**3GPP TSG RAN WG2 Meeting #118-e R2-220xxxx
E-Conference, 9th -20th May 2022**

**Agenda item: 6.7.2.6**

**Source: Qualcomm Incorporated**

**Title: Summary of [AT118-e][614][Relay] 38.306 relay CR (Qualcomm)**

**WID/SID: NR\_SL\_Relay-Core – Release 17**

**Document for: Discussion and Decision**

# Introduction

This is for phase 1 of the below offline discussion:

* [AT118-e][614][Relay] 38306 relay CR (Qualcomm)

      Scope: Update the rapporteur CR (R2-2205880), incorporating decisions of this meeting and taking into account related proposals in the related tdocs: R2-2204637, R2-2204638, R2-2204770, R2-2205988.

      Intended outcome: Agreed CR (without CB if possible)

      Deadline:  Phase 1 to agree on proposals: Friday 2022-05-13 1800 UTC; Phase 2 to agree CR Wednesday 2022-05-18 0400 UTC

# Discussion

## Indication of simultaneous Uu and SL discovery per BC

In [2] and [3], Category “B” draft CRs to TS38.306 and TS 38.331 are provided to address the below issue.

“In the current specification, when defining relay / non-relay discovery PC5 BC list, there is no reporting on whether a specific relay / non-relay discovery PC5 BC can co-operate with a specific Uu BC, which however was defined clearly in R16 for PC5 BC list of sidelink communication.”

Specifically, the below capability parameters are introduced to indicate for each PC5 relay discovery and non-relay discovery BC whether the simultaneous transmission and reception capability is supported with a specific Uu BC. Proposal 1 in [4] is also about the support of reporting simultaneous transmission and reception capability of Uu and sidelink discovery for each BC.

| ***Definitions for parameters*** | Per | M | FDD-TDDDIFF | FR1-FR2DIFF |
| --- | --- | --- | --- | --- |
| ***supportedTxBandCombListPerBC-SL-RelayDiscovery-r17, supportedRxBandCombListPerBC-SL-NonRelayDiscovery-r17***Indicates, for a particular Uu band combination, the PC5 Relay discovery and non-Relay discovery band combination(s) on which the UE supports simultaneous transmission and reception. The leading / leftmost bit (bit 0) corresponds to the first band combination included in *supportedBandCombinationListSL-RelayDiscovery-r17/supportedBandCombinationListSL-NonRelayDiscovery-r17*, the next bit corresponds to the second band combination included in *supportedBandCombinationListSL-RelayDiscovery-r17/supportedBandCombinationListSL-NonRelayDiscovery-r17* and so on. with value 1 indicating simultaneous transmission and reception is supported. | BC | No | N/A | N/A |

In rapporteur’s view, the above parameters are like the ***supportedTxBandCombListPerBC-Sidelink-r16, supportedRxBandCombListPerBC-Sidelink-r16*** parameters that indicate the simultaneous transmission and reception capability of Uu and PC5 sidelink communication BCcorresponding to the BC *in* ***BandCombinationListSidelinkEUTRA-NR***.

Considering that RAN2 made below agreement in RAN2#117e that NR discovery capability is similar to Rel-16 supportedBandCombinationListSidelinkEUTRA-NR, Rapporteur thinks it is straight forward to consider the support of Uu simultaneous transmission and reception indication for each PC5 BC of relay discovery and non-relay discovery BandCombinationList. Rapporteur would like to get company input on this aspect first before discussing the parameters to introduce or how to address the changes.

NR discovery capability is signalled as a list of band combination list, which is similar to Rel-16 sidelink communication band combination list (i.e., supportedBandCombinationListSidelinkEUTRA-NR)

**Q1) Do you agree to introduce capability support to indicate for a particular Uu BC, PC5 Relay discovery and non-Relay discovery band combination(s) included in supportedBandCombinationListSL-RelayDiscovery-r17/supportedBandCombinationListSL-NonRelayDiscovery-r17 on which the UE supports simultaneous transmission and reception?**

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| Company | Response (Yes / No) | Comments  |
| Apple | Yes | Align with Rel-16 capability signaling |
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Secondly, Rapporteur thinks that there is some confusion in the above parameters defined in [2] and [3], on why there is Tx in Relay discovery parameter and Rx in NonRelayDiscovery parameter name. It is necessary to clarify which option is supported for introducing this simultaneous transmission and reception capability.

