**3GPP TSG RAN WG1 Meeting #101-E R1-2004688**

**e-Meeting, May 25th – June 5th, 2020**

**Source: Moderator (Intel Corporation)**

**Title: FL summary#1 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]-[25].

Identification of email discussions

## Initial FL input

Based on the identified critical issues list in section 3, it is proposed to pick around 2.5-3 components per thread in average (no limit per actual thread) to keep good trade-off between progress and workload. FL recommendation on the issue list is the following:

**Thread #1 – Processing times:**

**{1a, 1b, 1c}**

**Thread #2 – Pre-emption and re-evaluation finalization:**

**{2a, 2b, 2c}**

**Thread #3 – Step 1 and general selection:**

**{3a, 3b, 6a}**

**Thread #4 – Step 2 and periodic reservation:**

**{4a, 4b, 5a}**

For the TP threads, FL recommendation is to approve the following threads, based on discussion is section 5.

**TP thread #1 – TP to capture pre-emption triggering conditions**

**TP thread #2 – TP to capture procedure of signalling selected resources in SCI**

**TP thread #3 – TP to capture procedure for periodicity signalling and potentially other SCI signalling**

Identified critical issues list

1. **Processing times**
2. Values for Tproc,0, Tproc,1, T3
3. Confirmation of the sensing window size values in brackets
4. Whether/how to introduce an upper bound for ‘b’ (PSFCH processing plus retransmission preparation), and relation to Tprep for PSFCH-to-PUCCH preparation
5. **Pre-emption and re-evaluation finalization**
6. Time instance for re-evaluation and pre-emption check
7. Applicability to periodic reservations
8. Handling situations when timing restrictions could not be met
9. Confirming WA related to p\_preemption
10. **Step 1 finalization**
11. X% configurability and relation to RSRP threshold adaptation triggering issue due large selection window
12. RSRP for 2-port PSSCH DMRS
13. Max RSRP threshold
14. Additional exclusion conditions for unicast/groupcast reception
15. Handling of reserved but unused resources
16. **Step 2 finalization**
17. Should/shall in the agreements made in RAN1#100bis-e
18. Number of resources a UE selects at once and relation to number of intended retransmissions and Nmax
19. **Periodic transmission finalization**
20. Conversion of periodicity to logical slots of a resource pool, handling of UL-DL configurations, Tscal
21. Backward signalling
22. Periods for exclusion if a slot is not monitored in a sensing window
23. **Miscellaneous**
24. Handling of parallel resource selections
25. Allow by specification selection based on multiple selection windows

Initial summary of proposals on the critical issues

## Processing times

1. Values for Tproc,0, Tproc,1, T3
2. Confirmation of the sensing window size values in brackets
3. Whether/how to introduce an upper bound for ‘b’ (PSFCH processing plus retransmission preparation), and relation to Tprep for PSFCH-to-PUCCH preparation

## Pre-emption and re-evaluation finalization

1. Time instance for re-evaluation and pre-emption check
   * Mandate every slot re-evaluation: Huawei/HiSilicon, Qualcomm (or light re-evaluation)
   * Recommend every slot re-evaluation: Panasonic
   * Do not mandate every slot re-evaluation: ZTE/Sanechips, Samsung, Spreadtrum, OPPO, InterDigital, NEC, Ericsson
   * Pre-emption check at least at moment ‘m-T3’: Intel, OPPO
2. Applicability to periodic reservations
   * Pre-emption is extended to periodic reservations: Nokia, Panasonic, Intel (with restrictions), Spreadtrum (with restrictions), InterDigital (with restrictions), NTT DOCOMO, Qualcomm (with restrictions)
   * Pre-emption is not applied to periodic reservations: vivo
   * Re-evaluation is extended to periodic reservations: Huawei/HiSilicon, CATT, OPPO
   * Re-evaluation is not applied to periodic reservations: vivo, Intel, Ericsson
3. Handling situations when timing restrictions could not be met
   * Do not use the resource / reduce the number of resources: Nokia, Huawei/HiSilicon, CATT (with help of a priority threshold), InterDigital, NEC, NTT DOCOMO
   * Failed transmission: Panasonic
   * Trigger reselection: LGE
   * Violate restriction: LGE, Intel, Spreadtrum
   * Drop HARQ process, if HARQ RTT violated: Qualcomm
   * No further specification handling: Ericsson
4. Confirming WA related to p\_preemption
   * 1…8 change to 2…7: Huawei/HiSilicon, Spreadtrum

## Step 1 finalization

1. X% configurability and relation to RSRP threshold adaptation triggering issue due large selection window
   * X is a function of SCI signalled number of resources: Huawei/HiSilicon
   * X preconfigured: Panasonic (for small PDB), CATT (with modification of window for X%), Intel (with modification of window for X%), ITL
   * Fixed to 20%: Apple
   * Mix of 20% and 50% for the purpose of RSRP threshold adaptation issue fix: Qualcomm
   * Issue of RSRP threshold adaption: CATT, Intel, Qualcomm
2. RSRP for 2-port PSSCH DMRS
   * vivo, Intel, OPPO
3. Max RSRP threshold
   * Supported: vivo, ZTE/Sanechips, CATT, InterDigital (via #increments)
   * Not supported: Apple
4. Additional exclusion conditions for unicast/groupcast reception
   * vivo, Intel, Apple, Qualcomm
5. Additional handling of reserved but unused resources
   * Pre-configured number of reserved resources: vivo, NEC
   * Different RSRP threshold on retransmissions
     + By priority adjustment: Huawei/HiSilicon
     + Separate configuration: Ericsson
   * No handling: ZTE/Sanechips, Spreadtrum
   * PSFCH monitoring: Fujitsu, TCL, InterDigital, NEC, Qualcomm
   * General support: Panasonic
   * Reservation of up to 1 resource for feedback-based: Intel

