**3GPP TSG RAN WG1 Meeting #106-e R1-21xxxxx**

**e-Meeting, August 16th – 27th, 2021**

**Agenda item:** 7.2.4

**Title:** Summary of [106-e-NR-5G\_V2X-02]

**Source:** Moderator (Qualcomm)

**Document for:** Discussion and Decision

# Introduction

This document provides a summary of two draft CRs, [1] and [2], on specification text relating to in-device coexistence and collects companies’ views on whether they should be incorporated into specifications. The discussion is conducted in the following email thread:

[106-e-NR-5G\_V2X-02] Discussion on [R1-2107317](https://qualcomm-my.sharepoint.com/personal/gsarkis_qti_qualcomm_com/Documents/Documents/3GPP/Docs/R1-2107317.zip), [R1-2108139](https://qualcomm-my.sharepoint.com/personal/gsarkis_qti_qualcomm_com/Documents/Documents/3GPP/Docs/R1-2108139.zip): NR SL Transmission Prioritization with LTE SL Reception by August 18 – Gabi (Qualcomm)

# Discussion of R1-2107317

This draft CR [1] proposes a change to allow a UE to perform both a transmission on NR sidelink and a reception on LTE sidelink even when the two overlap. The document states the current specifications could be interpreted to force the UE to only perform one of the two operations even if it is able to do both. The reason for this change, as presented in [1], is that forcing the UE to perform only one of the operations could degrade performance of NR sidelink when PSFCH transmission is dropped due to overlap with LTE sidelink reception. This action increases the number of retransmissions due to missing feedback and, in turn, increases congestion. The proposed text change is:

|  |
| --- |
| -----------------------------------------------------begin text proposal for 38.213-----------------------------------------------------  16.2.4.1 Simultaneous NR and E-UTRA transmission/reception  >>>>unchanged text omitted<<<<  If a UE  - would respectively transmit or receive a first channel/signal using E-UTRA radio access and receive a second channel/signal or transmit second channels/signals using NR radio access, and  - a transmission or reception of the first channel/signal would respectively overlap in time with a reception of the second channel/signal or transmission of the second channels/signals, and  - the priorities of the channels/signals are known to both E-UTRA radio access and NR radio access at the UE msec prior to the start of the earliest transmission or reception, where and is based on UE implementation, and  the UE transmits or receives at least the channels/signals of the radio access technology with the highest priority as determined by the SCI formats scheduling the transmissions or, in case of a S-SS/PSBCH block or a sidelink synchronization signal using E-UTRA radio access, as indicated by higher layers or, in case of PSFCH, equal to the priority of the corresponding PSSCH.  ------------------------------------------------------end text proposal for 38.213------------------------------------------------------ |

The related agreement was made in RAN1 #98-bis [3]:

Agreements:

* For Tx/Rx overlap,
  + If packet priorities of both LTE and NR sidelinks are known to both RATs prior to time of transmission/reception (subject to processing time restrictions), then the packet with a higher relative priority is transmitted/received
    - In case the priorities of LTE and NR sidelink packets are the same, then it is up to UE implementation as to which packet is transmitted/received

The agreement states that the operation with the higher priority is performed without defining what happens to the operation with the lower priority. The current specification text could also be interpreted to prohibit FDMed operation, which was agreed to be feasible in RAN1 #96 [3]:

Agreements**:**

* From RAN1 point of view, for both intra-band and inter-band Tx/Tx FDM solutions for in-device coexistence are considered to be feasible, at least if the following conditions are met:
  + For the intra-band case for dynamic power sharing, NR and LTE transmissions are fully overlapped in the time domain, i.e., NR transmissions have to span the entire LTE TTI such that the total power across the transmissions is constant.
* For intra-band and inter-band FDM dynamic power sharing solutions, the following additional conditions apply:
  + Subframe boundary alignment is required between LTE and NR V2X sidelinks
  + Both LTE and NR V2X sidelinks are aware of the time resource index (e.g., DFN for LTE) in both carriers
* For purposes of dynamic power sharing between LTE and NR Tx,
  + High-level principles of prioritization (e.g., BSM is deemed to have a higher priority, etc.) of LTE/NR can be discussed during the WI phase, while it is expected that detailed solutions may be left for implementation