* Option 1: introduce a common parameter indicating both Tx/Rx BC simultaneous transmission and reception capability, i.e. 2 parameters
	+ one for relay discovery, ***supportedBandCombListPerBC-SL-RelayDiscovery-r17;*** and
	+ one for non-relay discovery, ***supportedBandCombListPerBC-SL-NonRelayDiscovery-r17***
* Option 2: introduce separate parameter for Tx and Rx BC indicating simultaneous transmission and reception capability, i.e. 4 parameters
	+ two for relay discovery, ***supportedTxBandCombListPerBC-SL-RelayDiscovery-r17*** and ***supportedRxBandCombListPerBC-SL-RelayDiscovery-r17***; and
	+ two for non-relay discovery, ***supportedTxBandCombListPerBC-SL-NonRelayDiscovery-r17 and supportedRxBandCombListPerBC-SL-NonRelayDiscovery-r17***

As per the RAN2#116bis-e agreement below, rapporteur thinks it is not necessary to separate the capability for transmission and reception as there is no separate Tx and Rx band combination list indicated for sidelink discovery BC capability for both relay and non-relay discovery.

* Proposal 3 (16/16): The NR discovery capability is common to transmission and reception of discovery message, L2 and L3 relay, and remote UE and relay UE.

**Q2) If answer to Q1 is yes, then do you agree to support option 1 or option 2?**

* Option 1: introduce a common parameter indicating both Tx/Rx BC simultaneous transmission and reception capability, i.e. 2 parameters
	+ one for relay discovery, ***supportedBandCombListPerBC-SL-RelayDiscovery-r17;*** and
	+ one for non-relay discovery, ***supportedBandCombListPerBC-SL-NonRelayDiscovery-r17***
* Option 2: introduce separate parameter for Tx and Rx BC indicating simultaneous transmission and reception capability, i.e. 4 parameters
	+ two for relay discovery, ***supportedTxBandCombListPerBC-SL-RelayDiscovery-r17*** and ***supportedRxBandCombListPerBC-SL-RelayDiscovery-r17***; and
	+ two for non-relay discovery, ***supportedTxBandCombListPerBC-SL-NonRelayDiscovery-r17 and supportedRxBandCombListPerBC-SL-NonRelayDiscovery-r17***

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| Company | Response (Yes / No) | Comments  |
| Apple | Option 1 | As quoted by Rapporteur, RAN2 agreed the discovery capability is common to TX and RX, which is also same as LTE discovery capability.  |
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## Support of powerclass and scalingfactor parameters

In [4], proposal 2 is for RAN2 to discuss the impact on the power class and scaling factor when the simultaneous transmission and reception for Uu and PC5 BC is supported for sidelink discovery with below argument.

“Furthermore, we see that intrabandConcurrentOperationPowerClass-r16, scalingFactorTxSidelink-r16, and scalingFactorRxSidelink-r16 are associated with supportedTxBandCombListPerBC-Sidelink-r16 or supportedRxBandCombListPerBC-Sidelink-r16, implying that the power class and scaling factor support simultaneous transmission and reception [3], TS 38.306.”

In rapporteur’s view, this proposal is reasonable to support for the particular Uu band combination and the PC5 discovery band combination(s) on which the UE supports simultaneous transmission and reception.

