**3GPP TSG RAN WG1 #106-e R1-2108266**

**e-Meeting, August 16 –27, 2021**

**Source: Moderator (OPPO)**

**Title: Moderator summary for [106-e-NR-R17-Sidelink-02] Reply LS to R1-2106413**

**Agenda item: 8.11.1.1**

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

Introduction

This document provides discussion on the following approved email thread as part of RAN1#106-e Release 17 SL enhancement WI discussion.

[106-e-NR-R17-Sidelink-02] Reply LS to [R1-2106413](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106-e/Docs/R1-2106413.zip) (LS on time gap information in SCI, RAN2) by August 20 – Kevin (OPPO)

Collection of outcomes

To be collected once agreement / conclusion is reached.

Discussion on SL HARQ RTT timer based on time gap information in SCI

## Round 1

**Background**: According to the received LS in [1], RAN2 made the following working assumption in RAN2#113bis.

19: Working assumption: SL HARQ RTT timer can be derived from the retransmission resource timing when the SCI indicates a retransmission resource. FFS whether explicitly configured SL HARQ RTT timer may be still required. If big problem is identified next meeting, we can revisit it.

This working assumption was made based on the assumption that the RX UE can determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource reserved by SCI is not reselected by the TX UE due to e.g. pre-emption/UL-SL prioritization) based on the “time resource assignment” field in SCI. In RAN2#114, some companies believed this is not feasible, while others believed that the network always guarantees that this is feasible. RAN2 would therefore like to ask RAN1.

**Q1**: For R17 SL DRX design, from RAN1 perspective, whether it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI?

Based on moderator’s reading of company views expressed in the submitted contributions [2-15], the following main points are summarized.

* There is a common understanding / opinion that the Rx UE is able to determine the time location of the next retransmission resource(s) of the Tx UE (assuming that resource is not reselected by the Tx UE) based on the “Time resource assignment” field in SCI, at least for the following cases when
  + Rx UE knows the Tx resource pool configuration of Tx UE, since the “Time resource assignment” field in SCI is used for sensing but not for Rx UE receiving of data, because sensing is performed on the Tx pool.
  + There is no uncertainty in the timing of a retransmission due to, e.g., no 2nd or 3rd resources indicated in SCI, or possible reselection due to pre-emption.
  + A one-to-one mapping relationship can be established between the Tx and Rx resource pool, such that the Rx UE is aware of the exact set of the sidelink slots in the resource pool used by the Tx UE.
* In [7/LGE], it was pointed out there are some error cases in which the “*sldrx-HARQ-RTT-timer*“ would not work and they should be addressed/resolved before RAN2’s working assumption can be confirmed. Based on moderator’s understanding, these error cases not directly concerning / relating to the question asked by RAN2, which is about the “Time resource assignment” in SCI. It is recommended that these error cases should be raised directly in RAN2 to find a solution.
* In [15/Nokia, Nokia Shanghai Bell], it was pointed out when there is a many-to-one mapping of two or more TX pools to the RX pool, it is feasible for the Rx-UE to determine an earliest possible time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI.

Then based on the above summary / observations, it is moderator’s opinion recommending to respond to RAN2 that it is it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the Tx-UE based on the “Time resource assignment” field in SCI under certain conditions. Please review the following proposed response and provide suggestion/modification (if any).

**Proposed response to Q1: In RAN1’s opinion, it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the Tx-UE based on the “Time resource assignment” field in SCI when the following conditions are met.**

* **A one-to-one mapping relationship between the Tx and Rx resource pools can be established, such that the Rx UE is aware of the exact set of the sidelink slots in the resource pool used by the Tx UE. This also implies that the Rx-UE knows the Tx resource pool configuration of the Tx-UE.**
* **There is no uncertainty in the timing of a retransmission due to, e.g., no 2nd or 3rd resources indicated in SCI, possible reselection due to pre-emption, or dropping SL retransmission(s) due to prioritization.**

