3GPP TSG-RAN WG3 #114-e draft R3-215895

Nov. 1~11, 2021

**Online**

**Agenda item: 24.4 (Others)**

**Source: Samsung (moderator)**

**Title: Summary of offline discussion on CB: # SDT3\_others**

**Document for: Approval**

# Introduction

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| **CB: # SDT3\_others**  **- How to change SDT to non-SDT during SDT period?**  **- RRC Reconfiguration during SDT session?**  **- LS to RAN2?**  (Samsung - moderator)  Summary of offline disc [R3-215895](D:\\3GPPmeeting\\202111 RAN3 114e\\TSGR3_114-e\\Inbox\\Drafts\\CB # SDT3_others\\Inbox\\R3-215895.zip) |

This e-mail discussion is divided into two phases:

* Phase I: View collection

Deadline: Friday, Nov. 5th, 2021, 6:00 UTC.

* Phase II:

Deadline: TBD

# For the Chairman’s Notes

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# Discussions

## Switch from SDT to non-SDT

* Common understanding for switch from SDT to non-SDT

Before discussing RAN3 impact, the clarification to the following RAN2 agreements should be carried out first:

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| UE switches from SDT to non-SDT in following cases:  - Case 1 (27/0): UE receive indication from network to switch to non-SDT procedure.  - Network can send RRCResume. FFS whether network can send indication in RAR/fallbackRAR/DCI to switch to non-SDT procedure.  - FFS Case 2 (18/9): Initial UL transmission (in msgA/Msg3/CG resources) fails configured number of times |

This agreement indicates that

* RRCResume message can be used to indicate the switch from SDT to non-SDT, i.e., during SDT session, if RRCResume message is received, the UE can enter into CONNECTED status, and start the non-SDT data transmission;

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| No new solution is defined to prevent data loss or duplication for the scenario where the anchor relocation is required in the middle of an SDT session, i.e. network can release UE back into RRC\_INACTIVE  Switching from SDT to non-SDT via RAR/fallbackRAR/DCI sent by network is not supported for RA-SDT |

The above agreements indicate:

* In the middle of SDT session, the network can send UE to RRC\_INACTIVE status first by sending RRCRelease message, and then another RRC Resume procedure is triggered for anchor relocation. Since the anchor relocation may be triggered for non-SDT data arrival, the agreement implicitly indicates that for switch from SDT to non-SDT, the network can send RRCRelease message first, and then another RRC Resume procedure is triggered.

Based on the above analysis to RAN2 agreement, [1] give the following observations:

*Observation: RAN2 agreements indicate that the anchor relocation for switch from SDT to non-SDT can be achieved either during SDT session by sending RRCResume message or after ending SDT session by sending RRCRelease message.*

This observation is the basis for the following discussion. Thus, the moderator believes it is beneficial to align the understanding among companies first.

**Proposal 1: the switch from SDT to non-SDT can be achieved by two following ways:**

* **Way 1: sending RRCResume message during SDT session**
* **Way 2: sending RRCRelease message to end SDT session first, and then another RRC Resume procedure is triggered for anchor relocation**

##### **Q1: Can companies take the above Proposal 1 as the common understanding for switch from SDT to non-SDT? If there are other ways in your mind, please also raise it out here.**

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| Company | Yes/No | Comments |
| Samsung | Yes |  |
| ZTE | Partial agree | According to the RAN2 progress,  In case of SDT with anchor relocation, Way 1 and Way 2 can be used.  In case of SDT without anchor relocation, Way 2 can be used, but the Way 1 cannot be used. |
| Intel Corporation | Yes or No | ZTE's understanding is correct. |
| CATT | See comments | For SDT with anchor relocation, the new serving gNB could decide whether to switch from SDT to non-SDT, way 1 is the most straightforward way.  For SDT without anchor relocation, way 2 could be applied. To support way 1, it might require some enhancement to Xn procedures, e.g. relocate the full UE context to the receiving gNB. |
| LGE | Partially agree | In case of SDT with anchor relocation, the new gNB (other than the anchor gNB) already becomes the new serving gNB because it receives the UE context from anchor gNB by Retrieve UE Context procedure. Therefore, the new gNB can send *RRCResume* message to enter the UE into RRC\_CONNECTED state. That is, Way 1 should be supported. But, for Way 2, we think that there is no need to re-initiate another RRC Resume procedure because the new gNB can send *RRCResume* message to UE as in Way 1.  In case of SDT without anchor relocation, Way 2 should be applied based on RAN2 agreement. |
| Huawei | Partial agree | Same view as ZTE. |
| E/// | See comments | Way 1 is under discussion in RAN2. It is not simply whether the generation of second RRCResume message is allowed by UE, somehow more open points remain, for example, RRCResume cause, security context updates. Way 2 is possible, i.e., initiating another RRCResume after the previous terminates. |
| Nokia | Partial agree | Way 1 for SDT with anchor relocation. Way 2 for SDT w/o anchor relocation. Way 1 for SDT w/o anchor relocation FFS. |