## Company Views (Round 1)

**Q1: Do you agree with the issue identified in R1-2107317 and the potential implementation of specification text on FDM operation between NR sidelink and LTE sidelink?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Reply (Yes/No)** | **Comments** |
| OPPO | No | The agreement in RAN1 #98-bis that “the packet with a higher relative priority is transmitted/received”, does not mention how to deal with the transmission/reception corresponding to the lower priority. The modification is not aligned with the agreement. |
| Sharp | No | The current spec correctly implements RAN1#98-bis agreements. |
| vivo | Comment | The agreement in RAN1#98-bis does not say the packet with lower priority should be dropped, which means how to handle the packet should be up to implementation; while the spec text enforces the UE to drop the lower priority packet, which seems to go beyond the agreement. |
| Samsung | Comment | Same view as vivo |
| Intel | Yes | We agree with the logic of the proponents. It is however should be commonly understood that the UE in this case does not violate any requirements/tests defined for the case of performing only transmission or only reception in the prioritized RAT. |
| NTT DOCOMO | Yes | Same view as vivo. |
| ZTE, Sanechips | Yes | We think the discussion of Tx/Rx overlap in RAN1#98-bis is only focused on the case with half duplex restriction. But we are okay to fix the cases that the moderator listed above. |
| NEC | No | The agreements explicitly said the higher priority one is transmitted/received. The argument that agreement without defining what happens to the operation with the lower priority is not totally convinced because even in TX/TX overlapped case, we also only agreed that the higher priority one is transmitted without mentioning the lower priority one. |
| Nokia, Nokia Shanghai Bell | Yes | We agree with the comment from vivo. |
| LG | No | In our understanding, FDM operation between NR sidelink and LTE sidelink is not specified in RAN4 requirements/test. In this case, it is unclear how this operation will affect the system. Without RAN4 requirement for this operation, UE needs to be conservatively implemented not to support this operation at least in Rel-16. |
| Qualcomm | Yes | In our view, the agreement defines the behavior in case the UE can only perform one of the two operations but does not require the UE to only perform only a single operation if it can do both. Therefore, the specifications do not accurately capture the agreement.  The implication on NR sidelink is performance because PSFCH transmissions would be dropped when overlapping with LTE sidelink reception. This would be interpreted as DTX in unicast and groupcast Option 2, causing additional retransmissions and congestions; or interpreted as ACK in groupcast Option 1, skipping some needed retransmissions. Addressing the issue by using higher priority for NR sidelink transmissions would degrade LTE sidelink performance by dropping LTE sidelink receptions that overlap with NR PSFCH transmission, which is also undesirable. |
| Huawei, HiSilicon | No | The spec has reflected the agreement in RAN1 #98-bis correctly, no more discussion and modification is necessary. |
| Apple | Yes | We share the views from vivo. |
| Ericsson | Comment | We agree that the specification limits the UE behaviour regarding the simultaneous Tx/Rx of NR and LTE. |
| CATT,GOHIGH | No | Firstly, in maintenance phase, it can be discussed only that whether agreements are captured in the specification and operations which is out of the agreements shall not be introduced.  For agreements in RAN1 #98-bis meeting, they are fully captured in current specification. While the text proposal and the relative scenarios are not discussed and defined in the agreements, it shall not be introduced. |

**Q2: Do you agree to adopt the text proposal from R1-2107317 (also captured above)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Reply (Yes/No)** | **Comments** |
| OPPO | No | Same comment as Q1, this modification is not aligned with the agreement. |
| Sharp | No |  |
| vivo | Yes |  |
| Samsung | Yes |  |
| Intel | Yes |  |
| NTT DOCOMO | Yes |  |
| ZTE, Sanechips | Yes |  |
| NEC | No | The change is out the scope of the agreement. |
| Nokia, Nokia Shanghai Bell | Yes |  |
| LG | No |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | No | Same comments as Q1 in section 2.1, the agreement has been captured correctly in the spec. |
| Apple | No | We think it may be fine to just remove “only”, i.e., we do not need to add “at least” in the text. |
| Ericsson | No | In our view, one way to solve the potential misalignment between the specification and the RAN1 agreements is to use the same sentence as in the agreements above. |
| CATT,GOHIGH | No | The modification and the relative scenarios are not discussed and defined in the agreements. |

## Round 2

In Round 1, the majority of companies mentioned that specifications were not aligned with the agreement from RAN1 #98-bis: the agreement does state that the operation with the lower priority is to be dropped whereas specifications do. There was not a majority to adopt the text proposal from R1-2107317. However, a proposal to reconcile specifications with the agreement was made in the comments that would be a good way forward. The proposal is to reuse the wording from the agreement, i.e. remove the word ‘only’ from specifications.