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| --- | --- |
| **Company** | **Comments (suggestion/modification)** |
| vivo | Here are some comments:   1. The 1st condition seems to be misleading, e.g., implying that it is a special case. Actually, in the case of PSFCH is configured, the one-to-one mapping between Tx and Rx pools is the prerequisite, not an additional condition. On the other hand, even if PSFCH is not configured, many-to-one mapping can be supported only if almost all the parameters for the Tx and Rx resource pools (except the time domain bitmap) are the same, e.g., PSCCH (same MCS table, reserve bits, DMRS scrambling, …), 2nd SCI (alpha/beta for 2nd SCI, PTRS, xOverhead, …), PSSCH (RB, subchannel configuration, etc.), otherwise the Rx decoding would fail. Therefore, in NR, it is obvious that many-to-one mapping is actually a corner case, especially considering that HARQ feedback is the important and mandatory NR feature. 2. The 2nd bullet is not needed, because in the question RAN2 already clearly states that the assumption is “resource is not reselected by the TX UE”. |
| Xiaomi | From our understanding, “**A one-to-one mapping relationship between the Tx and Rx resource pools can be established**” does not include all the feasible cases. For example, even if there is many-to-1 mapping between Tx and Rx pool (e.g. when there is no PSFCH), if the Rx UE knows the configuration of each Tx pool, the Rx UE can still determine the time location of next transmission of Tx UE. Therefore, the 1st condition is suggested to be revised as:   * **The Rx UE is aware of the exact set of the sidelink slots in the Tx resource pool used by the Tx UE, e.g. when there is a one-to-one mapping relationship between the Tx and Rx resource pools, or when the Rx-UE knows the Tx resource pool configuration of the Tx-UE.**   We agree with vivo that the second bullet is not necessary as RAN2 has clearly precluded the case of resource reselection in the question. |
| Sharp | We share similar views as vivo and propose to remove the two conditions.  Besides, in 38.321, sub-clause 5.22.2.1, for SCI reception  The MAC entity shall:  1> for each PSCCH duration during which the MAC entity monitors PSCCH:  2> if a 1st stage SCI has been received on the PSCCH:  3> determine the set of PSSCH durations in which reception of a 2nd stage SCI and the transport block occur using the received part of the SCI;  It seems the RX UE is able to determine the time location of the retransmission resources, i.e. PSSCH durations. Thus, in our understanding, no conditions are needed. |
| ZTE,Sanechips | Perhaps a simplified version for the response is 'Yes'. Other than the conditions mentioned by FL, we have mentioned in our contribution R1-2108076 the following two cases when the resolution of the retransmission occasions from Rx perspective is necessary, yet it seems not easy to accommodate all conditions in a mutually exclusive way.   * When the inter-UE coordination is enabled. * When SL HARQ is enabled. |
| Panasonic | We support the main bullet and the 1st sub-bullet. The 2nd sub-bullet is not necessary |
| Lenovo&MM | We think we should directly reply to the LS, i.e., it is feasible or not. We don’t need to discuss any additional case, which is not mentioned in current LS.  So we support the main bullet as the proposal:  **In RAN1’s opinion, it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the Tx-UE based on the “Time resource assignment” field in SCI ~~when the following conditions are met.~~** |
| Apple | We agree with the main proposed response.  We think the second sub-bullet is unnecessary since the main bullet already covers the retransmission time resources.  Regarding the first sub-bullet, we agree with vivo that the one-to-one mapping between Tx resource pool and Rx resource pool is the general case, while the many-to-one mapping is the corner case. We are fine not including the first sub-bullet in the reply, as it was not asked by RAN2. |
| Qualcomm | Knowing where a retransmission, and a new TB for periodic reservations, is going to arrive is a very important part of ensuring that NR sidelink works correctly. Otherwise, the reservation-based system breaks and RAN1 has worked extensively on minimizing the cases where a reservation is changed.  We share the view that RAN1 should reply directly to the RAN2 question and not add details that RAN2 did not request. We support the wording proposed by Lenovo, removing the sub-bullets, or even a simple ‘yes’ as commented by ZTE. |
| Ericsson | We are OK with the proposed response to Q1 without the two sub-bullets.  In our view, it is only needed to respond whether it is feasible to obtain the timing from SCI without any extra explicit signalling. From RAN1 perspective the SL HARQ RTT parameter can be derived by using the corresponding frequency and time fields included in the 1st stage SCI. The corresponding fields include information about the time/frequency resources used by the current TB as well as information for the time/frequency resources to be used by up to 2 further retransmissions of the TB. |
| InterDigital | We support the proposal in principle but the list of conditions doesn’t need to be included in the reply LS as it is not even asked by RAN2. We can simply answer that it is feasible, and it was the intended design in Rel-16. |
| Samsung | We are O.K the main bullet and the 1st sub-bullet. However, the 2nd sub-bullet is not necessary. As commented by many companies, further simple answer by using the main bullet is O.K for us. |