**Q3) If answer to Q1 is Yes, do you agree to support the intrabandconcurrent operationpowerclass and scalingfactor parameters for the PC5 discovery band combination(s) on which the UE supports simultaneous transmission and reception with Uu?**

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| Company | Response (Yes / No) | Comments  |
| Apple | No | We don't think they are essential, and they were not discussed in RAN2 before.  |
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It is rapporteur’s understanding that scalingfactor needs to be defined separately for Tx and Rx, as the Tx and Rx max data rate may differ for SL discovery similar to the max data rate for SL communication as defined in clause 4.1.5 of TS 38.306. Hence, we need to define 4 parameters

* + two for relay discovery, ***scalingFactorTxSL-RelayDiscovery-r17*** and ***scalingFactorRxSL-RelayDiscovery-r17***; and
	+ two for non-relay discovery, ***scalingFactorTxSL-NonRelayDiscovery-r17*** and ***scalingFactorRxSL-NonRelayDiscovery-r17***

**Q4) If answer to Q3 is Yes, do you agree to define scalingfactor separately for Tx and Rx, and separately for relay and non-relay discovery?**

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| Company | Response (Yes / No) | Comments  |
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## Relay type determination and indication

[5] has the below proposals, P1-P5. Rapporteur will provide arguments and clarifications on each proposal to collect company views. Delegates are strongly recommended to read [5] for the detailed arguments behind the proposals.

**Proposal 1: From the perspective of UE capability, it is possible that a relay/remote UE supports both L2 relay and L3 relay.**

**Proposal 2: If either the gNB capability or the relay UE capability supports only one relay type, the relay UE should only work in this relay type.**

**Proposal 3: Even if the remote UE capability supports both L2 and L3 relay, remote UE can only connected to relay UE using one relay type, and which relay type is used is up to remote UE’s implementation.**

**Proposal 4: If the gNB capability and the relay UE capability support both L2 and L3 relay, relay UE can indicate it supports both L2 relay and L3 relay in relay discovery message.**

**Proposal 5: If the gNB capability and the relay UE capability support both L2 and L3 relay, relay UE can use different relay type for different relay/remote UE pair.**

P1 seems reasonable and aligns with the SA2 specs where a relay UE and remote UE can be provisioned with multiple Relay Service Codes corresponding to L3 and L2 relay operation. However, rapporteur thinks that Proposal 1 is only to confirm the understanding and there is nothing to specify in TS 38.306.

**Q5) Do you agree that a) from the perspective of UE capability, relay/remote UE can support both L2 relay and L3 relay capabilities and b) there is nothing to clarify in RAN2 specs?**

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| Company | Response (Yes / No) | Comments  |
| Apple | Yes |  |
| OPPO | Yes | We take the liberty to revise the question a bit. |
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P2-P5 are proposing solutions to address the below issues

* Issue 1: how relay UE and remote UE can determine relay type to use based on the UE capabilities and gNB capabilities support (P2, P3)
* Issue 2: whether relay UE and remote UE can use both L3 and L2 relay types simultaneously between the same relayUE/remoteUE pair or different relayUE/remote UE pairs. (P4, P5)

For Issue 1 and Issue 2, there is some UE behaviour that is based on upper layer design and other behaviour that is based on AS layer capabilities and design.

Rapporteur would like first to provide some background on upper layer behaviour already covered in SA2 TS 23.304.

* “5G ProSe UE-to-Network Relay Discovery parameters (User Info ID, Relay Service Code(s), UE-to-Network Relay Layer Indicator(s)); the UE-to-Network Relay Layer Indicator indicates whether a particular RSC is offering 5G ProSe Layer-2 or Layer-3 UE-to-Network Relay service.”
* “The Relay Service Code (RSC) is used in the 5G ProSe UE-to-Network Relay discovery, to indicate the connectivity service the 5G ProSe UE-to-Network Relay provides to the 5G ProSe Remote UE. A 5G ProSe UE-to-Network Relay supporting multiple RSCs can advertise the RSCs using multiple discovery messages, with one RSC per discovery message.”
* PC5 unicast link setup between the relay UE and remote UE is based on the relay service and the relay service type is indicated during link setup. Thus, the links for different relay types are setup independently between the UEs and there is no dependency on Relay UE supporting different relay type service with different relay UE/remote UE pairs.