It seems that both [1] and [2] carry out the discussion based on the **Proposal 1**. In the following, the discussion will be carried out by considering the above two ways, separately.

* Way 1: sending RRCResume message during SDT session

For this way, some cases are considered in [1] and [2]. Since the DL/UL non-SDT data arrival is possible, the following two cases can be taken into account:

* + Case 1: DL/UL non-SDT data arrival during SDT session, where anchor is relocated for RA-SDT or CG-SDT is carried out.

In this case, the DL non-SDT data arrives at the serving gNB, or UL non-SDT data arrives the UE, and notifying gNB.

* + Case 2: DL/UL non-SDT data arrival when anchor is not relocated for RA-SDT (RETRIEVE UE CONTEXT REQUEST message is received)

The moderator understands that such case indicates the anchor gNB already receives RETRIEVE UE CONTEXT REQUEST message due to SDT. However, the anchor is not relocated, and the SDT context may/may not be sent to the serving gNB.

##### **Q2: Which of the following two cases can be applicable for Way 1 (i.e., sending RRCResume message during SDT session)?**

* + **Case 1: DL/UL non-SDT data arrival during SDT session, where anchor is relocated for RA-SDT or CG-SDT is carried out**
  + **Case 2: DL/UL non-SDT data arrival when anchor is not relocated for RA-SDT (RETRIEVE UE CONTEXT REQUEST message is received)**

**If there are other cases in your mind, please also raise it out here.**

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| Company | Comments |
| Samsung | Case 1 is applicable for Way 1 since RRCResume message is generated by the serving gNB after context relocation. Moreover, it can reduce the delay for the UE to enter RRC CONNECTED status.  For case 2, technically, it is possible for Way 1 as well. However, in this case, how to generate RRCResume message needs further discussion. It may introduce more specification impact. Thus, we are open for discussion on case 2 for Way 1 at this moment.  **In summary, we prefer to apply Way 1 in Case 1.** |
| ZTE | According to RAN2 progress, Way 1 can only be used in Case 1. |
| Intel Corporation | ZTE's understanding is correct. |
| CATT | Way 1 could be applied to case 1.  For case 2,   * **Case 2.1** If the anchor decides to do the switch when it receives the RETRIEVE UE CONTEXT REQUEST message (the UE context has not been transferred to the receiving gNB), it could relocate the full UE context as usual, the new gNB may resume the RRC connection. Way 1 could also be applied.   **Case 2.2** If the anchor decides to do the switch when the SDT transmission is ongoing, e.g. non anchor relocation has been decided for SDT (full or partial UE context has been transferred to the new gNB). Support of way 1 would need extra design in the Xn interface. |
| LGE | Same view with ZTE |
| Huawei | Way 1 can only be used in Case 1.  But for case 2, in case of DL non-SDT arrival at the anchor gNB side, the anchor gNB shall trigger anchor relocation, then case 2 becomes case1. For UL non-SDT arrival, pending to RAN2 discussion. |
| E/// | As mentioned in Q1, it is too early to discuss the cases for Way 1 without clear conclusion like new RACH for non-SDT and so on. Especially Case 1 should be postponed. Once there is conclusion in RAN2, RAN3 is open to discuss. |
| Nokia | Case 1 for Way 1 at the moment. |

For case 1, it seems that no RAN3 impact can be foreseen since the serving gNB already has all UE context, and it can send the RRCResume message to the UE once DL/UL non-SDT data arrives.