## Step 2 finalization

1. Should/shall in the agreements made in RAN1#100bis-e
   * ReTX reservation agreement
     + Shall: Intel, Fujitsu, OPPO, TCL, Sharp, NTT DOCOMO, Qualcomm (and increase W to 127), Ericsson (with wording change)
     + Should: Nokia, Huawei/HiSilicon, [Panasonic], MediaTek, Futurewei
   * Nselected WA
     + Shall: Intel, Fujitsu, OPPO, TCL, Sharp, NTT DOCOMO, Ericsson
     + Should: MediaTek, Futurewei, Huawei/HiSilicon (i.e. with exceptions on QoS)
2. Number of resources a UE selects at once and relation to number of intended retransmissions and Nmax
   * Nselected should be at least 2, depending on number of intended transmissions: CATT, Intel

## Periodic transmission finalization

1. Conversion of periodicity to logical slots of a resource pool, handling of UL-DL configurations, Tscal
   * Huawei/HiSilicon, Samsung, Spreadtrum, OPPO
2. Backward signalling
   * No: Nokia, ZTE/Sanechips, Spreadtrum, OPPO, Sharp
   * Full: Huawei/HiSilicon, LGE, CATT, NTT DOCOMO
   * 1-bit: Panasonic, Ericsson
   * Pre-configured 0,1,2 bit: Apple
3. Periods for exclusion if a slot is not monitored in a sensing window
   * No change: Huawei/HiSilicon, Spreadtrum, Ericsson
   * Pre-configured sub-set: LGE, Intel, OPPO
   * Rule-based sub-set: NTT DOCOMO
   * Configured probability to exclude a period: CATT
   * Skip this exclusion: Samsung
   * Configured number N, , is 100ms: ASUSTeK
   * TX period only: InterDigital, Qualcomm

## Miscellaneous

1. Handling of parallel resource selections: Panasonic, Intel, vivo (limit the total number of resources)
2. Allow by specification selection based on multiple selection windows: Qualcomm

## Spec corrections

1. Description for RSRP threshold for a priority pair: Huawei/HiSilicon, ZTE/Sanechips
2. Period values signalling: ASUSTeK
3. Fix in reporting X% ratio to higher layer: Spreadtrum

TPs for Previous Agreements

## Pre-emption triggering condition

In the last meeting, the following agreement was made, but nothing is captured in L1 specification.

|  |
| --- |
| Agreements:   * The procedure to check whether a reserved resource to be signaled in slot ‘m’ should be re-selected due to pre-emption:   + A regular Step 1 (as in 8.1.4 in 38.214) of the resource (re-)selection procedure is performed   + If the reserved resource is still in the identified candidate resource set after the Step 1 execution, then Step 2 for reselection of the reserved resource(s) is not triggered   + If the reserved resource is NOT in the identified candidate resource set after the Step 1 execution     - If the resource is excluded by comparison with the RSRP measurement for an SCI associated with a priority which can trigger pre-emption, then Step 2 for reselection of the reserved resource(s) is triggered     - If the resource is excluded by comparison with the RSRP measurement for an SCI associated with a priority which cannot trigger pre-emption, then Step 2 for reselection of the reserved resource(s) is not triggered |

In FL understanding, this agreement should be implemented in both MAC and L1 as follows:

* L1 specification, TS 38.214 section 8.1.4, describes the regular procedure of resource set identification, and provides to the MAC layer the highest L1 priority associated with the resource, wherein the RSRP threshold for this priority was exceeded
* MAC specification describes handling of triggering resource reselection if the resource is not in the identified set and the priority condition is met

## Nselected signalling

The following agreement needs to be captured in TS 38.213, section 16.4:

|  |
| --- |
| Working assumption:   * The UE should/shall indicate min(Nselected, N) first-in-time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1, where   + Nselected is the number of resources selected by MAC within 32 slots (including the current one)   + N is the maximum number of resources that can be signalled in one SCI   + To discuss and conclude “should vs. shall” in RAN1#101 |

## Periodicity signalling and other SCI signalling

There are a few places in 212 and 214 referring to the procedure how a UE sets/determines a period in SCI 0\_1. However, there is no such clause currently in specification. In FL understanding, it can be implemented in 38.213, section 16.4, assuming RAN1#99 agreement covers this.

In addition, like in LTE, the UE behaviour to set other SCI fields may need to be explicitly captured in 38.213, section 16.4.

References & Companies Proposals

## [R1-2003310](file:///C:\\My_documents\\3gppDocs\\RAN1_101e\\Docs\\R1-2003310.zip) Nokia, Nokia Shanghai Bell Remaining details of Resource Allocation 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**: For re-evaluation and/or pre-emption, if there are no resources satisfying the timing restrictions in the identified resource set after Step 1, consider a UE reducing the number of transmissions for a TB or even stopping transmissions.

**Proposal 4**: For pre-emption, if timing restriction could not be met, consider a UE reducing the number of transmissions for a TB and only using non-preempted resources for the transmissions.

**Proposal 5**: Consider extending resource re-selection due to pre-emption to periodic reservations.

**Proposal 6**: In Step 2, a UE should select resources so that HARQ retransmission resources can be reserved by a prior SCI.