| NTT DOCOMO | Agree with companies, i.e. OK without the two sub-bullets.  It seems that RAN2 understands the 2nd sub-bullet’s intention, based on ‘(assuming that resource is not reselected by the TX UE)’ in the question. The sub-bullet would be unnecessary. |
| CATT, GOHIGH | We propose to remove the first condition and keep the second.  In our view, “**A one-to-one mapping relationship between the Tx and Rx resource pools”** is not a condition, but a fact. Considering the higher-layer parameter *sl-DMRS-ScrambleID* is configured per SL resource pool, the Tx and Rx resource pool must always be one-to-one mapping. Otherwise, PSCCH cannot be decoded successfully due to the various understanding between Tx UE and Rx UE on the DMRS sequence, which is uniquely identified by the *sl-DMRS-ScrambleID*. Thus, the first condition is not needed.  For the second condition, we think the clarification given by FL is indeed needed here. In Q1, RAN2 just assumed that **resource is not reselected by the TX UE**. However, there are others cases that the timing of a retransmission is uncertainty, e.g., the SCI does indicate the next retransmission resource(s). Hence, the second condition here is necessary.  Furthermore, from RAN1’s perspective, the SCI-derived SL HARQ RTT timer may lead to some potential problems. For example, in pre-emption enabled scenarios, if pre-emption occurs and the reselected resource is in the SL HARQ RTT timer running duration (i.e. DRX inactive time) of the Rx UE, packet loss will occur. Therefore, we propose to revise the response as follows:  **In RAN1’s opinion, it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the Tx-UE based on the “Time resource assignment” field in SCI when the following condition~~s are~~ is met.**   * **~~A one-to-one mapping relationship between the Tx and Rx resource pools can be established, such that the Rx UE is aware of the exact set of the sidelink slots in the resource pool used by the Tx UE. This also implies that the Rx-UE knows the Tx resource pool configuration of the Tx-UE.~~** * **There is no uncertainty in the timing of a retransmission due to, e.g., no 2nd or 3rd resources indicated in SCI, possible reselection due to pre-emption, or dropping SL retransmission(s) due to prioritization.**   **RAN1 respectfully ask RAN2 to further consider a configured SL HARQ RTT timer at least for cases where there is some uncertainty in the timing of a retransmission.** |
| Huawei, HiSilicon | The two sub-bullets are miss-leading and not needed.   * First sub-bullet: It should be noted that sidelink communication is performed on resource pool basis, where transmission in a TX pool and reception in a RX pool. The TX and RX resource pool alignment (not only on time-freq resources, e.g.  how many subCHs, size of subCH, etc., but also on transmission parameters, e.g. PSSCH symbol length, DMRS pattern, PSFCH duration, etc.) is ensured by network configuration/pre-configuration in order to support sidelink communication between UEs. So it is questionable to use the sub-bullet as a prerequisite for sidelink communication, which is already guaranteed by network or pre-configuration. * Second sub-bullet is already excluded in the RAN2’s question “*(assuming that resource reserved by SCI is not reselected by the TX UE due to e.g. pre-emption/UL-SL prioritization)*”, so no need to include it as a condition.   We share the views that RAN1 should focus on what RAN2 asked and answer the question blow directly,  *Q1: For R17 SL DRX design, from RAN1 perspective, whether it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI?*  The answer is Yes, given that Rel-17 will reuse Rel-16 first stage SCI signalling, including time resource indication, such that a RX UE can know the position of retransmission upon detection of the first stage SCI (assuming that resource is not reselected by the TX UE). |
| Fujitsu | We agree the main bullet.  And for the 1st sub-bullet, we agree Vivo’s view that the one-to-one mapping b/w Tx resource pool and Rx resource pool should be a prerequisite. For instance, the main bullet and the 1st sub-bullet are the fundamental working principle for NR sidelink, without them, there will be potential misalignment b/w UEs about the resource reservation, which may cause the UEs cannot perform sensing, reception and HARQ-ACK feedback correctly.  The 2nd sub-bullet is not required since RAN2 has already put the assumption of “no uncertainty” in the question. |
| Spreadtrum | We should only response to what RAN2 asked. So we support the main bullet without the two sub-bullets. |
| OPPO | In our view, if we only reply “yes” to RAN2, the RAN2 colleagues may misunderstand that Rx UE is able to determine the time location of re-transmission by “time resource assignment” field in all cases and scenarios. Actually, Rx UE cannot derive the time location of re-transmission resources without the knowledge of Tx pool. Therefore, we propose to keep the conditions at least in the first bullet in the proposed response.  In addition, the one to one mapping relationship between Tx pool and Rx pool is just one of the cases that the knowledge of Tx pool can be achieved by RX UE and other cases like network configuration are precluded by the first condition, so we suggest to rephrase the first condition as:   * **The Rx UE is aware of the exact set of the sidelink slots in the resource pool used by the Tx UE, e.g. the one-to-one mapping relationship between the Tx and Rx resource pools can be established.**   Finally, we also propose to add a note that the first condition is not always applied from RAN1’s perspective. For example, Tx pool A and Tx pool B with same parameters except the bitmap indicating the slots belong to each Tx pool and the two Tx pools map into one Rx pool. |

