**3GPP TSG-RAN2 Meeting #113-e R2-2102075**

**e-Meeting, 25 Jan - 05 Feb, 2021**

**Source: email discussion Rapporteur (ZTE Corporation)**

**Title: Offline 509 on SDT control plane and CBs**

**Agenda item:** **8.6.3**

**Document for:** **Discussion and Decision**

# Introduction

This document is the report of the following email discussion:

* [AT113-e][509][SData] Control Plane and CBs (ZTE)

**Scope:**

1. Further discussion on pending proposals (and those marked for CB) for email discussion R2-2101162

Tdoc summary and identification of possible proposals to agree/discuss for these topics

2. Discussion on Handling of non-SDT

When non-SDT bearers are resumed

- when SDT is initiated

- only upon RRC resume by UE

What to do when non-SDT arrive and DRBs are suspended

- trigger legacy RRC resume procedure

- introduce a MAC indication to indicate non-SDT arrival

2. Whether we use RRC Resume or new RRC message/indication of SDT?

3. How to handle RRC release for subsequent data – sending a release before SDT phase or RRCRelease at the end of the SDT phase.

**Intended outcome:**

* + - Agreeable proposals

**Deadline for providing comments:**

* + - Companies comments/inputs – Feb. 1st 17:00 UTC
    - Proposals by rapporteur – Feb. 2nd

# Discussion

## RRCResume or new message with SDT indication

The following agreement was reached at RAN2#112e:

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| As a baseline, the RACH resource i.e. (RO+preamble combination) is different between SDT and non-SDT  - If ROs for SDT and non SDT are different, preamble partitioning between SDT and non SDT is not needed.  - If ROs for SDT and non SDT are same, preamble partitioning is needed |

Based on the above agreement, the network will know about the SDT cause after receiving msg1. This also means that the CCCH message would be the same for both SDT and non-SDT.

However some companies have said that supporting other options may be disussed further. Specifically, the following were mentioned in the tdocs:

* Option 1: Some companies said that we could just stick with this agreed baseline:
  + This option means that already at MSG1 level the network will know the SDT cause (and hence no new CCCH message or cause is needed further down the protocol)
  + E.g: (R2-2100141, P4)
* Option 2: Other companies mentioned that we could also allow common RACH pool in addition but with a new cause:
  + Then, this requires either a new cause in the CCCH message (R2-2100367, P2), (R2-2101369, P1) or it requires a new CCCH message to identify the SDT cause
* Option 3: Whilst there are also proposals that the CCCH message could remain the same even if we support common pool
  + E.g: (R2-2100367, P1), (R2-2101204, P2)
  + the assumption is that either the MSG3/MSGA grant size will accommodate BSR (which will indicate the SDT cause) when common resource pool is used or that a new logical channel ID is used for the CCCH message

The advantage of option 1 (i.e. the current baseline) is that the CCCH message will be common regardless of whether or not SDT or non-SDT is selected down the line (e.g. in MAC – see the discussion in section 2.4), but requires that the network can provide the resource separation (i.e. preamble + PO combination is different).

Option 3 also has similar advantages as option 1, but this comes with the requirement that the MSG3/MSGA payload size needs to accommodate at least the BSR (i.e. this has implications on coverage) – but this has no restriction on the network to provide separate preamble+PO resource pool as per option 1 or a new LCID for CCCH is needed.

Option 2 on the otherhand might require new cause in the CCCH message and will require additional complexity and interaction between RRC and MAC in case switching/fallback to non-SDT happens in MAC. Further, the available space in the CCCH message is quite limited and reusing the code points or adding bits in this message seems to come with additional complexity/cost.

Based on the above, it seems the current baseline could be sufficient perhaps?

