**3GPP TSG RAN WG1 #110bis-e R1-2210278**

**e-Meeting, October 10th – 19th, 2022**

**Agenda item:** 8.16.1

**Source:** Moderator (NTT DOCOMO, INC.)

**Title:** Summary#1 on UE features for SL enh and RedCap

**Document for:** Discussion and Decision

# **Introduction**

This document summarizes contributions submitted to AI 8.16.1 and AI 5 regarding UE features for SL enh. and RedCap and captures company views based on the announcement in the following email thread.

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| [110bis-e-R17-UE-features-01] Email discussion on Rel-17 UE features topics 1 by October 19 – Hiroki (NTT DOCOMO)* eIIoT & URLLC, RedCap, UE power saving, coverage enhancement, NB-IoT & eMTC, sidelink, MBS, 5G terrestrial broadcast, UL TX switching, SDT
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# **Discussion on UE features for NR sidelink enhancement**

## **2.1 RAN2 LS on Per-FS L1 feature for NR sidelink discovery BC-list**

In [1], RAN2 asked following questions to RAN1 regarding per FS L1 feature for NR sidelink discovery BC-list such as FG15-25, 32-4 and 32-5a-1.

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| **Q1**: Can RAN1 confirm the RAN2 assumption above, i.e., these per-FS L1 features above also apply to the band-combination supporting discovery?**Q2**: If Yes to Q1, in case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, whether the UE capability of these per-FS L1 feature would be different for NR Sidelink communication and NR sidelink discovery, or it would be the same? |

Following views are provided in contributions for the RAN1#110bis-e meeting.

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| [2] | vivo | **Q1:** Can RAN1 confirm the RAN2 assumption above, i.e., these per-FS L1 features above also apply to the band-combination supporting discovery?**Answer**: Yes, from the RAN1 perspective, the sidelink discovery message in PSSCH is handled in the same way as other sidelink communication data. Thus, the RAN1 per-FS features, specifically FG 15-22, 32-4, and 32-5a-1, also apply to the band-combination supporting sidelink discovery.**Q2:** If Yes to Q1, in case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, whether the UE capability of these per-FS L1 feature would be different for NR Sidelink communication and NR sidelink discovery, or it would be the same?**Answer**: From the RAN1 perspective, NR sidelink discovery transmission is handled in the same way as normal NR sidelink communication. Thus, the abovementioned per-FS L1 features can be same for both of them. |
| [3,4] | OPPO | FG 15-25 and FG 32-4 are both related to mode 2 resource selection for PSSCH transmission, and FG 32-5a-1 is related to IUC information determination and transmission. As already indicated by RAN2 in the LS, discovery is also carried by PSSCH. Furthermore, according to 38.321, dedicated resource pools are configured for discovery transmission, but resource selection mechanism within the resource pool for discovery are the same as that for SL communication, including partial sensing and inter-UE coordination. Hence, all the 3 per-FS L1 features should be applicable to discovery.Proposed reply to Q1:* ***Yes, the 3 per-FS L1 features, i.e. 15-25, 32-4 and 32-5a-1, can also apply to the band-combination supporting discovery.***