## Round 2

* TBD, if needed.

LS reply to R2-2106623 (R1-2106413) based on outcome of Section 3

* TBD

Summary of contributions

* [2/Samsung]: Yes. There is a one-to-one mapping between the signal slot resources of the Tx pool of the Tx UE and the Rx pool of the Rx UE. Therefore, the RX UE knows the TX timing.
* [3/CATT, GOHIGH]:

***Proposal 1****: If the SCI does indicate the next retransmission resource(s) and the reserved resource(s) is assumed not to be re-selected, the Rx UE can determine the time location of the next retransmission resource(s) of the Tx UE based on the “Time resource assignment” field in SCI.*

***Observation 1****: If SL HARQ RTT timer is entirely derived from the SCI indication, packet loss may occur for e.g. pre-emption enabled scenarios.*

***Observation 2****: There are indeed some cases in which the retransmission resource(s) may not be indicated by the “Time resource assignment” of a prior SCI.*

***Proposal 2****: An explicitly configured SL HARQ RTT timer is still required, at least for cases where there is some uncertainty in the timing of a retransmission for a HARQ process.*

***Proposal 3****: Reply LS to RAN2.*

* *From RAN1’s perspective, if the SCI does indicate the next retransmission resource(s) and the reserved resource(s) is assumed not to be re-selected, the Rx UE can determine the time location of the next retransmission resource(s) of the Tx UE based on the “Time resource assignment” field in SCI.*
* *For cases where there is some uncertainty in the timing of a retransmission for a HARQ process (e.g. due to no retransmission resource indicated in the SCI, or possible reselection by the Tx UE), the Rx UE uses a configured SL HARQ RTT timer.*
* *RAN1 respectfully asks RAN2 to take the above information into account.*
* [4, 5/OPPO]: It is RAN1’s understanding that when a SL resource pool is configured with PSFCH resources, there is a one-to-one mapping between a TX and RX pool. As such, it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI. Otherwise, not.
* [6/Qualcomm]: Yes, it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI.
* [7/LGE]:

***Observation 1****: At least the following issues should be addressed/resolved before the working assumption in LS [1] is confirmed:*

* *When the next retransmission resource(s) are farther than 31 slots from the time of SCI reception and these are not indicated through the SCI, whether/how to apply* *sldrx-HARQ-RTT-timer for this case?*
* *Under a situation where the SCI decoded at the 1st resource indicates the 2nd/3rd resources and the sldrx-HARQ-RTT-timer is applied between the 1st resource and the 2nd resource, if the SCI decoding fails on the 2nd resource (due to e.g., the reselection of 2nd resource based on the pre-emption procedure), whether/how to apply sldrx-retransmission-timer for this case?*
* *If the sldrx-HARQ-RTT-timer is applied after the time of SCI reception until the time of next retransmission resource indicated by the SCI, there may be no available candidate transmission resource (that does not exceed the PDB of MAC PDU) to be used for the pre-emption based reselection of the next retransmission resource after its time point. How to resolve this problem?*