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| Q1: Do companies agree that option 1 is sufficient? | | |
| Company | Y/N | Comments (if answer is No then please explain why other options are essential) |
| Nokia, Nokia Shanghai Bell | No | We don’t agree with rapporteur’s understanding that the CCCH message would be the same for both SDT and non-SDT, this has not been agreed.  We don’t agree with rapporteur’s consideration of complexity for Option 2 and it does neither require any cause in the CCCH message.  With subsequent SDT agreed, common RACH pool would seem beneficial to allow NW not to always configure SDT specific RACH resources – this would increase the possibilities to use the whole feature.  Furthermore, we don’t fully understand why Msg1 indication means same CCCH message for SDT and non-SDT. |
| OPPO | Y | Option1 can be taken as baseline. |
| ZTE | Y | We think option 1 is sufficient.  For the option 2, we think this option implies different CCCH message (or different content of CCCH message) will be used to distinguish SDT and Non-SDT. Considering the size of CCCH message is sensitive for coverage and the codepoints in CCCH is quite precious which should be reserved for future use case, we want to keep the CCCH message the same for both SDT and Non-SDT, thus the option 2 is not preferable to us.  Option 3 is acceptable if the contents of CCCH can be kept the same as the CCCH for normal RRCResumeReq (i.e. either different LCID is used or BSR is included). Considering extra complexity will be required, we prefer not to have this. However, we can live with this if the majority of companies also want to support option 3. |
| LG | Postpone | It is difficult to say now whether Option 1 is sufficient or not. Anyway, there is a baseline, and RAN2 can progress the work based on the baseline. |
| ASUSTeK | Y | Since the RACH resource is different between SDT and non-SDT (i.e. shared RO with preamble partition and/or seperated RO without preamble partition), the network can distinguish the SDT and non-SDT at MSG1 level. |

## Timing of the RRCRelease message

There are two possible options for the RRCRelease message:

* Option 1: RRCRelease message to be sent at the end of the subsequent data transfer:
  + E.g: (R2-2100366, P4); (R2-2101161, P4); (R2-2100283, P2)
* Option 2: RRCRelease message in the beginning before the subsequent data transfer:
  + E.g: (R2-2100139, P11)

In general, it seems option 1 is supported by the majority of companies.

R2-2100139 mentions that the RRCRelease like message may be needed upfront for network authentication.

However, even if an RRC message is sent (by the genuine network) up front, there is no guarantee that the subsequent messages on the user plane are also from an authentic network (the only way to guarantee this would be to have DRB IP, which of course can be configured for SDT if needed). So, it seems sending an RRC message by itself is not really necessary. Of course we can send an LS to SA3 to confirm the overall procedure with them from security perspective.

Based on the above, it seems option 1 is okay:

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| Q2: Do companies agree that option 1 (i.e. RRCRelease at the end of the SDT phase including subsequent data transfer) can be assumed as the baseline from RAN2 perspective? | | |
| Company | Y/N | Comments (if answer is No then please explain why option 2 is essential) |
| Nokia, Nokia Shanghai Bell | Y, but | We agree to send RRCRelease at the end of the procedure but we don’t understand what “i.e. RRCRelease at the end of the SDT phase including subsequent data transfer” means.  Rapporteur Clarification:  Option 1 means that RRCRelease is at the end of the overall procedure. i.e. if there is subsequent data, then first this subsequent data phase is finished and than the network sends RRCRelease (and the UE will go back to INACTIVE/IDLE upon receiving the RRCRelease).  Option 2: Requires the network to send an integrity protected message in DL (e.g. RRCRelease) first and then after this RRC message is sent, then DL DRB data is sent (e.g. for the subsequent data transmission). It seems the assumption of the proponents is that with this option there will be a timer started after this RRCRelease message during which subsequent data transmission can happen etc (but this is not clear). I guess the main issue to discuss is whether we need RRCRelease (or some RRC message) in DL before any subsequent data transmission phase (and this is option 2). Hope that clarifies.  Anyway, the answer above seems clear to me. |
| OPPO | Y | As we have agreed, UE shall execute a set of actions such as suspending DRBs upon the reception of RRCRelease, after which data transmission in RRC\_INACTIVE is not supported any more. Therefore, the subsequent transmissions shall be performed before RRCRelease. Note that the subsequent transmissions aim to cover the data that has ready in the buffer. However, to support subsequent tranmssion before RRCRelease, we also have a concern on gNB verification issue, our option is to consult with SA3. |
| ZTE | Y | We think option 1 works, and the RRC release can be sent separately after the transmission of last DRB packet (i.e. the RRC release has not to be sent together with the last data packet). We support sending an LS to SA3 informing about the overall framework of our agreements. |
| LG | Y | We think the R2-2100139 P11 is only for DL UP data transmission.  **Proposal 11: In NR SDT, the UE does not expect to be scheduled a DL UP data without integrity protection before scheduling for network verification information**  If there is no DL UP data, then RRCRelease message can still be transmitted at the end of the subsequent UL data transfer. Thus, Option 1 could be considered as baseline.  If there is any security concern on DL data transfer, we can consider it later. |
| ASUSTeK | N | After receiving the first small data from UE, the network may obtain the information (e.g., BSR) related to subsequrnt data and could provide some configuration, e.g., CG resources, to the UE for subsequent transmission. It is beneficial for the network to send *RRCRlease* before the subsequent transmission in SDT procedure. So, both option 1 and 2 can be supported and then up to NW implementation. |