As both discovery and communication data are carried by PSSCH, and the applicable resource selection mechanism within the discovery resource pool and communication resource pool are the same, it is not necessary to differentiate UE capability per the contents included in the PSSCH.Proposed reply to Q2:* ***It is RAN1’s understanding that there is no need to differentiate UE capability per the contents included in PSSCH, therefore, in case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, the UE capability of these per-FS L1 feature is the same.***
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| [5] | Xiaomi | **Q1**: Can RAN1 confirm the RAN2 assumption above, i.e., these per-FS L1 features above also apply to the band-combination supporting discovery?*[RAN1 reply] :* *Yes, RAN1 confirms the RAN2 assumption above.***Q2**: If Yes to Q1, in case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, whether the UE capability of these per-FS L1 feature would be different for NR Sidelink communication and NR sidelink discovery, or it would be the same?*[RAN1 reply] :* *In case a band combination supporting both NR Sidelink communication and NR Sidelink discovery,* *the UE capability of these per-FS L1 feature would be same for NR Sidelink communication and NR sidelink discovery.* |
| [6] | ZTE, Sanechips | **Q1: Can RAN1 confirm the RAN2 assumption above, i.e., these per-FS L1 features above also apply to the band-combination supporting discovery?****A1:** Yes.**Q2: If Yes to Q1, in case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, whether the UE capability of these per-FS L1 feature would be different for NR Sidelink communication and NR sidelink discovery, or it would be the same?****A2:** In case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, the defined UE capability for NR SL communication can be reused for NR SL discovery, so it would be the same. |
| [7] | Huawei, HiSilicon | For L2 and L3 relay discovery, the network may configure a resource pool dedicated for relay discovery. In such case, the resource pools for SL relay discovery and SL communication are separated, and thus the operation on those resource pools are physically isolated. From RAN1’s perspective, these per-FS L1 features above also apply to the band-combination supporting discovery and the UE capability of these per-FS L1 feature would be the same for SL communication and SL relay discovery. Thus, following RAN1 answer is proposed:***Proposal 1: Reply to RAN2 as follows:**** *RAN1 confirms that these per-FS L1 features also apply to the band-combination supporting discovery.*
* *The UE capability of these per-FS L1 feature would be the same for NR Sidelink communication and NR sidelink discovery*
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| [8] | NTT DOCOMO, INC. | For Q1, although we do not understand why RAN2 refer to not all per-FS FGs but only the three, the answer would be YES. In our understanding, PSSCH-related FGs do not care the transmission contents basically. Even if PSSCH is transmitted for discovery purpose, the per-FS FGs should be applied to the transmission as well.For Q2, our view is that it should be the same. As abovementioned, the FGs are applicable to any PSSCH regardless of the contents. Then, we do not see any clear reason to have different UE capabilities. For example, FG 15-25 is FG for cross-carrier scheduling between Uu and SL. Definitely this capability is not relevant to the transmission contents.**Proposal 4-1: Send a reply LS to RAN2 for NR\_SL\_enh/NR\_SL\_Relay with the following answers.*** **Answer to Q1: Yes.**
* **Answer to Q2: The UE capability of the per-FS L1 features is the same for NR SL communication and NR SL discovery.**
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| [9] | Ericsson | **Q1**: Can RAN1 confirm the RAN2 assumption above, i.e., these per-FS L1 features above also apply to the band-combination supporting discovery?**Q2**: If Yes to Q1, in case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, whether the UE capability of these per-FS L1 feature would be different for NR Sidelink communication and NR sidelink discovery, or it would be the same?**Reply from RAN1 to Q1:** Yes, these features can also appy to the band-combination supporting discovery**Reply from RAN1 to Q2:** The UE capability of these per-FS L1 features is the same for NR Sidelink communication and NR sidelink discovery. |
| [10] | Qualcomm Incorporated |

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| **Q1**: Can RAN1 confirm the RAN2 assumption above, i.e., these per-FS L1 features above also apply to the band-combination supporting discovery? |

Yes, the above features also apply to a band-combination supporting discovery. RAN1 would like to note that there are other L1 features that also apply to such band-combinations.

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| **Q2**: If Yes to Q1, in case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, whether the UE capability of these per-FS L1 feature would be different for NR Sidelink communication and NR sidelink discovery, or it would be the same? |

The features are defined for PSSCH, independently of whether it carries sidelink discovery or communications. RAN1 notes that feature other than those in the RAN2 are also applicable. The UE capability could be the same from RAN1’s perspective. |

Based on above, reply LS is necessary and it seems companies have same views for the answers to RAN2 questions.

### **Proposal 2-1-1:**

* **For Q1 in R1-2208727 “Can RAN1 confirm the RAN2 assumption above, i.e., these per-FS L1 features above also apply to the band-combination supporting discovery?”,**
	+ **RAN1 answer is “Yes”.**

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| Company | Comment |
| ZTE,Sanechips | Yes |
| Qualcomm | Yes in general.We think it would be helpful if RAN1 also mentioned that other per-FS L1 features also apply to such band combinations. |
| Samsung | O.K |
| Intel | We are agree with the FL’s proposal , and it is our understanding that this feature indeed applies to band-combination supporting discovery.  |
| vivo | Yes |
| Huawei, HiSilicon | Yes |
| DCM | Yes |

### **Proposal 2-1-2:**

* **For Q2 in R1-2208727 “If Yes to Q1, in case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, whether the UE capability of these per-FS L1 feature would be different for NR Sidelink communication and NR sidelink discovery, or it would be the same?”,**
	+ **RAN1 answer is “In case a band combination supporting both NR Sidelink communication and NR Sidelink discovery, the UE capability of these per-FS L1 feature would be the same for NR Sidelink communication and NR Sidelink discovery”.**

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| Company | Comment |
| ZTE,Sanechips | Yes |
| Qualcomm | Yes |
| Samsung | O.K |
| Intel  | We are supportive of the FL’s proposal. |
| vivo | Yes |
| Huawei, HiSilicon | Yes |
| DCM | Yes |

## **2.2 Remaining issues on UE features list for NR sidelink enhancement**

Following view is provided in contributions for the RAN1#110bis-e meeting.