**Proposal 7**: As for SCI indication, consider Option 1: backward indication is not supported.

## [R1-2003379](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003379.zip) vivo Remaining issues on mode 2 resource allocation mechanism

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

**Proposal 2**: If two-port DMRS is indicated, the measurement results from two ports are combined to derive PSSCH-RSRP.

**Proposal 3**: For RSRP threshold increment in the procedure of candidate resource identification, the upper bound(s) of RSRP threshold should be restricted.

**Proposal 4**: Additional procedure of candidate resource identification based on priority only once it reaches the upper bound of RSRP threshold should be supported.

**Proposal 5**: Transmission type of unicast, groupcast and broadcast should be taken into consideration in sensing procedure to reduce the half-duplex conflict.

**Proposal 6**: Tproc,0 and Tproc,1 are defined in absolute time (i.e. Tc), where the value is depending on the SCS.

**Proposal 7**: T3 ≤ Tproc,0 + Tproc,1 , and determination of T3 value is up to UE implementation.

**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.

## [R1-2003495](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003495.zip) Huawei, HiSilicon Remaining details of sidelink resource allocation mode 2

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

**Observation 2**: The SCI which indicates resource collision could occur before the moment .

**Observation 3**: The procedure of re-evaluation for re-selected resource could be repeated.

**Observation 4**: 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 5**: It is possible that the resource which has already been excluded in the previous resource selection window would be considered as the identified candidate resource again when the sensing window is changed.

**Observation 6**: If “shall” in the agreement is chosen, then it is possible that all the selected resources are close to the end of the resource selection window, thus introducing large transmission latency and cannot satisfy latency requirements of URLLC type traffic.

**Proposal 1**: The indication of HARQ feedback enable/disable for the corresponding PSSCH transmission is a field in the 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**: Support full backward indication, i.e., support Proposal 1b (full) in the FL summary R1-2003038.

**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 3 ms for all SCS.

**Proposal 7**: A UE is mandated to perform Step 1 check for re-evaluation every slot before (and including) m-T3.

**Proposal 8**: The value of T3 is equal to T1.

**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 [), where slot which satisfies .

**Proposal 10**: The resources which cannot satisfy the timing restrictions are not selected during the resource re-selection trigged by re-evaluation and/or pre-emption.

**Proposal 11**: 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 12**: 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 13**: The procedure of resource re-evaluation is performed in the same way for both blind and feedback-based retransmission.

**Proposal 14**: The value of X is derived depending on the maximum number of SL resources indicated by one SCI for the same TB.

**Proposal 15**: For the resource selection in Step 2, HARQ retransmission on resources reserved by a prior SCI is not mandatory.

**Proposal 16**: For indicating future resources for HARQ feedback-based retransmission, the UE indicates min(Nselected, N) first in time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1 if QoS requirement can be met, where

* Nselected is the number of resources selected by MAC within 32 slots (including the current one)
* N is the maximum number of resources that can be signalled in one SCI
* If the QoS requirement would not be met, the above constraint does not apply.

**Proposal 17**: Regarding the two working assumptions on pre-emption threshold, adjust as follows:

* Can optionally configure a priority level p\_preemption {12…87}, and if prioRX <p\_preemption, and prioTX > prioRX, then pre-emption can be triggered

**Proposal 18**: For exclusion of slots in the selection window which correspond to slots not monitored in the sensing window, do not change current procedure, i.e., apply all the periods configured for a UE.

**Proposal 19**: 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.

## [R1-2003549](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003549.zip) ZTE, Sanechips Remaining issues in Mode-2

**Proposal 1**: V2X UE is not mandated to perform Step 1 check for re-evaluation in every slot.

**Proposal 2**: 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 3**: 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 4**: 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 5**: In Step 1, the RSRP threshold increment should be stopped if the RSRP threshold used for resource exclusion exceeds a maximum RSRP threshold.

**Proposal 6**: To adopt following TP 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:  ......   1. The internal parameter is set to the corresponding value indicated by the k-th SL-ThresPSSCH-RSRP field from higher layer parameter *~~SL-ThresRSRP\_pi\_pj~~* SL-ThresPSSCH-RSRP-List for equal to the given value of and each priority value , where .   ...... |

**Proposal 7**: Do not support additional handling of reserved but unused resources.

**Proposal 8**: Backward indication is not supported in Rel-16.

## [R1-2003559](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003559.zip) Panasonic Remaining Issues on Sidelink Mode 2 Resource Allocation Corporation

**Proposal 1**: To use "should" or "shall" is case by case discussion. In following case, to use "should" should be considered.

- When all exceptional cases are not able to conclude in RAN1 but the recommended behaviour needs to be described.

- In spite of up to UE implementation on the detail, certain way of the implementation is recommended.

**Proposal 2**: If there is no resource satisfying the timing restrictions in the identified resource set after Step 1, a UE treats a transmission as failed.

**Proposal 3**: A UE is recommended to perform Step 1 check for re-evaluation every slot when resource utilization is high. Note that how high resource utilization is up to UE implementation.

**Proposal 4**: A UE should treat the transmission as failure when timing restriction could not be met after pre-emption.

**Proposal 5**: There is no distinction between the aperiodic and periodic reservations when pre-emption re-selection condition is met at the UE.