For case 2, [1] and [2] indicate some potential RAN3 impact. For example,

* + *RRCResume message generation*: In [1], for above case 2, the RRCResume message is generated by serving gNB, while the PDCP PDU containing such message should be generated in anchor gNB. Thus, the interaction for RRCResume message is needed between the serving gNB and anchor gNB
  + *Non-SDT UL data arrival indication from serving gNB to anchor gNB*: in [1], if UL non-SDT data arrives at the UE, the UE will notify the serving gNB, and then, the serving gNB will inform the anchor gNB in order to trigger the anchor relocation.
  + *Non-SDT DL data arrival indication from anchor gNB to serving gNB*: In [2], for above case 2, the non-SDT DL data arrival indication should be sent to the serving gNB via RETRIEVE UE CONTEXT RESPONSE message in order to help serving gNB send RRCResume message to the UE

##### **Q3: Please companies indicate the potential impacts to RAN3 if the above Way 1 is supported by considering Case 1/Case 2. The above mentioned impacts can be taken into account. If other impacts or no impact are identified, please also indicate here.**

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| Company | Comments |
| Samsung | For case 1, no additional impact is identified.  For case 2, enhancement to RRCResume message generation is needed, and the 2nd impact is also needed since the indication of non-SDT data arrival can trigger the UE context relocation from anchor gNB to serving gNB. The 3rd impact may need further discussion. It can be observed that for case 2, if RRCResume message is used, the specification is large. So, it is better to use Way 2 for case 2. |
| ZTE | We shall following RAN2’s progress. Then Way 1 cannot be used in Case 2. |
| Intel Corporation | ZTE's understanding is correct. |
| CATT | For case 1, way 1 could be applied without additional impact to RAN3.  Even if we want to apply way 1 for case 2, we assume the anchor should be allocated for non-SDT transmission, and the *RRCResume message generation* and corresponding PDCP encapsulation should be done in the new gNB.  For case 2, we could split it to two sub-cases (case 2.1 and 2.2 in CATT’s comments for Q2),   * For case 2.1, legacy anchor relocation could be applied, the new gNB could resume the RRC connection for non-SDT transmission. No additional impact to RAN3. * For case 2.2, pending to the design of the overall signalling flow for SDT, e.g. partial or full UE context is transferred for SDT, how to relocate the anchor for non-SDT transmission is needed. Xn impact is unavoidable. |
| LGE | Same view with ZTE |
| Huawei | For case 1, no RAN3 impact foreseen.  For case 2, the 1st impact has already been ruled out by RAN2, the 2nd impact can wait for RAN2 progress. The 3rd impact seems to be a not essential optimization, as the downlink data would be forwarded to the serving gNB, then serving gNB can identify the non-SDT data arrival. |
| E/// | It seems a bit early to discuss any potential enhancement before RAN2 reaches a stable conclusion. |
| Nokia | Way 1 on case 1: no RAN3 impact  Way 1 on case 2: RAN3 impacts if it happens (FFS). |

* Way 2: sending RRCRelease message to end SDT session first, and then another RRC Resume procedure is triggered

Similar to Way 1, the same cases can be considered. Thus, the moderator raises the same question for Way 2.

##### **Q4: Which of the following two cases can be applicable for Way 2 (i.e., sending RRCRelease message to end SDT session first, and then another RRC Resume procedure is triggered)?**

* + **Case 1: DL/UL non-SDT data arrival during SDT session, where anchor is relocated for RA-SDT or CG-SDT is carried out**
  + **Case 2: DL/UL non-SDT data arrival when anchor is not relocated for RA-SDT (RETRIEVE UE CONTEXT REQUEST message is received)**

