**3GPP TSG-RAN WG2 #124 *R2-230xxxx***

**Xiamen, China, October 2023**

Agenda Item: 7.9.2

Source: OPPO

Title: Summary of [Post123][406][Relay] Local ID in SRAP (OPPO)

Document for: Discussion, Decision

# Introduction

This is for the following email discussion.

* [Post123][406][Relay] Local ID in SRAP (OPPO)

Scope: Discuss the assignment and management of the local ID in U2U relay and its impact on SRAP spec, including:

* FFS issue “FFS impact on SRAP header”, e.g., how to reflect the two local IDs in header format, field length, etc.
* When/how to allocate the local ID to ensure consistency and uniqueness, e.g., the related PC5-RRC procedure/details

Intended outcome: Report to next meeting

Deadline: Long

# Discussion

## FFS impact on SRAP header

We have agreed to use 2 local IDs to identify the source and target remote UE on both hops, and the impact on SRAP header is FFS.

At least for single-hop relay, use local ID instead of L2 ID as UE ID in SRAP header.

At least for single-hop U2U relay, two local IDs are included in SRAP header to identify source and target Remote UE respectively. FFS impact on SRAP header.

For single-hop U2U relay, the local ID for a particular UE is the same on both hops.

In R17 U2N Relay, the UE ID in SRAP header for L2 U2N Remote UE is 8bits.

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| 1. 6.3.2 UE ID   Length: 8 bits.  This field carries local identity of U2N Remote UE. |

The following question is to check companies view on the local ID size for a particular UE (i.e., Source Remote UE or Target Remote UE)

**Q1-1a: Do you think the UE ID size in R17 U2N Relay (i.e., 8 bits) can be reused in R18 U2U Relay for each particular UE (Source/Tagret Remote UE)?**

**1) Yes**

**2) No (Please clarfify the suggested size and why)**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | Yes |  |
| Apple | No | To reduce the signalling overhead, we think 4-bit for each local ID, and 8 bits are enough for a pair of local IDs. This is sufficient to support 16\*15=240 different source-target remote UE pairs, which is sufficient for singe-hop U2U case. So, we suggest to agree with a 4-bit local ID.  This also makes the size of SRAP header in R18 U2U is as same as R17 U2N relay case.  [OPPO] Thanks, just try to understand the benefits of “This also makes the size of SRAP header in R18 U2U is as same as R17 U2N relay case” since we understand with or without the same size header does not make difference on the compatibility since U2U and U2N anyway will use different links/L2 IDs, so will not appear in the same L2 link or LCH. And the UE ID field in U2N and U2U, even if same length, anyway have different meanings and format, i.e., one is 8-bit used to identify one U2N Remote UE, while the other is a pair of 4-bit used to identify 2 U2U Remote UEs. So no need to worry about compatibility issue and they are indeed incompatible even if same length. |
| vivo | Yes | We prefer to just reuse 8-bit which we think is a proper size for a particular UE to avoid collision. |
| Xiaomi | Yes | Reuse R17 format |
| China Telecom | Yes |  |
| Fujitsu | Yes | We prefer to reuse 8-bit. |
| Nokia | No | We agree to Apples point that the overhead reduction and backwards compatibility should be counted in as factors in when determining the size, and that 4 bits should be enough (i.e. 8 in total). In terms of backwards compatibility, “seamless integration” may be a better term, as similar SRAP headers may benefit us in the long run. Given the fact that U2N was concluded to be sufficient with 8 bit support, 2\*4 should be enough also for U2U. |
| LG | Yes | We agree that we don’t need to consider the compatibility with Rel-17 U2N Relay operation. But, considering signalling overhead, we think 8bit local ID (i.e., 4-bit src local ID, 4-bit dst local ID) is enough. |
| Huawei, HiSilicon | Yes (i.e. 8-bit for each end UE, 16 bits for a E2E link) | For clarification, the question is 8-bit UE ID for each end UE, right? (It seems to be interpreted as 8-bit for an end UE pair.....)  For the proposal to use 4-bit for each UE from Apple, we think 4-bit may be too short, considering the maximum number of destinations is 32 since Rel-16. And we also agree with rapporteur’s analysis on compatibility issue. |
| Futurewei | Yes |  |
| CATT | Yes | 8 bits for each remote UE(source or target). |
| ZTE | Yes | Prefer to reuse 8 bits UE ID size for a particular UE. |
| Samsung | Yes | While we agree that compatibility with Rel-17 U2N should not be a determining factor, and we also agree that 4 bits may be enough for the single-hop U2U case, we still feel 8 bits (for each remote UE) is a good choice and will help any future U2U extensions to multiple hops. |
| Qualcomm | Yes | Reuse existing existing local ID size |
| Ericsson | Yes |  |

