**#3GPP TSG RAN WG1 #102-e R1-20xxxxx**

**e-Meeting, August 17th – 28th, 2020**

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**Source:** Moderator (LG Electronics)

**Title:** FL summary#1 for AI 8.11.2.2 Feasibility and benefits for mode 2 enhancements

**Document for:** Discussion and decision

1. **Email discussion**

As per Chairman’s guideline, the following email discussion was allocated for AI 8.11.2.2.

* + - * **[102-e-NR-SL\_enh-02] Email discussion/approval using the summary as a starting point, focusing on high-level concepts for 8.11.2.2 – Seungmin (LGE)**
* **To start from 8/21 till 8/27**

When considering the relevant objective below, it would be desirable to focus on discussing high-level concepts for “Inter-UE coordination” in this meeting. Based on the outcome of email discussion, in the next meeting, RAN1 can discuss/conclude details and send LS to RAN (subject to decision of September RAN meeting). Please provide your view on the questions in Section 1.1/1.2/1.3/1.4 **by 8/26 (Wednesday)**. Based on the collected view, I’ll make a set of proposals that will be discussed and finalized **by 8/27**.

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| *2. Resource allocation enhancement:** *Specify resource allocation to reduce power consumption of the UEs [RAN1, RAN2]*
	+ *Baseline is to introduce the principle of Rel-14 LTE sidelink random resource selection and partial sensing to Rel-16 NR sidelink resource allocation mode 2.*
	+ *Note: Taking Rel-14 as the baseline does not preclude introducing a new solution to reduce power consumption for the cases where the baseline cannot work properly.*
* *Study the feasibility and benefit of the enhancement(s) in mode 2 for enhanced reliability and reduced latency in consideration of both PRR and PIR defined in TR37.885 (by RAN#91), and specify the identified solution if deemed feasible and beneficial [RAN1, RAN2]*
	+ *Inter-UE coordination with the following until RAN#90.*
		- *A set of resources is determined at UE-A. This set is sent to UE-B in mode 2, and UE-B takes this into account in the resource selection for its own transmission.*
	+ *Note: The study scope after RAN#90 is to be decided in RAN#90.*
	+ *Note: The solution should be able to operate in-coverage, partial coverage, and out-of-coverage and to address consecutive packet loss in all coverage scenarios.*
	+ *Note: RAN2 work will start after [RAN#89].*
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**1.1 How to define “A set of resources” in Mode 2**

* + - * Q1: Do you agree that the followings can be considered? If you want to add other options, please specify it.
* Resource set recommended by UE-A
	+ e.g.,
		- TX resource set which can be used by UE-B
		- Preferred RX resource set of UE-A

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| Company | Comment |
| Ericsson | In our view, the general procedure for Inter-UE coordination should consider the set of resources which are suitable for the TX of UE-B. Unless “the preferred RX resource set of UE-A” can be understood as “the suitable resource set for UE-B”, we consider that the second alternative (preferred set of resource from UE-A perspective) does not bring advantages compared to the other options and should not be included.Moreover, we think it is important to study the overhead of the coordination message in all casting scenarios, i.e., unicast, groupcast and broadcast, and assess the feasibility of the Inter-UE coordination message as defined in Proposal 1.1. In our view, the potential size of the coordination message containing the set of resources could create issues in groupcast or broadcast scenarios and potentially different options for the inter-UE coordination message may need to be defined. |
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**1.2 When UE-A transmits “A set of resources” to UE-B in Mode 2**

* + - * Q1: Do you agree that the followings can be considered? If you want to add other options, please specify it.
* When requested by UE-B
* When satisfying the pre-defined condition

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| Company | Comment |
| Ericsson | We agree with both options. We think that the Inter-UE coordination mechanism should be triggered upon request from UE-B or/and whenever some specific defined conditions are met. Nevertheless, some further study must be done before agreeing on the options:* For the first proposed option, the feasibility of the request message should be considered in terms of latency and signaling overhead. Also, if supported, the specific format and the channel on which it is carried should be discussed.
* For the second proposed option, the pre-defined conditions should be listed and studied before agreeing on its feasibility.