**Proposal 1: Adopt the following text change in 38.213 to align specifications with RAN1 agreement on prioritization between LTE sidelink and NR sidelink.**

|  |
| --- |
| -----------------------------------------------------begin text proposal for 38.213-----------------------------------------------------  16.2.4.1 Simultaneous NR and E-UTRA transmission/reception  >>>>unchanged text omitted<<<<  If a UE  - would respectively transmit or receive a first channel/signal using E-UTRA radio access and receive a second channel/signal or transmit second channels/signals using NR radio access, and  - a transmission or reception of the first channel/signal would respectively overlap in time with a reception of the second channel/signal or transmission of the second channels/signals, and  - the priorities of the channels/signals are known to both E-UTRA radio access and NR radio access at the UE msec prior to the start of the earliest transmission or reception, where and is based on UE implementation, and  the UE transmits or receives the channels/signals of the radio access technology with the highest priority as determined by the SCI formats scheduling the transmissions or, in case of a S-SS/PSBCH block or a sidelink synchronization signal using E-UTRA radio access, as indicated by higher layers or, in case of PSFCH, equal to the priority of the corresponding PSSCH.  ------------------------------------------------------end text proposal for 38.213------------------------------------------------------ |

**Q: Do you agree with the text change in Proposal 1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Reply (Yes/No)** | **Comments** |
|  |  |  |

# Discussion of R1-2108139

The draft CR [2] proposes to explicitly capture that behavior is up to UE implementation when the priorities of LTE sidelink or NR sidelink operations are not known to the UE sufficiently in advance. The contribution mentions that without this change, specifications are not clear regarding this case. The proposed text change is:

|  |
| --- |
| **<Unchanged parts omitted>** 16.2.4 Prioritization of transmissions/receptions16.2.4.1 Simultaneous NR and E-UTRA transmission/reception If a UE  - would transmit a first channel/signal using E-UTRA radio access and second channels/signals using NR radio access, and  - a transmission of the first channel/signal would overlap in time with a transmission of the second channels/signals, and  - the priorities of the channels/signals are known to both E-UTRA radio access and NR radio access at the UE msec prior to the start of the earliest of the two transmissions, where and is based on UE implementation,  the UE transmits only the channels/signals of the radio access technology with the highest priority as determined by the SCI formats scheduling the transmissions or, in case of a S-SS/PSBCH block or a sidelink synchronization signal using E-UTRA radio access, as indicated by higher layers or, in case of PSFCH, equal to the priority of the corresponding PSSCH.  In case the priorities of the respective channels/signals are unknown to both E-UTRA radio access and NR radio access prior to the time of transmission subject to processing time restriction, it is up to UE implementation to manage the overlap of the transmissions.  If a UE  - would respectively transmit or receive a first channel/signal using E-UTRA radio access and receive a second channel/signal or transmit second channels/signals using NR radio access, and  - a transmission or reception of the first channel/signal would respectively overlap in time with a reception of the second channel/signal or transmission of the second channels/signals, and  - the priorities of the channels/signals are known to both E-UTRA radio access and NR radio access at the UE msec prior to the start of the earliest transmission or reception, where and is based on UE implementation,  the UE transmits or receives only the channels/signals of the radio access technology with the highest priority as determined by the SCI formats scheduling the transmissions or, in case of a S-SS/PSBCH block or a sidelink synchronization signal using E-UTRA radio access, as indicated by higher layers or, in case of PSFCH, equal to the priority of the corresponding PSSCH.  In case the priorities of the respective channels/signals are unknown to both E-UTRA radio access and NR radio access prior to the time of transmission subject to processing time restriction, it is up to UE implementation to manage the overlap between the transmission and reception.  **<Unchanged parts omitted>** |

The related agreements were made in RAN1 #96-bis and RAN1 #98, [4] and [5]:

Working assumption:

* For Tx/Tx overlap,
  + If packet priorities of both LTE and NR sidelink transmissions are known to both RATs prior to time of transmission subject to processing time restriction, then the packet with a higher relative priority is transmitted
    - In case the priorities of LTE and NR SL transmissions are the same, then it is up to UE implementation as to which transmission is chosen (e.g., taking into account congestion, etc.)
  + If packet priorities of both LTE and NR sidelink transmissions are not known to both RATs prior to time of transmission subject to processing time restriction, then it is up to UE implementation to manage Tx/Tx overlaps (e.g., LTE transmissions are always prioritized, etc.)
  + RAN1 does not assume any impact to LTE physical layer specifications

Agreements**:**

Unless packet priorities of both LTE and NR sidelink are known to both RATs prior to time of collision (subject to processing time restriction), then

1. It is up to UE implementation to handle LTE Tx/NR Rx overlap.
2. It is up to UE implementation to handle NR Tx and LTE Rx overlap.