Besides the local ID, we have also discussed the bearer ID issue in RAN2 #123, which also has impacts on SRAP header, so the following question is to check companies view on the Bearer ID size in R18 U2U Relay UE. In R17 U2N Relay, the Bearer ID in SRAP header is 5bis.

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| 1. 6.3.3 BEARER ID   Length: 5 bits.  This field carries Uu radio bearer identity for U2N Remote UE. |

**Q1-1b: Do you think the Bearer ID size in R17 U2N Relay (i.e., 5 bits) can be reused in R18 U2U Relay?**

**1) Yes**

**2) No (Please clarfify the suggested size and why)**

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| Company | Yes/No | Comment |
| OPPO | Yes |  |
| Apple | Yes |  |
| vivo | No, use the 9-bit *SLRB-PC5-ConfigIndex* configured by PC5 RRC | In previous meetings, there was already conclusions to use SLRB-PC5-ConfigIndex as E2E BEARER ID(although the agreement was initially intended for PDCP security):  RAN2#121bis agreement:   * WA: E2E bearer ID (i.e., configuration index in the list of SLRB configurations) is used as input for the L2 U2U relay ciphering and deciphering at PDCP.   Thus, We prefer to use SLRB-PC5-ConfigIndex as the E2E Bearer ID for U2U relay instead of reusing BEARER ID definition for U2N relay.  And the SLRB-PC5-ConfigIndex has 9 bits as shown below, (a remote UE can have up to 512 SLRBs according to existing RRC specification,i.e., equals to *maxNrofSLRB-r16*).  SLRB-Config-r16::= SEQUENCE {  slrb-PC5-ConfigIndex-r16 SLRB-PC5-ConfigIndex-r16,  sl-SDAP-ConfigPC5-r16 SL-SDAP-ConfigPC5-r16 OPTIONAL, -- Need M  sl-PDCP-ConfigPC5-r16 SL-PDCP-ConfigPC5-r16 OPTIONAL, -- Need M  sl-RLC-ConfigPC5-r16 SL-RLC-ConfigPC5-r16 OPTIONAL, -- Need M  sl-MAC-LogicalChannelConfigPC5-r16 SL-LogicalChannelConfigPC5-r16 OPTIONAL, -- Need M  …  }  SLRB-PC5-ConfigIndex-r16 ::= INTEGER (1..maxNrofSLRB-r16)  maxNrofSLRB-r16 INTEGER ::= 512 -- Maximum number of radio bearer for NR sidelink communication per UE |
| Xiaomi | Yes |  |
| China Telecom | Yes |  |
| ASUSTeK | Yes | Since the header of a SRAP PDU also includes both the Source remote UE ID and the Target remote UE ID, it should be sufficient in terms of SLRB configuration/BEARER differentiation, from remote UE and relay UE’s points of view, to reuse the BEARER ID field of 5 bits. |
| Fujitsu | Yes |  |
| Nokia | Yes | We prefer to reuse structure of U2N SRAP.  Also, in respect to vivo’s concern, our understanding was that the 5 bits taken into account in our LS on the bearer ID for the relay (de)ciphering |
| LG | Yes | We have same view as Nokia. |
| Huawei, HiSilicon | Yes | We also think 5 bits are sufficient.  For vivo’s comment, we understand 9-bit configuration index is for all the unicast links maintained by the UE. So for each unicast link, 5-bit should be ok, that would also be the consumption regarding the security protection as mentioned by Nokia. |
| Futurewei | Yes |  |
| CATT | Yes |  |
| ZTE | Yes | According to TS 33.501 and TS 33.536, the BEARER used as an input parameter to the ciphering algorithm is a 5-bit bearer identity. On the other hand, according to TS 38.321, for SL-SCH, the size of LCID is 6bits, values of 4-19 are used for SL-DRBs and some values (20-55) are reserved. So in R16 SL, the BEARER for ciphering input parameter can be set to 5 LSB of LCID.  Though the value of *SLRB-PC5-ConfigIndex* is up to 512 (maybe for forward compatibility or other considerations for spec alignment), but actually, the SL-DRBs between a UE pair should be not more than 16. Otherwise, the LCIDs for SL-SCH need to be extended. Anyway, the 5bits BEARER ID in SRAP header is enough. |
| Samsung | Yes | Same understanding as ASUSTeK. |
| Qualcomm | Yes |  |
| Ericsson | Yes |  |