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| [11] | Ericsson | The remaining open issues for the Rel-17 UE features for sidelink are related to the Prerequisite feature groups in some of the features (as indicated by the groups in brackets). The feature groups with still open issues are the following: * 32-4: Transmitting NR sidelink mode 2 with partial sensing
* 32-4a: Transmitting NR sidelink mode 2 with random resource selection
* 32-5a-1: Transmitting Inter-UE coordination scheme 1 in NR sidelink mode 2
* 32-5a-2: Receiving Inter-UE coordination information of preferred resource set in NR sidelink mode 2
* 32-5a-3: Receiving Inter-UE coordination information of non-preferred resource set in NR sidelink mode 2
* 32-5b-1: Transmitting Inter-UE coordination scheme 2 in NR sidelink mode 2
* 32-5b-2: Receiving Inter-UE coordination scheme 2 in NR sidelink mode 2

For all these feature groups, we propose to remove the brackets in the current version of the RAN1 UE feature list [1] and keep the prerequisite feature groups within the brackets unchanged.**Remove the brackets in the current version of the pre-requisite feature groups for the following feature groups: 32-4, 32-4a, 32-5a-1, 32-5a-2, 32-5a-3, 32-5b-1 and 32-5b-2, keeping the prerequisite feature groups within the brackets unchanged.** |

Although it is proposed to remove the brackets, in the latest version of RAN1 NR UE features list for NR sidelink enhancement in [12], there is no bracket i.e., all the remaining issues for UE features on NR\_SL\_enh have solved at the RAN1#110 meeting. Therefore, it may be just misunderstanding, e.g., “one of {15-4, 32-2b, 32-4b}” is described as prerequisite for FG32-4, but it does not mean prerequisite is FFS.

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| Company | Comment |
| vivo | Agree with the moderator’s view. |
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# **Discussion on UE features for NR RedCap**

## **3.1 Applicability of UE features for RedCap UEs**

Following view is provided in contributions for the RAN1#110bis-e meeting.

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| [13] | ZTE | According to the WID [3] and agreement, UE capabilities related to CA, DC and wider max UE bandwidth are not applicable to RedCap UEs. However, it seems that whether to support the UE capabilities exceeding 1Tx/2Rx capability was controversial in the discussion of UE feature agenda. Given the Rel-17 RedCap WID description, the maximum UL peak data rate for wearables is 50Mbps. Obviously, support of more than 1Tx is not necessary, since the peak data rate can be up to 90Mbps for 64QAM and 1 layer with SCS=15KHz according to the calculation. More Tx antennas bring more complexity and cost, which is not aligned with the motivation of the WI. Moreover, for 1Rx RedCap UE, supporting more than 1 UL port seems to be impossible due to the physical circuit. Additionally, according to the RAN4 discussion [4] as following, actually 2Tx is excluded:

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| **Issue 1-1: Power class and TX architecture in FR1*** Proposals:
	+ Option 1: Agree below agreement from RAN4#101-bis-e

Issue 1-1-1: 1 PC3 UL TX architecture assumption * WF
	+ For TX architecture of 23 dBm PA

Issue 1-1-2: PC2 UL TX architecture assumption* WF
	+ 1 TX of 26 dBm PA in Rel-17 and 2 TX architecture is excluded in Rel-17

Issue 1-1-3: PC2 support for HD-FDD mode* WF
	+ PC2 support based on operator request
* Recommended WF
	+ Option 1

Discussion: **Agreement: agree on Option 1.** |

Some discussion details can be found in [5], as shown in the following:

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| WF:

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| **Issue 1-1-1** | *Agreements:*1 TX architecture of 23 dBm PA *Candidate options:**Recommendations for 2nd round:*No need to discuss in 2nd round. |
| **Issue 1-1-2** | *Tentative agreements:* 1 TX of 26 dBm PA in Rel-17 and 2 TX architecture is excluded in Rel-17 *Candidate options:**Recommendations for 2nd round:**Discuss the tentative agreement.* |
| **Issue 1-1-3** | *Agreements:* Based on operator support. (Previous WF)*Candidate options:**Recommendations for 2nd round:*No need to discuss in 2nd round. |