**If there are other cases in your mind, please also raise it out here.**

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| Company | Comments |
| Samsung | For case 1, compared to Way 1, Way 2 introduces more delay to resume UE to the CONNECTED status. Since Way 2 results in large delay and Way 1 has no specification impact, it is better to not apply Way 2 for case 1.  For case 2, compared to Way 1, Way 2 has less specification impact although some delays are introduced.  **Thus, we prefer to apply Way 2 for Case 2.** |
| ZTE | According to RAN2 progress, Way 2 can be used in Case 2 for DL/UL non-SDT data coming.  However, to be clarification, Way 2 can also be used be Case 1/2 when no SDT data coming. |
| Intel Corporation | There are several ways for different cases that I started to feel I am lost.  Anyway, we think ZTE's understanding is correct and aligned with RAN2. |
| CATT | Share the view with Samsung. |
| LGE | Case 1 and case 2 are unclear to us.  If the new gNB (other than the anchor gNB) already receives the UE context from the anchor gNB based on Retrieve UE Context procedure, we think that there is no need to re-initiate another RRC Resume procedure because the new gNB can send *RRCResume* message to UE as in Way 1.  For case 2, Way 2 should be supported based on RAN2 agreements. |
| Huawei | For case 1, up to the new anchor (serving) gNB implementation.  For case 2, way 2 has to be used. RAN2 agreed that way 2 can be used upon the UL non-SDT data arrival in case of w.o anchor relocation the data has been forwarded to the anchor gNB. And in our view that upon DL non-SDT data arrival, the anchor gNB can apply the same handling. |
| E/// | Both cases are possible in Way 2. |
| Nokia | Way 2 can be used in both cases. |

Both [1] and [2] discuss two options to trigger the RRC Resume procedures, and the related impacts are list as below:

* + Option 1: triggered by RAN paging
* *SDT UE identification in RAN paging message*: in [1], in case of DL non-SDT data arrival, the anchor gNB can send the RAN paging message to the serving gNB. In this message, the UE identity information should be contained to help the serving gNB identify that the paged UE is the one with ongoing SDT session so that the serving gNB can send RRCRelease to the UE first, and then send the Paging message.
* *UL non-SDT data arrival notification to anchor gNB*: in case of UL non-SDT data arrival, the UE should inform this to serving gNB, and then serving gNB can send the RRCRelease message to the UE to stop SDT session; meanwhile, the serving gNB can notify the anchor gNB the arrival of non-SDT. After that, the anchor gNB can send the RAN paging message to serving gNB.
  + Option 2: triggered by RRCRelease message

In this option, both [1] and [2] indicate that the RRCRelease message may need enhancement to add non-SDT data arrival indication, which needs RAN2 involvement. Meanwhile, [1] mentions the following potential impacts:

* *UL non-SDT data arrival notification to anchor gNB*: for UL non-SDT data arrival, the serving gNB should send non-SDT data arrival indication to anchor gNB to help it generate the new RRCRelease message;
* *RRCRelease message overwriting*: for DL non-SDT data arrival, the anchor gNB should update the RRCRelease message at the serving gNB side.

It can be observed that, both options have some impacts to RAN3. Thus, the moderator would like collect views for the potential impact to RAN3 if Way 2 is applied.

##### **Q5: Please companies indicate the potential impacts to RAN3 if the above Way 2 is supported by considering Case 1/Case 2.**

* + **Which option is preferred to support Way 2?**
  + **The impacts mentioned in [1] and [2] can be taken into account.**

**If other impacts or no impact are identified, please also indicate here.**

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| Company | Comments |
| Samsung | It can be observed that Option 1 is pure RAN3 solution, while option 2 needs RAN2 impact on RRCRelease message. In this sense, **we slightly prefer to Option 1**, and the above two impacts should be considered, i.e., *SDT UE identification in RAN paging message* and *UL non-SDT data arrival notification to anchor gNB*. |
| ZTE | For Case 1 (i.e., SDT with anchor relocation), Way 1 is suitable, i.e., anchor node sends the RRC Resume to UE directly, does not need to send RRC Release to UE.  For Case 2 (i.e. SDT without anchor relocation), we prefer option 2, due to avoiding paging. |
| Intel Corporation | Now I started to feel this is RAN2 discussion (not RAN3).. |
| CATT | For case 1, the new anchor gNB could send RRCResume to UE directly, without paging or RRCRelease.  For case 2, no need to trigger the Paging procedure, option 2 is preferred. |
| LGE | Basically, this is related to RAN2 discussion.  At least, we prefer Option 2 to support the DL non-SDT data arrival. |
| Huawei | We prefer option 2 as well, due to avoiding paging. |
| E/// | Feel the same as Intel. |
| Nokia | Assuming case 2, option 2 seems simpler. |

## Reconfiguration during SDT session

Contribution [1] raises two clarification points for RAN2 agreements:

* RRC Reconfiguration during SDT session

This clarification is based on the following RAN2 working assumption, which indicates that the SRB1/SRB2 RRC message can be transmitted during small data transmission.