## When/how to allocate the local ID to ensure consistency and uniqueness

For the local ID allocation, we have agreed it will be the relay UE to assign the local ID, while for when to assign, there are some contributions

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| R2-2308220 | Proposal 6. Upon establishment of per hop connection, relay UE should assign the UE ID to each remote UE. | Sharp |
| R2-2308220 | Proposal 7. Remote UE should transmit E2E SL-SRB0/1/2 messages with SRAP header including the assigned UE ID. | Sharp |

As implemented in the RRC Running CR of U2U Relay, there is SRAP configuration for the E2E SL-SRBs, which means the local ID has to be allocated before E2E SL-SRBs transmission.

**Q2-1a: Do you agree that local ID should be assigned before E2E SL-SRBs transmission?**

**1) Yes**

**2) No**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | Yes | As stated above, otherwise, E2E SL-SRB message, which contains SRAP layer/header, cannot be transmitted. |
| Apple | Yes with comment | We agreed that SRAP local ID assignment happens before E2E SL-SRB message. But one FFS point is whether the target local ID is also shared with source remote UE in the assignment signalling from the relay UE, and if yes, how this is associated to “target remote” in a AS-layer w/o linking the ID to “User Info ID” defined in ProSe layer.  [OPPO] Just for our better understanding on the FFS point,  1/ for “whether the target local ID is also shared with source remote UE in the assignment signalling”, we understand with the agreement on including both UE IDs in SRAP header this FFS can be resolved. i.e., both the U2U Remote Ues should know the peer UE’s ID to generate the SRAP PDU.  2/ for “how this is associated to “target remote” in a AS-layer w/o linking the ID to “User Info ID” defined in ProSe layer”, we agree that it is a valid FFS point to be considered, so Q2-1b is updated for companies to further discuss, thanks for the comment. |
| Vivo | Yes |  |
| Xiaomi | Yes | Share the concern from Apple. However, in legacy the “local ID” is linked to “L2 ID” so a bit hesitant to link the local ID to user Infor ID. |
| China Telecom | Yes |  |
| ASUSTeK | Yes |  |
| Fujitsu | Yes |  |
| Nokia | Yes |  |
| LG | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Futurewei | Yes |  |
| CATT | Yes | Same concern as Apple for how to associate to “target remote” in a AS-layer w/o linking the ID to “User Info ID”defined in ProSe layer. |
| ZTE | Yes |  |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| Ericsson | Yes |  |

Another issue need to be discussed is what message can be used to indicate the allocated local ID from relay UE to remote UE, if a PC5-RRC signaling is to be used, either a new signalling is to be defined or to reuse the old signalling,

* By reusing the old signalling (e.g., RRCReconfirationSidelink), the pros is we don’t need to define a new signalling, while the cons is RRCReconfirationSidelink is always sent from Tx to Rx UE (in a per-directional manner) but here the local ID configuration is used bi-directional (Relay UE is in control of the SRAP entity configuration of remote UE’s transmission) which seems violates the legacy principle;
* By using new signalling, the pros is no need to worry the legacy principle but another new signalling is to be defined.
* Besides, another dimension to consider is how for remote UE to know which target UE is associated with an assigned local ID, since eventually, remote UE needs to base on User Info (contained in PC5-S signaling) to identify different peer target UE
* if using PC5-RRC signalling to indicate the Local ID, user info needs to be contained in the PC5-RRC signalling
* if using PC5-S signalling to indicate Local ID, local ID need to be contained in PC5-S message.