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The common understanding in RAN4 is that 1 TX architecture of 23 dBm PA is supported and 2 TX architecture of 23 dBm PA is not supported, even though the description may be missed in the agreement of RAN4#102-e. Based on above, the FGs exceeding 1 Rx UE capability should not be supported, e.g., FG 2-13, 2-14, 2-16b . Therefore, we have the following proposal:***Proposal 4:*** *For RedCap UE, UE capabilities exceeding 1Tx capability are not supported.*For those Rel-17 features, we also need to determine whether RedCap UE can support or not. At least eIAB and NR DC/CA further enhancements should not be supported according to the Rel-17 RedCap WID and agreement. Regarding above-52GHz, from our perspective, it is premature to support this feature, since some of the FGs actually exceeds the RedCap UE capability, e.g., SCS for DL control channel. For Rel-17 feMIMO, at least the FGs exceeding RedCap UE capability should be excluded, e.g., 23-1-1c, 23-1-1e, 23-1-1f, 23-1-1g, 23-8-3, 23-8-9, 23-9-3. ***Proposal 5:*** *For RedCap UE, whether to support Rel-17 features also needs to be determined.* * *The Rel-17 features for eIAB and NR DC/CA further enhancements should be excluded.*
* *The Rel-17 features for above-52GHz and feMIMO are not supported.*
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The same proposals were provided at the RAN1#110 meeting and following discussion was done [14].

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| **High priority proposal 2-1-3:*** **Add a note to exclude the support of following features for RedCap UE**
	+ **UE capabilities exceeding 1Tx capability, e.g., FG 2-13, 2-14, 2-16b**
	+ **Rel-17 eIAB and NR DC/CA further enhancements capabilities**
	+ **Rel-17 above-52GHz and feMIMO capabilities, e.g., 23-1-1c, 23-1-1e, 23-1-1f, 23-1-1g, 23-8-3, 23-8-9, 23-9-3**
	+ **[Rel-17 MBS capabilities]**

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| Company | Comment |
| MediaTek | We support FL’s proposal 2-1-3. |
| Vivo | We are fine with excluding UE capabilities exceeding 1Tx capability, Rel-17 eIAB and NR DC/CA further enhancements capabilities and Rel-17 above-52GHz and feMIMO capabilities.About “Rel-17 eIAB and NR DC/CA further enhancements capabilities”, it was already stated in 38.306 that “CA, MR-DC, DAPS, CPAC and IAB (i.e., the RedCap UE is not expected to act as IAB node) related UE features and corresponding capabilities are not supported by RedCap Ues. All other feature groups or components of the feature groups as captured in TR 38.822 [24] as well as capabilities specified in this specification remain applicable for RedCap Ues same as non-RedCap Ues, unless indicated otherwise”For Rel-17 MBS capabilities, we do not support to exclude it for RedCap. |
| ZTE, Sanechips | We support the FL’s proposal.  |
| FUTUREWEI | Do not support FL proposal:Regarding 1st bullet (1Tx): It should be removed – we had this discussion regarding 1TX in FL summary R1-2112503 with the conclusion “Since there is no consensus for this proposal, it is recommended to not consider it further in this meeting”Regarding 2nd bullet: not needed – if RedCap UE does not support eIAB not NR DC/CA, it will not support the enhancementsRegarding 3rd bullet: we note that there are some capabilities (e.g. BW) that exceed RedCap Ues capabilities, a blanket exclusion of above 52 GHz is not needed. Likewise for feMIMO – there may be some RedCap Ues supporting 2 Rx.Regarding 4th bullet – MBS capabilities should not be excluded for RedCap |
| CMCC | For the MBS part, the approved LS with Tdoc number RP- 221861 in RAN#96 to SA2 has the following contents, and the LS is drafted according to agreed proposal on RP-221782 RedCap UE MBS support, off-line discussion summaryRAN would like to thank SA2 for the LS R1-2203128(S2-2203020) on UE capabilities of MBS. The following is RAN’s response:* RAN#96 has concluded that Rel-17 specifications do not prevent any UE, including RedCap Ues, to support MBS.