***Working assumption***

1. *Support configuring of SRB1 and SRB2 for small data transmission for carrying RRC and NAS messages.*
2. *Upon initiating RRC Resume procedure for SDT initiation (i.e. for first SDT transmission), the UE shall also resume SRB2 that is configured for SDT, in addition to SDT DRBs that are configured for SDT*
3. *RAN2 recommends to include SRB2 in WID*

As a result, RRCReconfiguration message towards UE may be allowed to revise the configurations for SDT bearers during SDT session in the following cases:

* + Case 1: Configuration update in case of RA-SDT without context relocation
  + Case 2: Configuration update in case of RA-SDT with context relocation
  + Case 3: Configuration update in case of CG-SDT

Case 2&3 may not cause problem since the serving gNB can directly send the RRCReconfiguration message to the UE under SDT session. However, for case 1, the content of RRCReconfiguration message is generated by the serving gNB, while the PDCP PDU of this message is generated by the anchor gNB. Thus, RAN3 impact, i.e., the interaction between anchor gNB and serving gNB, can be foreseen. Before discussion in RAN3, some clarifications to the RAN2 agreements may be needed.

##### **Q6: Can companies share the following understanding?**

* + **RRCReconfiguration message towards UE is allowed to revise the configurations of the UE during SDT session.**

**If not, do company agree to send an LS to RAN2 for clarification?**

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| Company | Yes/No | Comments |
| Samsung | Yes | The above WA in RAN2 allows SRB1/SRB2 transmission during SDT session.  Meanwhile, we also think it is beneficial to send an LS to RAN2 for clarification. |
| ZTE | Yes | For case 1, XnAP: RRC transfer message can be used with enhancement.  LS to RAN2 is not needed. |
| Intel Corporation |  | Not sure whether this is right to discuss and agree in RAN3.. |
| CATT | See comments | My understanding is the WA of RAN2 just means the SRB1/SRB2 transmission during SDT session is allowed, not mentioned if RRCReconfiguration message could be sent to UE to revise the configuration.  LS is not necessary. |
| LGE |  | Similar view with CATT.  Our understanding is that RAN2 agreement does not mean that *RRCReconfiguration* message towards UE is allowed to revise the configurations of the UE during SDT session.  LS to RAN2 is not needed. |
| Huawei | No, and no LS | RAN2 scope, should be discussed in RAN2 directly. |
| E/// | See comments | How to support SRB is being discussed in another SDT email thread. Furthermore, RAN2 is also busy working on a list of issues, we can keep the question in our pocket for now 😊 |
| Nokia | FFS | Need to clarify first about use of RRC reconfiguration in this case. |

* Configured Grant reconfiguration in serving cell

Till now, RAN2 reaches the following agreements w.r.t. the configured grant configuration

1. The configuration of configured grant resource for UE small data transmission is valid only in the same serving cell. FFS for other CG validity criteria (e.g. timer, UL/SUL aspect, etc)
2. CG-SDT resource configuration is provided to UEs in RRC\_Connected only within the RRCRelease message, i.e. no need to also include it in RRCReconfiguration message
3. RRCRelease message is used to reconfigure or release the CG-SDT resources while UE is in RRC\_INACTIVE
4. RAN2 design assumes that RRCRelease message is sent at the end to terminate the SDT procedure from RRC point of view. The RRCRelease sent at the end of the SDT may contain the CG resource (as per previous agreement). Write an LS to SA3 to explain SDT procedure and agreement.
5. UE should release CG-SDT resource (if stored) when UE initiates RRC resume procedure from another cell which is different from the cell in which the RRCRelease is received.

From the above agreements, [1] gives the following observations:

* The configured grant configuration is only included in RRCRelease message and it is only valid when the UE is in the cell where the RRCRelease message with Configured Grant configuration is received
* The RRCRelease message can be used to reconfigure the configured grant configuration.