**Proposal 6**: Power boosting/reduction related to pre-emption is not required to be specified.

**Proposal 7**: One bit in the first stage SCI indicate "resource index". When to indicate backward indication is up to UE implementation and the exception handling related to step 2 procedure is handled as up to UE implementation.

**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 8**: 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 9**: 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. UEs who 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 Rx UE(s) if the Tx UE has no more data.

**Proposal 10**: 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 11**: 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 12**: The dropping caused by prioritization includes inter-frequency measurement gap, LTE/NR Uu transmission/reception prioritization, and LTE V2X prioritization.

**Proposal 13**: The resource selection and indication are independent for different Tx-Rx links

**Proposal 14**: A mixed blind and feedback-based approach is supported. When it is used is up to UE implementation. PSCCH in each PSSCH transmission indicates the request of the feedback.

## [R1-2003563](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003563.zip) LG Electronics Discussion on resource allocation for Mode 2

**Proposal 1**: In case when there is no reselected resources satisfying the timing restrictions in the identified resource set after Step 1, the following options can be considered:

* Option 1) Exceptionally allow reselecting the resources which don’t satisfy the timing restrictions
* Option 2) Cancel the relevant SL grant and trigger all the resource reselection

**Proposal 2**: For exclusion of slots in the selection window which correspond to slots not monitored in the sensing window, a UE applies a separately (pre-)configured sub-set (including empty and full set possibilities) of periodicities and applies the period used for transmission, if any

**Proposal 3**: When periodic reservations are enabled in a resource pool, and when a (pre-)configuration indicates that “resource index” signaling is 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 in backward indication, 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 in backward indication, 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.

## [R1-2003613](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003613.zip) CATT Remaining issues on Mode 2 resource allocation in NR V2X

**Proposal 1**: should be 1/1/2/2 physical slots respectively for =0, 1, 2, 3, where is obtained from the higher-layer parameter subcarrierSpacing-SL.

**Proposal 2**: should be physical slots where is obtained from the higher-layer parameter subcarrierSpacing-SL.

**Proposal 3**: and should be defined separately.

**Proposal 4**: is the sum of and , which should be physical slots.

**Proposal 5**: The reserved resources in the upcoming periods should be re-evaluated for the periodic services.

**Proposal 6**: For the periodic service, UE should perform re-evaluation at least at ‘m-T3’ of every period, and the reselected resources should be applied to all upcoming periods.

**Proposal 7**: The priority level should be configured to determine whether transmission(s) of the pre-selected but collided resources should be dropped if the timing restrictions cannot be met.

* If the UE’s priority is higher than or equal to the configured priority level, UE should continue transmitting on the collided resource(s).
* If the UE’s priority is lower than the configured priority level, UE should drop transmission(s) on the collided resource(s).

**Proposal 8**: Maximum RSRP threshold should be configured for the higher priority UE in pre-emption mechanism.

**Proposal 9**: The re-selected resource of pre-empted resource should be applied to the upcoming periods.

**Proposal 10**: If the reselection of pre-empted resources could not ensure timing restrictions, with the configured priority level, the lower priority UE should drop the collided transmissions.

**Proposal 11**: The power boosting or reduction for the pre-emption scheme should not be supported.

**Proposal 12**: In step 2, if more than one transmission for a TB is applied, the slots interval between 2 selected neighbouring resources should be less than 32 slots and Nselected should be greater than 1.

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

**Proposal 14**: The X% can be configured as follows:

* 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 15**: 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 16**: The sub-set of the configured period values should be supported to resolve the excessive resource exclusion problem in the skipping procedure.

**Proposal 17**: Based on the configured probability per resource pool, a portion of (re-)transmissions should be applied in the skipping procedure to resolve the excessive resource exclusion problem.

**Proposal 18**: 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 19**: The mixed blind and feedback-based scheme should be supported and the counter of the maximum retransmissions applies to the combined total number.

**Proposal 20**: 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.

## [R1-2003653](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003653.zip) ITRI Remaining Issues on Resource Allocation in NR Sidelink Mode 2

**Proposal 1**: In order to effectively deal with resource collision in NR sidelink mode 2, we support the hybrid resource sensing procedure for periodic and aperiodic traffic.

**Proposal 2**: The hybrid resource sensing procedure includes long-term sensing and short-term sensing procedure.

**Proposal 3**: From our perspective, we support both hybrid resource sensing type 1 and type 2 schemes.

**Proposal 4**: UE should perform resource sensing and change the pre-selected resources that are still in the candidate resource set in the next period when there is no resource satisfying the timing restriction in the identified resource set after Step 1.

**Proposal 5**: It can help to reduce the collision problem by providing some assistance information when there are no enough resources that meet the timing restrictions.

**Proposal 6**: The assistance information should include the priority information, resource request timer information and resource required information.

**Proposal 7**: The mechanism to report geographical information to gNB should be FFS.

## [R1-2003671](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003671.zip) MediaTek Inc. Sidelink mode-2 resource allocation

**Proposal 1**: The following behavior is preferred:

* UE *should* select resources so that HARQ retransmission resources can be reserved by a prior SCI.
* The UE *should* indicate min(Nselected,N) first-in-time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1

## [R1-2003703](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003703.zip) ASUSTeK Remaining issues 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 cause endless periodic reservation if there is no code-point associated to 0ms reserved period value in SCI format 1-A.

**Proposal 2**: When *sl-MultiReserveResource-r16* is enabled, RAN1 adopts either alt1 or alt2 to capture one code-point of 0ms reserved period value could be indicated by SCI format 1-A.