## Handling non-SDT data

As noted in

The question is how to handle the data for non-SDT DRBs and this was already well discussed during the email discussion prior to the meeting and the following options have been identified:

* Option 1: Trigger a new MAC CE upon data arrival for non-SDT DRB
  + R2-2101160, R2-2100365, R2-2100294, R2-2100282, R2-2100146
* Option 2: Trigger a new RRCResume procedure
  + R2-2101221, R2-2101203, R2-2101176, R2-2101750, R2-2101513
* Option 3: Leave to UE implementation
  + R2-2100139, R2-2101370

It would be good to narrow down the options first so that we can focus the online discussion on fewer options.

In general, we don’t leave the BSR triggering or initiation of connection resume at the lower layers to UE implementation. So, the view of the rapporteur is that option 3 is not really ideal.

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| Q3: Can we exclude option 3? - i.e. we will at least specify the behaviour for data arrival for non-SDT DRBs one way or the other | | |
| Company | Y/N | Comments (if answer is No then please explain) |
| Nokia, Nokia Shanghai Bell | Y | Since the UE cannot determine how long the SDT procedure lasts, Option 3 is really not an option. |
| OPPO | Y |  |
| ZTE | Y | It would be preferable to specify this. |
| LG | Y |  |
| ASUSTeK | Y | We agree with rapporteur. |

Assuming the majority view to be that we aim to specify this, we need to further disucss how options 1 and 2 work.

With option 1, a new MAC trigger is needed to indicate the data arrival for non-SDT DRBs

* This trigger needs to be defined for both when there is MCG path and there is no MCG path for the bearer

For option 2, it seems there are few issues to clarify further:

* Will NAS actually trigger a new resume when a resume procedure is ongoing? (it is unclear whether this happens, because today whilst a RRCResume procedure is happening, we don’t trigger a new RRCResume procedure even if data for some other DRBs arrive whilst the resume is ongoing)
* What resume cause will be used? – will we use a new resume cause or will NAS provide another resume cause again (seems this doesn’t happen according today?)
* How does the security work (i.e. the contents of RRCResumeRequest – specifically the security token seems to be repeated if we have to repeat the RRCResumeRequest?)

For now, to facilitate the online discussion companies are encouraged to provide views on the above and also any other considerations that could be useful for making a decision.