It seems that if an UE in INACTIVE status moves to a new cell to carry out SDT session, the RRCRelease message from such new cell can contain configured grant configuration of such cell. If this is the correct understanding, RAN3 impact can be foreseen. In particular, the configured grant configuration is generated at the new serving gNB, while the RRCRelease message is sent by the anchor gNB; so, the interaction between anchor gNB and serving gNB is needed. Before discussion in RAN3, some clarifications to the RAN2 agreements may be needed.

##### **Q7: Can companies share the following understanding?**

* + **RRCRelease message received in the new serving cell (different from the one when UE enters into INACTIVE status) can contain the Configured Grant configuration of such new cell.**

**If not, do company agree to send an LS to RAN2 for clarification?**

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| Company | Yes/No | Comments |
| Samsung | Yes | According to “RRCRelease message is used to reconfigure or release the CG-SDT resources while UE is in RRC\_INACTIVE”, RAN2 does not preclude to use RRCRelease message to reconfigure the configured grant; moreover, it does not limit the cell where the RRCRelease message is received. In case of SDT session, the RRCRelease message may be received from the new serving cell. Thus, RAN2 agreements do not preclude the case where the new serving cell sends RRCRelease message to reconfigure configured grant.  Meanwhile, we also think it is beneficial to send an LS to RAN2 for clarification. |
| ZTE |  | I do not think the LS is needed. Because CG-SDT can be used in the same cell (CG resource can only be valid when UE kept in the same cell), so the old gNB will not apply allocate CG resource via RRCRelease message. |
| Intel Corporation | No | Regarding "*In particular, the configured grant configuration is generated at the new serving gNB, while the RRCRelease message is sent by the anchor gNB; so, the interaction between anchor gNB and serving gNB is needed.*"  Not sure based on what grounds, new gNB can decide CG-SDT, for which the old gNB (last serving gNB) decides what to do and generates *RRCRelease* message*.*  If the old gNB decides CG-SDT, then it can of course include related configuration into the *RRCRelease* generated. |
| CATT | Yes, but | We understand the CG-SDT resources is cell specific, it could only be assigned by the anchor gNB.  For SDT with anchor relocation, the new gNB could configure the CG-SDT resource to UE in RRCRelease when the SDT session is end.  For SDT without anchor relocation, RRCRelease is generated in the old anchor, coordination of CG-SDT resource between the gNBs is required, which has some impact to Xn interface, not essential to support this.  LS is not needed. |
| LGE | No | For the case where the UE accesses a new gNB other than the anchor gNB, we think that if the anchor gNB decides that the CG-SDT resource needs to be configured for the UE, it should forward the UE context to the new gNB, and then the new gNB should become the new serving gNB. Then, new serving gNB can configure the CG-SDT resource to the UE. |
| Huawei | No, but | In case of w.o anchor relocation:  - If the serving gNB share the same CU with the anchor gNB, then serving gNB-DU can provide the CG-SDT configuration to the CU, and it is included in the RRCRelease message to UE.  - Otherwise, it is not expected to provide the CG-SDT configuration in the serving gNB to UE because this would bring complicated UE context management, which is involved by the anchor gNB and the serving gNB when UE moves to another serving gNB. |
| E/// | See comments | I think we are talking about a new scenario, i.e., cell reselection during SDT, which is not yet confirmed in RAN2. In addition, we mentioned such in R3-215279 with potential UE context lost. Though we prefer to wait patiently. |
| Nokia | No but | We can clarify the scenario but in our understanding CG SDT is typically used for quasi-stationary UEs which are unlikely to drift away in a configuration without anchor relocation. This looks corner case. |

## Others

##### **Q8: Please provide the comments if anything is missing above.**

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| Company | Comments |
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# Conclusion, Recommendations [if needed]

If needed

# References

[1] [R3-214884](file:///D:\Work\3GPP\RAN3\RAN3%23113e(202108)\Inbox\CB%20%23%201303_IAB_Red_Serv_Inter\Docs\R3-213132.zip) Discussion on other issues related to SDT (Samsung)

[2] R3-215321 DL non-SDT data and signalling arrival during SDT procedure (Lenovo, Motorola Mobility)