* Alt1: The actual set (i.e., *sl-ResourceReservePeriodList-r16*) shall include a value 0ms
* Alt2: One fixed code point, indicated by resource reservation period field of SCI format 1-A, 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 short reserved period ().

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

|  |
| --- |
| 8.3.1.1 SCI format 1-A  SCI format 1-A is used for the scheduling of PSSCH and 2nd-stage-SCI on PSSCH  The following information is transmitted by means of the SCI format 1-A:  - 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. |

## [R1-2003735](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003735.zip) Intel Corporation Remaining details of Mode-2 NR V2X sidelink design

**Proposal 1**

* 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 2**

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

**Proposal 3**

* In case if no resource can be found for reservation based on the identified candidate set after Step 1 for a retransmission of a TB, the re-transmission can be transmitted on a resource that is not reserved
* In case if no resource can be found satisfying HARQ RTT minimum gap restriction with the already reserved resource, the resource violating the minimum gap is selected, and the feedback request in the first resource is set to “no feedback”
* Confirm “shall” behaviour for the agreement on HARQ retransmission reservation from RAN1#100bis-e

**Proposal 4**

* Do not support re-evaluation of already reserved resources in upcoming periods

**Proposal 5**

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

**Proposal 6**

* For a reserved resource to be signalled in slot ‘m’, the procedure to check whether it should be re-selected due to pre-emption, is performed at least at the moment ‘m-T3’
  + Checks before the moment ‘m-T3’ or after ‘m-T3’ but before ‘m’ are not precluded and are up to UE implementation

**Proposal 7**

* In a single iteration of resource (re)-selection/(re)-evaluation, UE can select up to *N* resources for sidelink transmission, where min(*M, NMAX*) ≤ *N* ≤ *M*, here *M* is number of remaining transmissions intended by UE
  + The actual number *N* applied by UE in each iteration is not specified, i.e. it is left up to UE implementation
* Confirm “shall” behaviour for the signalling agreement made in RAN1#100bis-e

**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**

* For exclusion of slots in the selection window which correspond to slots not monitored in the sensing window, a UE applies a separately (pre-)configured sub-set (including empty and full set possibilities) of periodicities and applies the period used for transmission, if any

**Proposal 10**

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

**Proposal 11**

* 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 12**

* 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 13**

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

**Proposal 14**

* In Step 1, a UE continues resource identification procedure and RSRP threshold incrementation until at least X % ratio of identified resources is obtained in
  + The resource selection window [T1, T2], if T2 ≤ 32
  + The resource selection window [T1, T2] and an additional window [T1, 32], if T2 > 32

**Proposal 15**

* RSRP over PSSCH DMRS is calculated as a sum of linear RSRP values calculated over each separate DMRS port

## [R1-2003807](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003807.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 |

**Proposal 2**: In the agreement of RAN1#100b-e:

* In Step 2, a UE should/~~shall~~ select resources so that HARQ retransmission resources can be reserved by a prior SCI, except that
  + In case no resource can be found for reservation (e.g., based on the identified candidate set after Step 1) for a retransmission of a TB, the re-transmission can be transmitted on a resource that is not reserved
  + After the resource selection is performed, HARQ retransmission on a resource not reserved by a prior SCI is allowed due to transmission dropping caused by prioritization, pre-emption and congestion control

**Proposal 3**: Confirm the working assumption of RAN1#100b-e with “should”:

* The UE should/~~shall~~ indicate min(Nselected, N) first-in-time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1, where
  + Nselected is the number of resources selected by MAC within 32 slots (including the current one)
  + N is the maximum number of resources that can be signalled in one SCI

## [R1-2003874](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003874.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 is defined as physical slots where is obtained from the higher-layer parameter subcarrierSpacing-SL.

**Proposal 3:** Every slot Step 1 checking before ‘m-T3’ should not be mandated for re-evaluation procedure since this requires increased UE processing burden.

**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.

## [R1-2003991](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2003991.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**: To make the RRC configuration clearer, the following two alternatives can be used:

* Alt 1: “p\_preemption {2…7}” and “prioRX < p\_preemption”
* Alt 2: “p\_preemption {1…6}” and “prioRX≤p\_preemption”

**Proposal 3**: When HARQ RTT could not be met in resource reselection for pre-emption, mixed retransmission is supported.

**Proposal 4**: If the initial resource in a period has been already periodically reserved and satisfies the pre-emption reselection condition, resource reselection of the resource is triggered.

**Proposal 5**: The reselected resources for pre-emption cannot be periodically reserved.

**Proposal 6**: 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 7**: For exclusion of slots in the selection window which correspond to slots not monitored in the sensing window, LTE V2X mechanism is reused at least in R16.

**Proposal 8**: 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 9**: Usage of the unused resource by the associated RX UE(s) and other UEs is not supported.

**Proposal 10**: The total number of (re)transmissions of a TB is not indicated in SCI.

**Proposal 11**: 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 12**: Resource identification procedure should consider the case where is not provided.

The following TP for TS 38.214 [8] is provided:

----------------------------------------------------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 parts omitted>

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

<Unchanged parts omitted>

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 if is not provided or if is provided, 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 FFS.

<Unchanged parts omitted>

-----------------------------------------------------End text proposal for 38.214-----------------------------------------------------

**Proposal 13**: candidates should be selected and reported to higher layers.

The following TP for TS 38.214 [8] is provided:

----------------------------------------------------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 parts omitted>

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

<Unchanged parts 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. Otherwise, the UE selects the candidate single-slot resource from the set to . This step is repeated until the number of candidate single-slot resources in the set becomes greater than or equal to .