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| Q4: Between options 1 and 2, which option do you prefer and why? | | |
| Company | Option 1/2 | Please explain how each option will work (especially please provide your views on the open issues mentioned for options above and add anything that is unclear for each option in the comments) |
| Nokia, Nokia Shanghai Bell | Option 2 | MAC solution would require NW to configure non-SDT DRBs to different LCG from SDT DRBs – this restricts NW implementation which is not OK.  We don’t see reasoning for introducing new resume cause for this case. |
| OPPO | Option1 | We have not discuss whether to resume those non-SDT DRBs upon SDT is initiated. Our view on this issue is that non-SDT DRBs are not resumed until the reception of RRCResume as legacy since non-SDT DRBs can not be transmitted in SDT procedure. We prefer not to mix the data transmission procedure in different RRC state together.  With this assumption, we prefer to introduce a new MAC CE to inform the network of the non-SDT data arrival duing an ongoing SDT. The MAC CE can be generated by the indicated of higer layer, i.e. RRC. Since AS (i.e. RRC) is capble to determine which DRBs the coming data belong to even before the data is delivered down. Therefore, it is feasible for AS to generate a MAC CE as an indication when non-SDT data is arriving. We think no matter whether there is MCG path bearer, same indication can be used since the intention of this MAC CE is to convey UE’s requirement of going back to RRC\_CONNECTED. That means no need to distinguish those DRBs not allowed to perform SDT, i.e. whether it is a DRB with MCG path. |
| ZTE | Option 1 | Option 1 is preferred. We think the option 1 refer to a new MAC CE other than BSR, since BSR can not work for the Non-SDT DRB without MCG path. Hence, this doesn’t require the NW to configure non-SDT DRBs to different LCG from SDT DRBs. So, even if non-SDT and SDT DRBs are mapped to the same LCG, then the new non-SDT DRBs are kept suspended and a new MAC indication is triggered (instead of the BSR) upon arrival of data for these non-SDT DRBs.  For option 2, our understanding is that today the UE doesn’t trigger a new Resume during an ongoing resume procedure but this can be checked with CT1 if needed.  Repeating the security token is not preferable either and hence option 2 seems to be more complex than option 1 |
| LG | Option 2 | Option 1 requires a new MAC CE, which would result in huge discussion in RAN2, e.g. new MAC CE format, trigger condition, LCP consideration, etc.  Option 2 is much simpler because it can rely on existing procedure. |
| ASUSTeK | Option 2 | We don’t restrict the network to configure non-SDT DRBs to different LCG from SDT DRBs, then it is possible that a LCG includes both SDT DRB and non-SDT DRB. The network is not able to determine whether a non-zero buffer status of such LCG indicates presence of SDT data or non-SDT data or both.  If the UE needs to trigger a new resume procedure for non-SDT data, the UE can abort the ongoing SDT procedure first. |

## Overall procedure for SDT type selection

The discussion for overall SDT procedure happened in the email discussion prior to the meeting and a set of proposals were made in R2-2101162.

During the online discussion we have the following tentative set of agreements and comebacks:

**Agreements**

1 For RA-SDT, up to two preamble groups (corresponding to two different payload sizes for MSGA/MSG3) may be configured by the network

*2 [CB]* UE performs carrier selection as per legacy procedure and then the UE determines whether SDT can be initiated.

*3 [CB]* Upon initiating SDT, after the carrier selection, if valid CG-SDT resource exists, then CG-SDT is chosen, otherwise UE proceeds to RA-SDT procedure.

*4* If RACH procedure is initiated for SDT (i.e. RA-SDT initiated), the UE first performs RACH type selection as specified in MAC (i.e. Rel-16). FFS whether threshold is SDT specific or not

Although some discussion on this happened as part of the email discussion, during the initial online discussion, it seems some further detail on the overall procedure would help with the agreement. Based on this, the following clarifications are added to the overall procedure:

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| **Possible agreements**  1FFS:RSRP threshold to select between SDT and non-SDT RA procedure. FFS whether this threshold is CG/RA-SDT specific.  2    [CB]For SDT, UE performs UL carrier selection (i.e. if SUL is configured in the cell, UL carrier selected based on RSRP threshold as in legacy – FFS whether the RSRP threshold for carrier selection is common or specific to SDT)  3 [CB] If CG-SDT resources are configured on the selected UL carrier and are valid, then CG-SDT is chosen. Otherwise,   * If 2 step RA-SDT is configured on the UL carrier and criteria to select 2 step RA SDT is met, then 2 step RA-SDT is chosen * else If 4 step RA-SDT is configured on the UL carrier and criteria to select 4 step RA SDT is met, then 4 step RA-SDT is chosen * else UE does not perform SDT (i.e. perform legacy resume procedure) * If both 2 step RA-SDT and 4 step RA-SDT are configured on the UL carrier, RA type selection is performed based on RSRP threshold as in legacy.   -           FFS whether RSRP threshold for RA type selection is common or different for SDT and non SDT. |

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| Q5: Can we take the above overall procedure as the baseline? | | |
| Company | Y/N | Please clarify which aspects need modification if any and how |
| Nokia, Nokia Shanghai Bell | Y, but | However, references to legacy should be removed as they seem to create quite some confusion.  For first possible agreement, the term “RA” should be removed from the first sentence. The second FFS in the first one is also confusing, could be formulated: FFS whether RSRP threshold to select between SDT and non-SDT procedure is used for CG-SDT, RA-SDT, or both and whether the RSRP threshold is the same for CG-SDT and RA-SDT.  For the second one, the FFS reads oddly, could formulate: FFS whether the RSRP threshold for carrier selection is specific to SDT or common between SDT and non-SDT.  For third, better to talk about 2/4-step RA-STD **resources** being configured on the UL carrier. |
| OPPO | N | In our opinon, whether SDT and non-SDT selection is performed in the first step depends on whether the RSRP threshold for selection can be configured per carrier. Considering that where SDT is allowed would be smaller than the largest coverage of each carrier, the RSRP threshold can be configured separately. Furthermores, the RSRP threshold to perform CG-SDT and RA-SDT can be different. If separate RSRP threshold is configured, we think it can be taken as one of the CG-SDT validity conditions.  We suggest the procedure to be as follows:  When SDT is initiated by upper layer, selections in MAC includes:   * 1. Selection between NUL/SUL. The RSRP threshold use the same one as legacy.   2. If CG-SDT resources are configured on the selected UL carrier and are valid, then CG-SDT is chosen   3. Else if selection RSRP threshold between RA-SDT and non-SDT is met,   - If both 2 step RA-SDT and 4 step RA-SDT are configured on the UL carrier, RA type selection is performed based on RSRP threshold as in legacy.  - else if only 2 step RA-SDT is configured on the UL carrier and criteria to select 2 step RA SDT is met, then 2 step RA-SDT is chosen  - else 4 step RA-SDT is chosen   * 1. Else, UE does not perform SDT (i.e. perform legacy resume procedure) |
| ZTE | Y | In general the above can be the baseline  If the RSRP threshold is agreed for the overall SDT vs non-SDT selection, then it is possible to set this threshold in such way that once this selection is made SDT can be selected (e.g. by setting this threshold as min{4-step RA SDT threshold in SUL, 4-step RA SDT threshold in NUL}) – but even in this case, the above framework will work (i.e. the final “else UE does not perform SDT” will not happen but can still be implemented like that in the procedure). |
| LG | Y | Our view on the overall procedure is same as rapporteur.  1. Selection between SDT and normal RA (RRCResume)  2. Selection between NUL and SUL  3. Selection between CG and RA (CG is prioritized)  4. Selection between 2-step RA and 4-step RA |
| ASUSTeK | Y, but | Regarding the proposal 1, we support to introduce a RSRP threshold for SDT and non-SDT selection in the first step. Then for the UL carrier selection, the UE should not only check the RSRP threshold but also need to check if SDT configuration is available. |

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# Annex (contact details for email discussions)

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| --- | --- | --- |
| Company | Contact name | Contact email |
| ASUSTeK | Erica Huang | Erica\_Huang@asus.com |
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