The following question is to check companies view on the signalling from relay UE to remote UE to indicate the allocated local ID:

**Q2-1b, What is your view on the signalling to be used to indicate the local ID from relay UE to remote UE?**

1. **Option-1: reuse old PC5-RRC signalling (e.g., RRCReonfigurationSidelink);**
2. **Option-2: new PC5-RRC signalling.**
3. **Option-3: PC5-S message**

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| Company | Option | Comment |
| Apple | Option 2 | We prefer a new PC5-RRC signalling and a one-way message is sufficient. If we use RRCReconfigurationSidelink, then the remote UE need send back Complete/Failure message, which is not needed. |
| vivo | Option 1 | It is fine to reuse RRCReconfigurationSidelink so that the local ID configuration can be integrated in the per-hop PC5 link setup phase and spec impact can be minimized. |
| OPPO | Option 3 | Considering there is User Info carried in PC5-S message already, the local ID can be carried by PC5-S signaling, i.e., linked to User Info. E.g., one solution can be, during the per-hop link establishment procedure   1. relay UE to indicate the 2 Local UE IDs in the DCR message at the second hop to target remote UE and 2. indicate the Local UE IDs in the DCA message at the first hop to the source remote UE,   thus the Local ID assignment can be done before E2E signalling transfer.  We can rely on S2 to finally confirm which message to use.  On the other hand, if we use PC5-RRC signaling, it seems a bit hard to include User Info which is essentially an upper layer info (even higher than PC5-S layer) |
| Xiaomi | Option 1 | Even we share the concern from Apple, we still prefer to rely on AS signalling to assign the local ID, i.e., rely on mapping between “L2 ID” and local ID to solve the issue raised by Apple. Please note in the DCR message over the first hop, the L2 ID of the target remote UE is optionally carried. If the L2 ID of source remote UE can be included in the DCR message over the second hop, then relay UE can still link the local ID to L2 ID and rely on PC5-RRC signalling for configuration. |
| China Telecom | Option 1 or 2 | We prefer to use PC5-RRC signalling. Regarding the detail solution, we think both Option 1 or 2 can work. |
| ASUSTeK | Option 3 | We think Option 3 is simpler. |
| Fujitsu | Option 1 | We think the local ID used in AS should be signalled by the AS message. The existing PC5-RRC message can be reused. |
| Nokia | Option 3 or 1 | We think that option 3 may be viable |
| LG | Option 1 | We prefer to use the old RRCReconfigurationSidelink message. Considering signalling overhead and bi-directional configuration for local ID, we think the RRCReconfigurationSidelink and RRCReconfigurationCompleteSidelink messages can include local ID assignments optionally. |
| Huawei, HiSilicon | Option 1 with comments | In general we think local ID should be assigned and maintained by AS layer.  The tricky thing here seems to be whether user info is suitable to be carried in an AS layer message, however, we are wondering whether the local ID has to be linked to User info. In current specification, a unicast link is managed in AS layer based on source/target L2 ID. To extend the same logic to U2U, the E2E L2 ID should be used for E2E unicast link, and to be mapped to each per-hop link based on local ID. In this sense, we think the local ID can be assigned via PC5-RRC message which is associated to **E2E L2 ID** like legacy. |
| Futurewei | Option 1 |  |
| CATT | Option 2 with comments | Q2-1b merge two questions into one which seems a little bit tricky. We suggest to discussing how to solve the local ID association issue (Raised in Q2-1a) firstly, and then discuss which signalling is used to transfer the local ID. Our point is we need to first identify the issue firstly then discuss further signalling details instead of merge them together. |
| ZTE | Option 1 | Both PC5-RRC and PC5-S signalling are feasible to solve this problem. To facilitate the progress, it is suggested to adopt reuse PC5-RRC signalling to solve this issue. |
| Samsung | Option 1 or 2 | We prefer to use PC5-RRC signalling. |
| Qualcomm | Option 1 | Local ID is AS layer ID, should use PC5-RRC. Existing PC5-RRC message is enough, |
| Ericsson | Option 1 |  |