The UE shall report set to higher layers.

<Unchanged parts omitted>

-----------------------------------------------------End text proposal for 38.214-----------------------------------------------------

## [R1-2004043](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004043.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**: Step 2 should ensure “reserved” resources are used for retransmission, “non-reserved” resources can be used for retransmission only in the exceptional cases provided by the first two sub-bullets of the last meeting’s agreements.

**Proposal 4**: “Shall” is preferred to be used in the last meeting’s agreements on step 2 resource selection procedure.

**Proposal 5**: 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 6**: If the two exceptional cases mentioned in the last meeting’s agreements do not occur, the selected resource *Rn*shall be within [-32, 32] slots of at least one resource from {*R1*, *R2* ... *Rn-1*}.

**Proposal 7**: When no resources within [-32, 32] slots of at least one resource from {*R1, R2 ... RM*} can be founded in the candidate resource set, the resources which are not within [-32, 32] slots of at least one another already selected resource can be selected for the remaining (*Mtarget* – *M*)transmissions.

**Proposal 8**: 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* orwhen no more available resources can be found in the candidate resource set.

**Proposal 9**: The working assumption on resource indication in a SCI which is made in RAN1# 100bis e-meeting should be confirmed and “shall” is preferred to be used.

**Proposal 10**: 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;
* The remaining steps and timing restrictions of the resource re-selection are the same as the initial resource selection.

**Proposal 11**: For resource re-selection of a pre-empted resource contained in a slot ‘m’,

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

**Proposal 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.

## [R1-2004074](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004074.zip) OPPO Discussion on remaining open issue for mode 2

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

**Proposal 2:** T3 should be equal to Tproc,0 + Tproc,1

**Proposal 3**: When PSSCH-RSRP measurement is (pre-)configured and the "number of DMRS ports" field in the received SCI is set to 1 (with 2 ports), sensing UE decreases 3dB of all (pre-)configured SL-RSRP thresholds or increases 3dB to the PSSCH-RSRP measurement.

**Proposal 4**: A subset of the (pre-)configured periodicities for reservation should be used to exclude resources in slots not monitored during sensing.

**Proposal 5**: should be aligned with resource selection window determined by sensing UE, = T2 or PDB.

**Proposal 6**: = β\* T2 or β\*PDB, β is a linear factor associated with .

**Proposal 7**: 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 8**: Avoid selecting / exclude resources with a large difference between target Tx power and measured RSRP of adjacent resources, or Tx-UE should select resource(s) that are adjacent to resources with similar power level to avoid creating interference.

**Proposal 9**: No support of backward signalling in NR sidelink.

**Proposal 10**: Confirm the following working assumption made and update to “shall” as:

|  |
| --- |
| **Working assumption:**   * The UE **shall** indicate min(Nselected, N) first-in-time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1, where   + Nselected is the number of resources selected by MAC within 32 slots (including the current one)   + N is the maximum number of resources that can be signalled in one SCI |

**Proposal 11**: A regular Step 1 of the resource (re-)selection procedure to check whether a reserved resource to be transmitted and/or signalled in the SCI in slot ‘m’ should be re-selected due to pre-emption is mandated to perform only at the moment ‘m-T3’. No UE capability signalling should be introduced for performing this Step 1 checking for either re-evaluation or pre-emption in every slot.

**Proposal 12**: For the case of enabled periodic reservation, already pre-selected or reserved resources in upcoming periods to be signalled in slot ‘m’ should be re-evaluated at the moment ‘m-T3’.

* If one of pre-selected / reserved resources in the upcoming periods is reserved / pre-empted by another UE, this resource in the upcoming period and its corresponding resource in the current period should all be re-selected at the moment ‘m-T3’.

**Proposal 13**: For the case of enabled periodic reservation, if a resource is reselected due to re-evaluation or pre-emption,

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

**Proposal 14**: Update RAN1#100bis-e mode 2 agreement as:

|  |
| --- |
| **Agreements:**   * In Step 2, a UE **shall** select resources so that HARQ retransmission resources can be reserved by a prior SCI, except that   + In case no resource can be found for reservation (e.g., based on the identified candidate set after Step 1) for a retransmission of a TB, the re-transmission can be transmitted on a resource that is not reserved   + After the resource selection is performed, HARQ retransmission on a resource not reserved by a prior SCI is allowed due to transmission dropping caused by prioritization, pre-emption and congestion control |

**Observation**: It is observed that since it is allowed for a UE to reselect any of the pre-selected resources, it should be possible for the UE to find replacement resource(s) during reselection triggered by re-evaluation and/or pre-emption. Furthermore, in a worst case when only the pre-empted resource can be reselected and there is no suitable resource can be found that satisfies the HARQ RTT timing restriction, the UE always has the option of dropping the pre-empted transmission. The next/following resource will always be minimum time gap Z slots away from the previous one.

**Proposal 15**: The 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 16**: 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 17**: 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 18**: 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 19**: 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).

## [R1-2004171](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004171.zip) TCL Communication Ltd. Resource allocation for NR sidelink Mode 2

**Proposal 1**: In Step 2, a UE *shall* select resources so that HARQ retransmission resources can be reserved by a prior SCI, except for mentioned situations.

**Proposal 2**: The UE *shall* indicate min(Nselected, N) first-in-time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1

**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.

## [R1-2004217](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004217.zip) Apple Remaining Issues 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:** When periodic reservations are enabled in a resource pool, resource pool (pre)configures the bit length (i.e., 0, 1 or ) of the “resource index” field in first stage SCI.