This issue was listed as one of the topics to discuss in RAN1 #100bis-e email thread [100b-e-NR-5G\_V2X\_NRSL-InDevice-Coex-01], conditioned on other TPs being agreed and prepared. However, a full discussion did not take place.

## Company Views

**Q1: Do you agree with the ambiguity issue identified in R1-2108139?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Reply (Yes/No)** | **Comments** |
| OPPO | No | The specification does not need to capture the behaviour that is up to UE implementation |
| Sharp | No | Agree with OPPO that UE behaviours which are up to UE implementation do not need to be captured in the spec. |
| vivo | No | If the behaviour is not specified, it can only be handled by implementation. |
| Samsung | No | Even without the specified behaviour, it can be handled by UE implementation.  This is to explicitly explain the case for the unknown priority, but it seems not needed. If the spec does not say that case, it is natuarally up to UE implementation. If that is described in the spec, RAN1 needs to specify what "unknown" means, what "prior to the time ... means, and what "manage the overlap" means, which seems unnecessary. |
| Intel | No | Agree with previous comments |
| NTT DOCOMO |  | ‘up to UE implementation’-like text is sometimes captured, sometimes not. We are OK with either way. |
| ZTE, Sanechips | No | Not necessary to clarify. |
| NEC |  | Either option is fine to us. |
| Nokia, Nokia Shanghai Bell |  | Statement that if the conditions are not met then it is up to UE implementation to decide which operation is prioritized, may be added. But we think that it is not essential to include the statement |
| LG | No | Even if the change is not adopted, the prioritization for the case will be up to UE implementation. |
| Qualcomm |  | We share DOCOMO’s view that “up to UE implementation” is captured in places but not in other, depending on the context. For this case, we’re ok either way. |
| Huawei, HiSilicon | No | Already agreed as up to UE implementation for the given cases, thus no need to capture it explicitly in the spec. |
| Apple | No | We do not need to capture “up to UE implementation” in the specification. |
| Ericsson | Yes | Even though the UE behaviour can be assumed and not captured in the specification, we have already included several paragraphs in the SL specification which defines the UE behaviour if the clarification –due to a potential misinterpretation– was needed. In our view, this is one of these cases where the UE behaviour needs to be defined in the specification to avoid any further misalignments in the implementations. |
| CATT,GOHIGH | No | The specification does preclude the behaviour of the mentioned UE implementation. No need to specify it. |

**Q2: Do you agree to adopt the text proposal from R1-2108139 (also captured above)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Reply (Yes/No)** | **Comments** |
| OPPO | No |  |
| Sharp | No |  |
| vivo | No |  |
| Samsung | No |  |
| Intel | No |  |
| NTT DOCOMO |  | We are OK with either way. |
| ZTE, Sanechips | No |  |
| NEC |  | Both sides are OK |
| Nokia, Nokia Shanghai Bell | No | We think this is not necessary. If it is included the wording should be clarified (as pointed out by Samsung, statements like “manage overlap” and “prior to the time…” should be clarified) |
| LG | No |  |
| Qualcomm |  | We are ok with either option. |
| Huawei, HiSilicon | No | See comment for Q1 in section 3.1. |
| Apple | No |  |
| Ericsson | Yes |  |
| CATT,GOHIGH | No |  |

## Conclusion

The majority of companies did not view the change in R1-2108139 as necessary and stated that UE behavior for cases that are not defined in specifications is already left up to UE implementation.

**Conclusion: Do not adopt the change from R1-2108139.**

# References

1. R1-2107317 “Draft CR on NR SL Transmission Prioritization with LTE SL Reception,” Qualcomm Incorporated, RAN1 #106-e.
2. R1-2108139 “[Draft] Correction on prioritizations for LTE and NR sidelink transmission and reception,” Ericsson, RAN1 #106-e.
3. Chair’s notes, RAN1 #96.
4. Chair’s notes, RAN1 #96-bis.
5. Chair’s notes, RAN1 #98.
6. Chair’s notes, RAN1 #98-bis.