Then for how to allocate the local ID, considering the consistency and uniqueness of the local ID allocation, there are some contributions on this issue

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| --- | --- | --- |
| R2-2307932 | Proposal 12: Even if the single short ID is duplicated at a relay UE, the relay UE can identify the receiving packet based on L2 ID of the MAC layer. | LG Electronics Inc. |
| R2-2308611 | Proposal 7) RAN2 discusses how to assign a unique ID in the path between a pair of source and destination UEs. | ETRI |
| R2-2308104 | Proposal 4. RAN2 to discuss handling of collision in the {SRC UE ID, DST UE ID} pair ID space. | Samsung |

The collision of ID allocation of local ID issue is proposed to be discussed in R2-2308611 and R2-2308104, while in R2-2307932, it is clarified that even if the ID collides, the UE can still identify the packet based on L2 ID of the MAC layer which means there seems no critical issue.

The following question is to check companies view on the uniqueness of the local ID issue:

**Q2-1c: Do you think there is major issue about uniqueness of local remote UE ID?**

**1) No**

**2) Yes (if this option is selected, please clarify what is the major issue, and what is the solution)**

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| --- | --- | --- |
| Company | Option | Comment |
| OPPO | No | Agree with LG’s point that if considering the different L2 ID for different entities, the ID collision issue seems not critical, thus it can be up to relay UE implementation to allocate the local ID to save the further optimization. |
| Apple | No for single-hop case. FFS for multi-hop | We do not see a collision issue as all local IDs are allocated by the same single entity (U2U relay UE). |
| Vivo | No | Agree with the Rapporteur. The local ID uniqueness can be ensured by the relay UE in the U2U network managed by this relay ID. In case when certain node (relay UE/remote UE) is in two single-hop U2U networks, the L2 ID can be used to identify the SRAP PDU in case of collided local ID allocations.  Further, as it was already agreed that both src ID and dst ID are to be included in the SRAP header, the relay UE can perform routing based on both IDs, which means that even when there is one of src ID and dst ID of a SRAP PDU collides with any other remote UE, the UE that has received this SRAP PDU can still perform correct forwarding of a SRAP PDU as a relay UE or determine to deliver the SDU of a received SRAP PDU to its upper layer as a remote UE, based on the non-collided ID within the src ID and dst ID. |
| Xiaomi | No at least for single hop | Can leave to relay UE implementation. When collision is detected by the relay UE, e.g., the ID assigned to the remote UE by relay UE collides with the ID assigned to the relay UE itself (if the relay UE acts a remote UE in another flow), the relay UE can reconfigure the local ID to remote UE. |
| China Telecom | No |  |
| ASUSTeK | No |  |
| Fujitsu | No |  |
| Nokia | No | No, we think that since we agreed to have hop-by-hop assignment of the local ID, and this assignment is done by the relay UE, there should be no major issue. |
| LG | No |  |
| Huawei, HiSilicon | No | We do not see collision issue for the local UE ID pair, however, we would like to check whether the each local ID is assigned once for the per-hop link, or local ID is to be assigned for each E2E link. |
| Futurewei | No |  |
| CATT | No |  |
| ZTE | No for single-hop case. FFS for multi-hop | For single-hop case, all local IDs for the UE pairs the relay UE served are allocated by the relay UE, the relay UE can ensure the local ID uniqueness. However, for multi-hop case, it is not clear how/which node/relay UE to allocate the local IDs, so the collision issue may happen. |
| Samsung | No | FFS for multi-hop (i.e. future Releases), so same view as Apple. |
| Qualcomm | No for single hop |  |
| Ericsson | No |  |

## Others

**Q3: Besides the above questions, do you think there are other issues on Local ID to be discussed in this offline?**

**1) No**

**2) Yes (if this option is selected, please add the issues in the table)**

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| Company | Option | Issues to be discussed |
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1. Xxx.