**Proposal 7:** In the case a resource in a period of periodic reservation is pre-empted, if the newly selected resource and other resources in the same period are within a resource reservation window, then the newly selected resource is used for the following periods. Otherwise, the original reserved resource is used for the following periods.

**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.

## [R1-2004295](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004295.zip) InterDigital, Inc. Remaining Issues on NR Sidelink Mode 2 Resource Allocation

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

**Proposal 2**: Support the maximum number of RSRP threshold increment.

**Proposal 3**: The UE selects the transmission resource from the candidate resources when RSRP threshold increment is greater than a configured value.

**Proposal 4**: It is up to UE implementation when to trigger Step 1 of resource re-evaluation.

**Proposal 5**: 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 6**: For resource re-evaluation, the UE drops the transmission on the resource to be reselected if there is no resources satisfying the timing restrictions in the identified resource set after Step 1.

**Proposal 7**: For pre-emption, the UE drops the transmission on the resource to be reselected if timing restriction could not be met.

**Proposal 8**: For resource re-selection of a (pre-)empted resource with periodic reservations

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

**Proposal 9**: For the resource exclusion procedure, the UE only excludes the period to be indicated in the SCI of the TB.

## [R1-2004310](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004310.zip) NEC Remaining issues on resource allocation Mode 2

|  |
| --- |
| Text proposal 1 to TS 38.212  8.3.1.1 SCI format 0-1  ===omitted part===  - Resource reservation period – bits as defined in clause x.x.x of [6, TS 38.214], where is the number of entries in the higher layer parameter *sl-ResourceReservePeriod* if higher layer parameter *sl-MultiReserveResource* is configured; 0 bit otherwise.  ===omitted part=== |
| Text proposal 2 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  ===omitted part===  *- sl-ResourceReservePeriod*  *- t0\_SensingWindow*: internal parameter is defined as the number of slots corresponding to *t0\_SensingWindow* ms.  ===omitted part===  - for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriod* 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.  ===omitted part=== |

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

**Proposal 2:** UE should signal the remaining pre-selected resources except the occupied resources identified in the step 1 re-evaluation and/or pre-emption if there is no resource could be selected to satisfy the timing restriction.

**Proposal 3**: Introduce restrictions for TX UE to determine whether to reserve retransmission resources.

**Proposal 4:** Support PSFCH monitoring for the release of unused resources.

## [R1-2004328](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004328.zip) Sharp Remaining issues on resource allocation mode 2 for NR sidelink

**Proposal 1:** Backward indication is not supported in Rel-16.

**Proposal 2:** “shall” is used in the following agreement/working assumption:

* In Step 2, a UE should/shall select resources so that HARQ retransmission resources can be reserved by a prior SCI
* The UE should/shall indicate min(Nselected, N) first-in-time resources when setting the values of frequency resource assignment and time resource assignment in SCI format 0\_1

## [R1-2004385](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004385.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.

**Observation 1:**

* For HARQ retransmissions on reserved resources,
  + If ‘should’ is used, UEs can do HARQ retransmissions on unreserved resources anytime.
  + Clear description on exceptions to support ‘shall’ lead to many RAN works in future releases.

**Proposal 2:**

* Support the wording “shall” in the latest agreement on reservation of a HARQ retransmission resource, and add the following note , instead of clear description on exceptions.
  + Note: the HARQ retransmission on a resource not reserved by a prior SCI is allowed if any HARQ retransmission resource which is originally reserved by a prior SCI is found to be unavailable

**Proposal 3:**

* Support the wording “shall” in the latest working assumption on the number of resources indicated in SCI.

**Proposal 4:**

* For reselection of pre-selected but not reserved resource, which is triggered by re-evaluation and/or pre-emption, timing restrictions shall be ensured.
  + In case of no resources satisfying the timing restrictions after Step 1, resource re-selection is not performed and the pre-selected resource is dropped.

**Proposal 5:**

* Once pre-emption re-selection condition is met at the UE,
  + Re-selection for pre-empted resource(s) is not performed and the pre-empted resource is dropped, if no resource satisfying timing restriction with non-preempted resource(s) is found after Step 1.

**Proposal 6:**

* For resources reserved by Resource reservation period field, re-selection is performed for pre-empted periodic resource as well.
  + i.e. once pre-emption re-selection condition is met at the UE, re-selection is performed for all resources which satisfy the pre-emption re-selection condition.

**Proposal 7:**

* Support backward indication
  + For Nmax = 2, 1 bit is used.
    - 0 indicates forward indication
    - 1 indicates backward indication
  + For Nmax = 3, 2 bits are used.
    - MSB of the 2-bits indication indicates the sign (plus/minus) of t2 value.
    - LSB of the 2-bits indication indicates the sign (plus/minus) of t1 value.

**Proposal 8:**

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

## [R1-2004452](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004452.zip) Qualcomm Incorporated Sidelink Resource Allocation Mode 2

**Proposal 1:** Tproc,0 is set to the equivalent of 0.5ms in slots of the corresponding sub-carrier spacing. Tproc,0=1,1,2,and 4 slots for sub-carrier spacing 15kHz, 30kHz, 60kHz, and 120kHz, respectively.

**Proposal 2:** Tproc,1 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: Tproc,1=2μ+1 slots, where μ=0,1,2,and 3 for sub-carrier spacing 15 kHz, 30kHz, 60 kHz, and 120 kHz, respectively.