So the it seems not correct to exclude R17 MBS capabilities. |
| Nokia, NSB | Do not support the proposal. There is no support from WID or WI activity to discard >1TX support. As for eIAB and NR DC/CA they should be out of scope by definition already by lack of CA support. Similar reasoning applies for other cases too. As for MBS it is not clear why it would be explicitly excluded. In fact there is an LS from RAN#96 saying the contrary (R1-2205726): RAN#96 has concluded that Rel-17 specifications do not prevent any UE, including RedCap Ues, to support MBS. |
| Ericsson | We do not support the proposal. We share the views expressed by Futurewei, CMCC, and Nokia. |
| Qualcomm | We can live with the first two bullets of FL’s proposal. We have concerns for the last bullet. Based on the conclusion of RAN#96 meeting, UE capabilities of NR R17 MBS can be optionally supported by R17 RedCap UE. |
| Moderator (NTT DOCOMO) | Based on the feedbacks, there seems to be no consensus on the proposal given RAN#96 conclusion. |
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Based on above, even without the proposal on MBS capabilities, there may or may not be different views on the necessity of explicit notes in the UE features list. So, companies’ feedbacks can be checked at the RAN1#110bis-e meeting.

### **Proposal 3-1:**

* **Add a note for FG28-1 to exclude the support of following features for RedCap UE**
	+ **UE capabilities exceeding 1Tx capability**
	+ **Rel-17 features for eIAB and NR DC/CA further enhancements**
	+ **Rel-17 features for above-52GHz and feMIMO**

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| Company | Comment |
| Ericsson | We do not see the need for such a note. |
| Nokia, NSB | We do not see a need for such a note either. |
| ZTE, Sanechips | Can we say 2Tx and related capabilities are supported, if such a note is not supported?In our understanding, if not stated, any capability is supported by default for RedCap. If such note is not supported, then RedCap UE would give the impression that 2Tx and related capabilities are supported, which is conflicting with the RAN4 agreement.At least, the following should be considered:* **Add a note for FG28-1 to exclude the support of following features for RedCap UE**
	+ **UE capabilities exceeding 1Tx capability**

We need to decouple the discussion of 2Tx and other Rel-17 features. There is no need to bundle them in one proposal. |
| Qualcomm | We are fine to add the first and the second bullets. If the first bullet is adopted, it is necessary to change the definition for R17 RedCap UE in TS 38.306 as well. |
| Intel | We do not see a need for the note. These are already addressed elsewhere in the specifications.  |
| vivo | We are fine with the 1st bullet.For the 2nd and 3rd bullet, they are already captured elsewhere in the specifications. |
| Huawei, HiSilicon | Agree with vivo. |
| Samsung | Don’t see the need for such a note.  |
| NTT DOCOMO | We don’t see the need for such a note. |
| CMCC | We are open to add such notes. |

# **Conclusions**

TBD

# **References**

[1] R1-2208727 LS on Per-FS L1 feature for NR sidelink discovery BC-list RAN2, OPPO

[2] R1-2208585 Draft reply LS on Per-FS L1 feature for NR sidelink discovery BC-list vivo

[3] R1-2208809 Discussion on the LS on Per-FS L1 feature for NR sidelink discovery BC-list OPPO

[4] R1-2208810 Draft reply LS on Per-FS L1 feature for NR sidelink discovery BC-list OPPO

[5] R1-2209253 [Draft] Reply LS on Per-FS L1 feature for NR sidelink discovery BC-list xiaomi

[6] R1-2209765 Draft reply LS on Per-FS L1 feature for NR sidelink discovery BC-list ZTE, Sanechips

[7] R1-2209844 Discussion on LS on Per-FS L1 feature for NR sidelink discovery BC-list Huawei, HiSilicon

[8] R1-2209886 Discussion on remaining issues regarding Rel-17 RAN1 UE features topics 1 NTT DOCOMO, INC.

[9] R1-2210120 [Draft] Reply LS on Per-FS L1 feature for NR sidelink discovery BC-list Ericsson

[10] R1-2210235 Draft Reply to RAN2 LS on Per-FS L1 feature for NR sidelink discovery BC-list Qualcomm Incorporated

[11] R1-2209670 Rel-17 UE features topics set #1 Ericsson

[12] R1-2207923 Updated RAN1 UE features list for Rel-17 NR after RAN1 #110 Thursday Moderators (AT&T, NTT DOCOMO, INC.)

[13] R1-2208530 Discussion on UE features for topics 1 ZTE

[14] R1-2208117 Summary#2 on UE features for NR RedCap Moderator (NTT DOCOMO, INC.)