Additionally, we propose to study the periodic transmissions of the coordination message for particular scenarios. |
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**1.3 Which container is used to transmit “A set of resources” to UE-B in Mode 2**

* + - * Q1: Do you agree that the followings can be considered? If you want to add other options, please specify it.
* PSSCH
	+ MAC message
	+ PC5-RRC signaling
* New 2nd SCI format
* New physical channel

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| Company | Comment |
| Ericsson | First of all, we think that we should not engage in a major designing of PHY structures. Besides, the limitations in TUs, we must ensure that Rel-17 functionalities can coexist with Rel-16 sidelink. Modifications of PHY structures, if any, should respect these principles (e.g., including the Inter-UE coordination in PSFCH-like transmission or modifications to SCI format) We agree on considering the higher layer signaling (MAC or PC5-RRC signaling) as well as a potential new 2nd SCI format. |
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**1.4 How to use “A set of resources” for UE-B in Mode 2**

* + - * Q1: Do you agree that the followings can be considered? If you want to add other options, please specify it.
* Take it into account to make a candidate TX resource set in the resource selection procedure
* Take it into account to decide selected resources for PSCCH/PSSCH TX

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| Company | Comment |
| Ericsson | We are supportive of the first option, where UE-B takes into account the suggestion included in the Inter-UE coordination message to create its candidate resource set (i.e., sensing).We would like to ask for clarification regarding the second option included in the proposal since it is not clear for us the intention of it. If the intention is to include the information as part of the resource (re-)selection procedure, we are open to consider it. However, as indicated in the WID, the set of resources indicated in the Inter-UE coordination message cannot be used to “force” the receiving UE to select a specific set of resources. Therefore, if this is the intention of the second option, we do not agree with it.As indicated in Proposal 1.1, some additional options should be considered from the UE-B, e.g., resource re-selection, upon receiving an Inter-UE coordination message. |
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**1.5 Other aspects for “Inter-UE coordination”**

* + - * Q1: What other aspects (other than those in Section 1.1/1.2/1.3/1.4) are needed to be discussed?