**Proposal 3:** T3 is set to 1.5ms.

**Proposal 4:** Adopt the following text proposal to capture Tproc,0 and Tproc,1 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 T3 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--------------------------------------------------

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

**Proposal 7:** In Step 2, a UE shall select resources so that HARQ retransmission resources can be reserved by a prior SCI.

**Proposal 8**: Increase the time gap between reservations for SCI resource signalling to 127 from 31

**Proposal 9:** If HARQ RTT related minimum time gap Z constraint cannot be met for a TB after pre-emption, the UE drops remaining transmissions of that TB.

**Proposal 10:** When a transmission in an SPS grant is pre-empted, the resources for the current HARQ process is reselected following procedure for aperiodic grant. For future HARQ process in the same SPS grant

* If the pre-empted transmission is the first transmission of the HARQ process, it is up to UE implementation to
  1. Release current SPS grant. Initiate a new SPS grant based on the resources used in the current (pre-empted) HARQ process.
  2. Release current SPS grant. Initiate a new SPS grant for the next HARQ process.
  3. Keep current SPS grant for the next HARQ process.

In case UE keeps current SPS grant for the next HARQ process:

1. Define UE signalling to inform that the UE intends to keep current SPS grant for the next HARQ process.
2. Re-evaluate the resources in the SPS grant before using them in the next HARQ process.

* If the pre-empted transmission is not the first transmission of the HARQ process, all resources in the current HARQ process that are not re-selected are kept in the current SPS grant. It is up to UE implementation to
  1. Release un-used resources due to reselection of the current HARQ process and their future occurrence from the current SPS process. Add reselected resources for the current HARQ process to the current SPS process.
  2. Release un-used resources due to reselection of the current HARQ process and their future occurrence from the current SPS process. Reselect new resources to add to the current SPS process from the next HARQ process.
  3. Keep the future recurrence of the un-used resources due to reselection of the current HARQ process in the current SPS process.

In case UE keeps the future recurrence of the un-used resources due to reselection of the current HARQ process in the current SPS process:

1. Define UE signalling to inform that the UE intends to future occurrence of resources in current SPS grant for the next HARQ process without using them in the current HARQ process.
2. Re-evaluate the resources in the SPS grant before using them in the next HARQ process.

**Proposal 11** Re-evaluation for selected resources to be indicated in an SCI transmitted at time m is performed every slot up to at least time m-T3.

**Proposal 12**: If Re-evaluation for selected resources to be indicated in an SCI transmitted at time m is performed not every slot up to at least time m-T3, light evaluation should be performed every slot up to at least time m-T3 where the UE uses SCI decoding results and the RSRP threshold outcome of the latest step 1.

**Proposal 13** 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 14** Require UE to check for future resource collisions with other UEs before signalling SPS rsvp when reservation for another TB is enabled.

**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-----------------------------------------------------

**Proposal 18** Adopt the following text proposals to properly trigger RSRP threshold adaptation for both periodic and aperiodic traffic.

--------------------------------------------begin text proposal for Option 2 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 Option 2 for 38.214------------------------------------------

**Proposal 19** Allow UE to select resources using multiple selection windows per TB, e.g. a resource can be selected right before its reservation signalling.

**Proposal 20** 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.

## [R1-2004531](file:///C:\My_documents\3gppDocs\RAN1_101e\Docs\R1-2004531.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.

## [R1-2004544](file:///C:\\My_documents\\3gppDocs\\RAN1_101e\\Docs\\R1-2004544.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** Mandating the behavior of selecting resources so that HARQ retransmission resources can be reserved by a prior SCI requires listing all possible exceptions.

**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** Finalize the agreement from RAN1#100bis-e as ”In Step 2, whenever possible the UE selects resources so that HARQ retransmission resources can be reserved by a prior SCI”. Details can be left up to UE implementation.

**Proposal 6** Confirm the working assumption with the use of ”shall”.

**Proposal 7** Support Option 2.

**Proposal 8** No changes to the exclusion procedure.

**Proposal 9** No additional specification is introduced to deal with ”the case that there is no resources satisfying the timing restriction in the identified resource set after Step 1”.

**Proposal 10** The specification does not require a UE to perform Step 1 checking in every slot before ‘m-T3’.

**Proposal 11** Re-evaluation of periodic reservations is not supported after the reserving SCI has been transmitted.

**Proposal 12** In the evaluation of the condition for determining reselection due to pre-emption, SCI priorities are used. Send an LS to RAN2.

**Proposal 13** 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 14** If the timing restrictions cannot be met, the UE does not select the corresponding resources. If multiple resources are affected, details are up to UE implementation, including the possibility of selecting a smaller number of resources.

**Proposal 15** If the periodic reservation is not pre-empted, the use of the resources indicated in the periodic follows the existing agreements.

**Proposal 16** Confirm the working assumptions on the value range and inequality sign in the agreement on pre-emption from RAN1#100bis-e.

**Proposal 17** RSRP thresholds are (pre-)configured for each TX-RX priority pair for initial transmission and retransmission.

Prior Agreements on Resource Allocation

## RAN1 101-e

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

## RAN1 100-e

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

## RAN1 99

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

## RAN1 98bis

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

## RAN1 98

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

## RAN1 97

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

## RAN1 96bis

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

## RAN1 96

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

## RAN1 AH1901

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

## RAN1 95

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

## RAN1 94bis

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

## RAN1 94

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