***Proposal 1****: Adopt the following as RAN1’s feedback to RAN2’s question in LS [1]:*

* *According to the current specification, the RX UE is not aware of the exact set of the sidelink slots in the resource pool used by the TX UE and thus it is not feasible for the RX UE to determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI. If the RX UE is provided with information of the exact set of the sidelink slots in the resource pool used by the TX UE (e.g., by being allowed to assume that the configuration of the resource pool used by the TX UE is the same as that of the resource pool used by the RX UE for reception), such determination becomes feasible.*
* [8, 9/Apple]:

***Observation 1:*** *There is no ambiguity between Tx UE and Rx UE on the time location of the next retransmission resources, when the transmitting resource pool and receiving resource pool have the same configuration on time resources.*

***Proposal 1:*** *RAN1 to reply to RAN2 that it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI.*

* [10/Xiaomi]: No, it is not always feasible. From RAN1 perspective, the “Time resource assignment” field in SCI is used for sensing but not for Rx-UE receiving. To determine the time location of the next retransmission resource, the Rx-UE must know the Tx resource pool configuration of Tx UE. However, it is not mandatory for Rx-UE to know Tx resource pool configuration from sidelink receiving perspective.
* [11/vivo]: Yes, the Rx UE can determine the time location of the resource that can be used for the next retransmission of the Tx UE based on the “Time resource assignment” field in SCI, in case the resource is not reselected by the Tx UE.
* [12, 13/Ericsson]: From RAN1 perspective, it is feasible to determine the time location of the time location of the next retransmission resource(s) by using the information contained in the SCI. The first stage SCI contains information regarding the frequency and time resources used for the current TB, as well as information about the time and frequency resources of up to two further retransmissions of the TB. Therefore, using this information, i.e., the information contained in the SCI, it is possible to obtain the value required for the SL HARQ RTT without any additional indication.
* [14/Nokia, Nokia Shanghai Bell]: Reply to RAN2 as follows:

In case of one-to-one mapping between TX pool and RX pool, it is feasible for the Rx-UE to determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI.

In case of many-to-one mapping of two or more TX pools to the RX pool, it is feasible for the Rx-UE to determine an earliest possible time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI.

* [15/Huawei, HiSilicon]: It is feasible for a RX UE to determine the time location of the next retransmission resource(s) of the TX UE (assuming that resource is not reselected by the TX UE) based on the “Time resource assignment” field in SCI.

References

1. [R1-2106413](C:\\3GPP\\RAN1_Meetings\\Tdocs\\2021\\R1-2106413.zip) LS on time gap information in SCI RAN2, OPPO

1. [R1-2106850](C:\\3GPP\\RAN1_Meetings\\Tdocs\\2021\\R1-2106850.zip) Draft reply LS on time gap information in SCI Samsung
2. [R1-2106923](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2106923.zip) Discussion on LS from RAN2 on time gap information in SCI CATT, GOHIGH
3. [R1-2107226](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2107226.zip) Discussion on time gap information in SCI OPPO
4. [R1-210](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2107227.zip)7227 Draft reply LS on time gap information in SCI OPPO
5. [R1-2107304](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2107304.zip) [Draft] Reply to RAN2 LS on time gap information in SCI Qualcomm
6. [R1-2107532](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2107532.zip) Discussion on LS on time gap information in SCI LG Electronics
7. [R1-2107700](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2107700.zip) Draft Reply LS on Time Gap Information in SCI Apple
8. [R1-2107703](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2107703.zip) Discussion on RAN2 LS on Time Gap Information Apple
9. [R1-2107891](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2107891.zip) [Draft] Reply LS on time gap information in SCI Xiaomi
10. [R1-2107957](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2107957.zip) [DRAFT] Reply LS on time gap information in SCI vivo
11. [R1-2108130](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108130.zip) [Draft] Reply LS on time gap information in SCI Ericsson
12. [R1-2108135](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108135.zip) Discussion on RAN2 LS on time gap information in SCI Ericsson
13. [R1-2108181](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108181.zip) Discussion of RAN2 LS on time gap information in SCI Nokia, Nokia Shanghai Bell
14. [R1-2108185](file:///C:\3GPP\RAN1_Meetings\Tdocs\2021\R1-2108185.zip) Discussion on RAN2 LS on time gap information in SCI Huawei, HiSilicon