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| Company | Comment |
| Ericsson | In our view, one point that should also be discussed is the different casting types that need to be considered for the Inter-UE coordination mechanism and the associated signaling, including potential restrictions and/or different solutions. |
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1. **Appendix A -** Summary of contributions
	* + - Targeting scenario
* Problems to be considered
	+ Hidden-node problem [1] [3] [4] [6] [8] [9] [12] [14] [19] [20] [26] [27]
		- Example of related scenario:
			* UE-A transmits PSCCH/PSSCH to UE-B.
			* UE-C transmits PSCCH/PSSCH to UE-B.
			* UE-A and UE-C cannot recognize each other.
	+ Exposed-node problem [1]
		- Example of related scenario:
			* UE-A transmits PSCCH/PSSCH to UE-C.
			* UE-B transmits PSCCH/PSSCH to UE-D.
			* UE-A and UE-B are close each other.
			* UE-C and UE-D cannot recognize each other.
	+ Half-duplex problem [1] [3] [4] [5][6] [8] [9] [12] [14] [26] [27]
		- Example of related scenario:
			* UE-A transmits PSCCH/PSSCH to UE-B in slot i.
			* UE-B transmits PSCCH/PSSCH to UE-C in slot i.
	+ Persistent collision [2] [4] [9] [12] [20]
		- Example of related scenario:
			* UE-A transmits PSCCH/PSSCH with period of N slots from slot i.
			* UE-B transmits PSCCH/PSSCH with period of N slots from slot i.
	+ PSFCH collision problem [3] [25]
		- Example of related scenario:
			* UE-A transmits PSCCH/PSSCH to UE-B and expects to receive the corresponding PSFCH in slot i.
			* UE-A receives PSCCH/PSSCH from UE-C and is expected to transmit the corresponding PSFCH in slot i (and/or UE-A receives PSCCH/PSSCH from UE-D and is expected to transmit the corresponding PSFCH in slot i).
* Cast type to be considered
	+ Broadcast: [6] [17] [20]
	+ Groupcast: [3] [4] [6] [8] [17] [18] [20] [21]
	+ Unicast: [3] [4] [6] [8] [17] [18] [20] [21]
		- * How to define “A set of resources”
* e.g.
	+ Selected resources of UE-A [2] [5][6] [9] [10] [11] [18] [21] [22]
	+ Set of SL resources where UE-A can or cannot perform SL RX [3] [4] [5][6] [8] [9] [12] [26]
	+ Set of SL resources suggested by UE-A [3] [5][9] [13] [15] [20] [22] [24] [26] [27] [28]
	+ Sensing results of UE-A [5][6] [7] [8] [9] [10] [12] [14] [19] [20] [21] [22] [25] [26]
	+ Indication for release of reserved resources [5][8][9]
	+ Recommendation of transmission characteristics [9] [26] [27]
	+ Resource re-selection triggering for UE-B [3] [8][13] [20] [26]
	+ Selected resources for UE-B [1] [3] [7] [8] [23]
		- * When UE-A transmits “A set of resources” to UE-B
* e.g.
	+ Request of UE-B [1] [6] [27]
	+ Event-triggered [1] [6] [27]
		- * Which container is used to transmit “A set of resources” to UE-B in Mode 2
* e.g.
	+ New 2nd SCI format [2] [9] [12] [16] [24] [27] [28]
	+ PSSCH [9] [12] [15] [16] [18] [24] [27] [28]
		- MAC message
		- PC5-RRC signal
	+ New physical channel [9] [28]
		- * How to use “A set of resources” for UE-B
* e.g.
	+ Take “A set of resources” into account to make S\_A in Mode 2 [9] [11] [15] [16] [18] [19] [20] [24]
	+ Take “A set of resources” into account to decide selected resources for PSCCH/PSSCH transmission [1] [3] [7] [8] [9] [11] [13] [14] [16] [20] [21] [23]
		- * Further consideration on mixture of blind retransmission and HARQ-ACK feedback-based retransmission [8] [25] [26]
			* Further consideration on Mode 2 RA enhancement considering sum of multiple interference and TX power level [9]
			* Further consideration on resource selection from the earliest available resources [13] [25] [26]
1. **Reference**
2. R1-2005255 Inter-UE coordination in sidelink resource allocation Huawei, HiSilicon
3. R1-2005276 Sidelink resource allocation for Reliability enhancement Lenovo, Motorola Mobility
4. R1-2005296 Views on resource allocation enhancements for sidelink communication FUTUREWEI
5. R1-2005404 Discussion on mode-2 enhancements vivo
6. R1-2005501 Discussion of sidelink resource allocation mode 2 enhancements Nokia, Nokia Shanghai Bell
7. R1-2005537 Resource Allocation Enhancements for Mode 2 Fraunhofer HHI, Fraunhofer IIS
8. R1-2005546 Considerations on inter-UE coordination for mode 2 enhancements Fujitsu
9. R1-2005588 High-level concepts for mode 2 enhancements Sony
10. R1-2005612 Considerations on Mode 2 Latency Enhancement ITRI
11. R1-2005645 Discussion on Mode 2 enhancements MediaTek Inc.
12. R1-2005692 Discussion on feasibility and benefits for mode 2 enhancements CATT
13. R1-2005749 Discussion on feasibility and benefits for mode 2 enhancements LG Electronics
14. R1-2005763 Views on feasibility and benefits for mode 2 enhancements NEC
15. R1-2005774 Feasibility and benefits for mode 2 enhancements TCL Communication Ltd.
16. R1-2005840 Sidelink resource allocation for Reliability enhancement Lenovo, Motorola Mobility
17. R1-2005897 On feasibility and benefits of sidelink enhancements targeting Mode 2 reliability and latency Intel Corporation
18. R1-2005903 Inter-UE coordination for enhanced resource allocation Mitsubishi Electric RCE
19. R1-2005961 Inter-UE coordination in mode-2 ZTE, Sanechips
20. R1-2006010 Discussion on feasibility and benefits of mode 2 enhancements OPPO
21. R1-2006171 On Feasibility and Benefits for Mode2 Enhancements Samsung
22. R1-2006184 NR SL Mode 2 enhancement for reliability improvement InterDigital, Inc.
23. R1-2006231 Discussion on reliability and latency enhancements for mode-2 resource  allocation CMCC
24. R1-2006268 Discussion on feasibility and benefit of mode 2 enhancements Spreadtrum Communications
25. R1-2006445 Feasibility and benefits of mode 2 enhancements for inter-UE coordination Ericsson
26. R1-2006508 Mode 2 Resoruce Allocation with Inter-UE Coordination Apple
27. R1-2006537 Mode 2 enhancements in sidelink Panasonic Corporation
28. R1-2006587 Discussion on V2X mode 2 enhancements ASUSTeK
29. R1-2006626 Discussion on Mode 2 enhancement for enhanced reliability and reduced latency Xiaomi
30. R1-2006748 Discussion on sidelink resource allocation for reliability and latency enhancements NTT DOCOMO, INC.
31. R1-2006829 Reliability and Latency Enhancements for Mode 2 Qualcomm Incorporated
32. R1-2006876 Sidelink Resource Allocation Enhancements ROBERT BOSCH GmbH
33. R1-2006922 On Resource Allocation Mode 2 Enhancement for NR Sidelink Convida Wireless