the time interval correspond to one candidate single-slot resource, where

- selection of is up to UE implementation under , where is 2, 3, 5, 9 slots for sub-carrier spacing 15 kHz, 30kHz, 60kHz, and 120kHz, respectively;

<<<unchanged text omitted>>>

 2) The sensing window is defined by the range of slots [) where is defined above and is 1, 1, 2, and 4 for sub-carrier spacing 15kHz, 30kHz, 60kHz, and 120kHz, respectively. 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.

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

**Proposal 5:** Adopt the two text proposals to capture and pre-emption timeline requirements in TS 38.213 and TS 38.214.

* (TS 38.213):

-------------------------------------------------begin text proposal for 38.213-------------------------------------------------

16.4 UE procedure for transmitting PSCCH

A UE can be provided a number of symbols in a resource pool, by *timeResourcePSCCH*, starting from a second symbol that is available for SL transmissions in a slot, and a number of PRBs in the resource pool, by *frequencyResourcePSCCH*, for a PSCCH transmission with a SCI format 0\_1.

A UE does not transmit a scheduled PSCCH, and the associated PSSCH, in a slot if

* The PSCCH and PSSCH use resources not reserved by a prior PSCCH transmission and the UE receives, in a slot , a PSCCH transmission reserving a subset of those resources, or
* The PSCCH and PSSCH use resources reserved by the UE in a prior PSCCH transmission and the UE receives, in a slot , a PSCCH transmission reserving a subset of those resources with a higher priority as indicated in the corresponding SCI format 0\_1.

where ms.

--------------------------------------------------end text proposal for 38.213--------------------------------------------------

* (TS 38.214):

-------------------------------------------------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) 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.

The UE shall report set to higher layers.

The resource (re)selection procedure in steps 1—7 is triggered for a PSSCH scheduled for transmission in a slot if

* The PSSCH uses resources not reserved by a prior PSCCH transmission and the UE receives, in a slot , a PSCCH transmission reserving a subset of those resources, or
* The PSSCH uses resources reserved by the UE in a prior PSCCH transmission and the UE receives, in a slot , a PSCCH transmission reserving a subset of those resources with a higher priority as indicated in the corresponding SCI format 0\_1.

where  **ms**..

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

**Observation 1**: Unreserved retransmissions severely degrade system performance.

**Proposal 6**: Unreserved retransmissions degrade system performance and should not be allowed.

**Proposal 7**: follow the RAN2 specification behaviour of checking for pre-emption every slot and reselecting all resources once pre-emption is detected.

**Proposal 8**: The RSRP thresholds from the latest step 1 evaluation is used to check the pre-emption condition.

**Proposal 9**: Only allow pre-emption for any P1-P2 pair such that P1 > Po and P2 <= Po, where Po is (pre-)configurable

**Proposal 10**: Re-evaluation for selected resources to be indicated in an SCI transmitted at time is performed every slot up to at least time .

**Proposal 11:** Adopt the following text proposal to resolve excessive resource exclusion in TS 38.214.

--------------------------------------------------begin change 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>>>

The sensing window is defined by the range of slots [) where is defined above and is TBD. 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.

3) The internal parameter is set to the corresponding value from higher layer parameter *SL-ThresRSRP\_pi\_pj* for equal to the given value of and each priority value .

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

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

- the UE has not monitored slot in Step 2.

- for any hypothetical SCI format 0-1 received in slot with "Resource reservation period" field set to and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.

---------------------------------------------------end change proposal for 38.214---------------------------------------------------

**Proposal 12**: Require UE to check for future resource collisions with other UEs before signalling SPS rsvp when reservation for another TB is enabled.

**Proposal 13**: Adopt the following text proposal to exclude reserved resources when reservation for another TB is disabled in TS 38.214

----------------------------------------------------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>>>

b) the RSRP measurement performed, according to clause 8.4.2.1 for the received SCI format 0-1, 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 0-1, is assumed to be received in slot(s) determines according to clause [TBD] in [6, TS 38.213] the set of resource blocks and slots which overlaps with for *q*=0,1, 2, …, *Q* and *j=*0, 1, …, . Here, is converted to units of logical slots, 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 FFS.

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

**Proposal 14**: Mix of blind and feedback-based retransmissions is allowed.

**Observation 2:** Reclaiming by other UEs of released feedback-based reservations improves performance.

**Proposal 15**: If a TB has been successfully received by the target Rx UEs and no further HARQ retransmissions are necessary, then any reserved resources associated with that TB are released for use by other UEs.

**Proposal 16:** For the purpose of reclaiming reservations made by another UE, a UE determines whether a reserved is released by listening to PFSCH transmissions.

**Proposal 17:** Adopt the following text proposal enabling reclaiming of released resources in TS 38.214.

----------------------------------------------------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>>>

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

<<<unchanged text omitted>>>

d) the SCI format received in slot determines according to clause [TBD] in [6, TS 38.213] the set of resource blocks and slots which includes and *j=*0, 1, …, , if the feedback request indicator is set in the SCI format 0-1 received in slot , and at least one negative acknowledgement was observed on the PSFCH resources of the PSSCH associated with the SCI.

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

**Observation 3**: Selecting the earliest available candidate within the selection window for the first transmission significantly reduces packet reception delay without impacting performance.

**Proposal 18**: For the initial transmission of a TB, the earliest available resource from the identified candidates within the selection window is selected.

**Proposal 19**: For retransmissions of a TB, a resource is randomly chosen from the identified candidates within that retransmission’s selection window.

**Proposal 20:** Adopt the following text proposal to properly trigger RSRP threshold adaptation for both periodic and aperiodic traffic

----------------------------------------------------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>>>

6) A candidate single-slot resource for transmission is defined as a set of contiguous sub-channels with sub-channel *x+j* in slot where . The UE shall assume that any set of contiguous sub-channels included in the corresponding resource pool within the time interval correspond to one candidate single-slot resource, where

- selection of is up to UE implementation under , where is TBD;

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

The total number of candidate single-slot resources is denoted by . The total number of candidate single-slot resources within the time interval [n + T1, n + 16] is denoted by

<<<unchanged text omitted>>>

7) If the number of candidate single-slot resources remaining in the set is smaller than , or the number of candidate single-slot resources remaining in the set that is within the time interval [n + T1, n + 16] is smaller than [0.5] then is increased by 3 dB for each priority value and the procedure continues with step 4.

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

**Proposal 21** A UE is allowed is to exclude candidates, from the candidate resources for transmission, in slots where it expects to receive transmissions based on decoding prior SCIs**.**

Prior Agreements on Resource Allocation

## 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  elseif  else end ifend ifwhere* 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
 |