From the above background, it is clear that the type of discovery message is decided by the upper layers and it is not in scope of RAN2 to discuss the content of discovery messages to indicate the relay type or the relay service supported. Also, a single relay UE can advertise support of multiple Relay services which may correspond to L2 relay or L3 relay simultaneously and remote UE can connect for more than one relay service, i.e. L3 or L2, independently with the same relay UE or different relay UE simultaneously. Similarly, relay UE can connect simultaneously for more than one relay service with same remote UE or different remote UE pair.

**Q6) Do you agree that a) the content of discovery messages to indicate the relay type (L2 or L3) or the relay service is decided by upper layers and b) nothing to specify in RAN2 specs?**

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| Company | Response (Yes / No) | Comments  |
| Apple | Yes |  |
| OPPO | Yes |  |
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**Q7) Do you agree that a) whether a remote UE can connect for more than one relay service, i.e. L3 or L2, simultaneously with the same relay UE or different relay UE is defined by upper layers b) nothing to specify in RAN2 specs?**

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| Company | Response (Yes / No) | Comments  |
| Apple | Yes |  |
| OPPO | Yes |  |
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For Issue 1 and Issue 2, whether the relay UE can support AS layer operation (like requesting discovery configuration, Mode 1 resources for Remote UE, Local ID assignment for L2 Remote UE) for L2 relay or L3 relay type based on the gNB capability and its own capability support is in scope of RAN2. Rapporteur thinks that the AS layer behaviour based on if gNB indicated capability for L2 relay or L3 relay operation, and, whether a relay UE or remote UE with the corresponding capability support (L3 or L2) can perform specific AS procedures is already covered in TS38.331 (clause 5.8.3) and other specs. If companies think there are any missing procedures for the AS layer design, those issues should be raised explicitly.

**Q8) Do you agree that the remote UE and relay UE support for the specific L3 or L2 relay AS procedures based on when gNB either supports L3 or L2 relay operation or both is already covered in the AS layer specs?**

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| Company | Response (Yes / No) | Comments  |
| Apple | Yes |  |
| OPPO | Yes |  |
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For Issue 1, rapporteur thinks that there is one aspect that needs further discussion which is related to P2 in [5]. If the gNB indicated or the relay UE supports only L3 relay type from AS layer capabilities, but the upper layer configuration is for both types of relay services, then as per the current upper layer background relay UE may advertise both relay types during discovery. Remote UE may connect to the relay UE for both relay types. However, as the AS layer does not support L2 relay operation, the L2 Remote UE connection setup via relay UE fails. To avoid this failure at a late stage, the AS layer could provide an indication to the upper layers on whether L2 relay type capability is supported by AS layer. AS layer could determine this by considering both gNB and UE capabilities. This indication can be used by upper layers to decide whether to send discovery messages for a relay type or not and thus avoid failures of relay connection setup at a later stage.

**Q9) Do you agree that AS layer provide an indication to upper layers** **on whether L2 relay type is supported by AS layer?**

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| Company | Response (Yes / No) | Comments  |
| Apple | No | We think it is one issue not discussed before, and current spec is not broken. At this stage, we tend to avoid optimization.  |
| OPPO | No | In general, this kind of UE internal cross-layer indication seems not critical to be captured.. |
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**Q10) If answer to Q9 is yes, then do you agree that a NOTE “AS layer provide an indication to upper layers on L2 relay type operation support in AS layer, determined considering both UE and gNB capabilities” in TS 38.331 is sufficient to address the change?**

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| Company | Response (Yes / No) | Comments  |
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# Conclusion

TBD based on company inputs

# References

[1] R2-2205880, 38.306 CR for sidelink relay UE capabilities, Qualcomm Incorporated

[2] R2-2204637, Correction on UE capability for discovery BC list (38.331), OPPO

[3] R2-2204638, Correction on UE capability for discovery BC list (38.306), OPPO

[4] R2-2205988, Clarification on supported BC of Uu and sidelink discovery, Huawei, HiSilicon

[5] R2-2204770, Further discussion on UE capability, CATT