# Conclusion

We have the following proposals:

[Proposal 1 Xxx.](#_Toc144133462)

# Reference

1. R2-2307233 Discussion on U2U relay OPPO discussion Rel-18 NR\_SL\_relay\_enh-Core
2. R2-2307386 Discussion on remaining issue of U2U relay NEC discussion Rel-18 NR\_SL\_relay\_enh-Core
3. R2-2307402 Discussion on the adaptation layer Fujitsu discussion Rel-18 NR\_SL\_relay\_enh-Core
4. R2-2308952 Discussion on U2U relay Sharp discussion Rel-18 NR\_SL\_relay\_enh-Core
5. R2-2307548 Discussion on the remaining issues of L2 U2U relaying vivo discussion
6. R2-2307551 Discussion on U2U Relay CATT discussion Rel-18 NR\_SL\_relay\_enh-Core
7. R2-2307641 U2U Relay selection reselection, SRAP design Beijing Xiaomi Mobile Software discussion Rel-18 NR\_SL\_relay\_enh-Core
8. R2-2307655 Discussion on using short ID in U2U relaying Fraunhofer IIS, Fraunhofer HHI discussion Rel-18 NR\_SL\_relay\_enh
9. R2-2307716 Discussion on U2U relay TCL discussion
10. R2-2307732 QoS and bearer configuration for L2 U2U relaying Samsung discussion Rel-18 NR\_SL\_relay\_enh-Core
11. R2-2307742 Common part and Layer-2 specific part on U2U Relay Qualcomm Incorporated discussion NR\_SL\_relay\_enh-Core
12. R2-2307743 gNB involvement and capability on U2U relay Qualcomm Incorporated discussion NR\_SL\_relay\_enh-Core
13. R2-2307750 Considerations for U2U L2 relay operations Kyocera discussion Rel-18
14. R2-2307855 Discussion on remaining issues on UE-to-UE Relay Apple discussion Rel-18
15. R2-2307932 Control plane procedure for U2U relay LG Electronics Inc. discussion Rel-18 NR\_SL\_relay\_enh-Core
16. R2-2307944 Further discussion on L2 U2U relay China Telecom discussion Rel-18 NR\_SL\_relay\_enh-Core
17. R2-2307989 Discussion on L2 U2U relay Lenovo discussion Rel-18
18. R2-2308101 Discussion on U2U relay L2-specific functionality ZTE, Sanechips discussion Rel-18 NR\_SL\_relay\_enh-Core
19. R2-2308104 SRAP design for U2U Sidelink Relay Samsung discussion
20. R2-2308119 Discussion on UE-to-UE Relay Spreadtrum Communications discussion Rel-18
21. R2-2308205 Discussion on UE-to-UE relay Huawei, HiSilicon discussion Rel-18 NR\_SL\_relay\_enh-Core
22. R2-2308220 Remaining issues for UE-to-UE relay Sharp discussion Rel-18 NR\_SL\_relay\_enh-Core
23. R2-2308321 Discussion on U2U relay CMCC discussion Rel-18 NR\_SL\_relay\_enh-Core
24. R2-2308368 Considerations on U2U relay (re)selection and Local ID assignment Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_SL\_relay\_enh-Core R2-2305590
25. R2-2308380 Open Issues on Discovery, Relay Selection, and SRAP for UE to UE Relays InterDigital discussion Rel-18 NR\_SL\_relay\_enh-Core
26. R2-2308381 QoS and Configuration for L2 UE-to-UE Relays InterDigital discussion Rel-18 NR\_SL\_relay\_enh-Core
27. R2-2308470 Control Plane Procedures for Layer 2 UE-to-UE Relays Ericsson España S.A. discussion Rel-18
28. R2-2308611 Discussion on Adaptation Layer for L2 U2U Relay ETRI discussion Rel-18 NR\_SL\_relay\_enh-Core
29. R2-2308721 Discussion on E2E PC5-RRC procedures ASUSTeK discussion Rel-18 NR\_SL\_relay\_enh-Core
30. R2-2308722 Discussion on AS layer configuration for L2 U2U Relay ASUSTeK discussion Rel-18 NR\_SL\_relay\_enh-Core