**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. |
| Qualcomm | Y | Option 1 can be as baseline. |
| Huawei, HiSilicon | Y | We think Option 1 is sufficient and we are against introducing a new resume cause for SDT. SDT is just a data transmission mechanism, it is not itself a cause for resuming the connection by the UE. In our understanding, if really needed, the common RACH pool could be supported even without any changes, i.e. via BSR as in option 3 or via inclusion of actual DTCH data in msg3/msgB. This of course requires at least slightly bigger grant for msg3/msgB, but it can be up to network configuration. |
| Panasonic | Y |  |
| Lenovo | Y | Option.1 could be considered as the baseline. |
| Ericsson | Y | Option 1 is a good baseline. At the moment we do not see a need for the other options. |
| Sony | Y | Option 1 is sufficient. |
| vivo | Y | Option 1: It is sufficient.  Option 2: We don’t support this. We don’t see the need to introduce a new resume cause, which also has impacts on the CT1 work. If there is a really valid use case, a new RRC SRB0 message can be considered in our understanding.  Option 3: We don’t support this. In our understanding, using different RACH resources for SDT can better satisfy TBS requirement of SDT and reduce the impacts to legacy UEs. Common RACH resources for SDT can be further considered since this mode might facilitate the SDT deployment (i.e. associating a large TBS with the preamble B to support SDT). But, we don’t see the need to use a new LCID. |
| APT | Y | Option 1 as what we have agreed should be the baseline.  Option 2 is not preferred because it needs additional efforts on signaling design and UE’s behaviors.  Option 3 is acceptable to us if there is no much specification impact, but how to achieve it may need more time to discuss. |
| Fujitsu | Y | Option 1 is the baseline. With Option 1, we are not sure if new cause for CCCH is needed. |
| Samsung | Y | Option 1 is sufficient |
| Intel | N | Option 1 is already agreed and should be supported.  Specifications should allow deployments with a share RACH resource and option 3 should not be precluded. We see Option 3 as a network deployment choice without additional specification complexity. If network wants to use a shared RACH pool and provide a larger grant, specifications should not artificially prevent it. |
| NEC | Y | Option 1 is sufficient, i.e. we don’t see the need to introduce any new resume cause for SDT for the case of dedicated or shared RACH resource. For SDT, the UL MAC PDU received by the network will include subSDU with LCID of DTCH, not only CCCH, the gNB can then be aware of that this is a SDT transmission. |
| Xiaomi | Y | Option 1 can be considered as the baseline. Using shared PRACH resource for both SDT and non-SDT can be discussed further if the beneifts are sufficient. |
| Apple | N | We prefer Option 2 with the new cause in RRC resume message.  1> We are not against Option 1, but think it’s not the only one way.  2> We see the benefit to support the shared RACH pool, because if the PRACH resources for SDT and legacy procedure can not share the same PRACH resource, the RACH resource may be cut into pieces, which may increase the delay for each usage. Therefore, we should allow the shared RACH pool configuration. With the shared RACH pool configuration, NW need to have some information to distinguish the different access purposes (SDT and legacy Resume procedure) to perform the access control. So we think the new cause introduced in ResumeRequest message will be the simple way to provide the information.  3> We donot agree with the rapporteur’s consideration of the complexity for Option 2. For RRC based SDT procedure, it’s RRC layer to make the decision whether to trigger the SDT procedure or legacy RRC resume procedure. So we donot think the introduction of the new cause will introduce any additional complexity based on this design. |
| Spreadtrum | Y | Option1 is sufficient.  We think legacy CCCH message can be used in SDT and no need to introduce new CCCH message or modify it. Reusing legacy CCCH message is beneficial to fallback scenario and can reduce the specification work. Option 2 is not preferred.  BSR and data can be included in the first SDT message. The network has to configure larger grant size in RAR or MsgA resource comparing to non-SDT. Then option 1 is suitable. |

## 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. |
| QC | N | The disadvantage of option 1 is it can not support the case that after RRC release message if UE still needs send a small amount response uplink data for example TCP ACK when UE receives the DL application response. Given there is no available SR resource, it seems UE has to repeat to trigger RACH again to finish such small amount data transfer right after the just finished RACH procedure which we don’t think efficient.  In our understanding, the DL response message (corresponding to the first UL data transmission) should be sent together or after the RRC release message due to the security issue. So this is why we think it is possible UE still have the uplink small data requirement after the RRC release message. We support to consult SA3 by LS on this perspective but we would like to suggest not making any RAN2 agreement before SA3 replies.  For the subsequent small data transmission, we think it is just a matter of term. Before the RRC release message, there may be the subsequent small data transmission phase to handle the small data already stored in UE buffer by MSGA/Msg3 or by monitoring C-RNTI scheduling (i.e. option 1). After the RRC release message, it is still possible UE may generate a small amount data to response the DL application feedback (i.e. option 2), which we don’t think it is out of WI scope. In our view, the best solution is to provide some physical layer resources, such as CG resource together with the RRC release message for UE to have chance to handle the newly arrived data after RRC release instead of repeating RACH again. (see R2-2101223)  It should be also noted that RAN2 has already agreed that the CG resource configuration can be contained in RRC release message in the last meeting. Thus, we believe it is straightforward to adopt this agreement in this case with little specification effort to support subsequent transmission after RRC release. And we believe it can provide benefit and flexibility for both network and UE to support small data traffic (and possible subsequent transfer phase) in various scenarios. |
| Huawei, HiSilicon | Y | We agree with the spirit of the proposal and support that RRC Release should to be sent after the subsequent data transfer to mark the end of a successful SDT procedure. However, we would also like to point out that. in general, the same set of RRC messages as for normal RRC Resume Request i.e. RRC Setup, RRC Reject, RRC Resume and RRC Release will also be applicable for other scanarios during the SDT procedure. About the security issue, it should be noted that UE already sends initial data together with RRC message without prior gNB verification and this seems to be non-controversial in neither NR SDT nor EDT/PUR, so we are not sure why SA5 needs to be consulted for subsequent data now. |
| Panasonic | Y | Option 1 is the baseline, and option 2 can be considered if a new indication is introduced in the RRCRelease message or in the DCI that indicates whether there is any subsequent data transmission opportunity. |
| Lenovo | Y | RRCRelease message is used to indicate the end of the total subsequent data transmission procedure, we hope a simple and logic procedure for subsequent data transmission.  Another question, how does the network give the RRC response to the first UL data with RRCResumeRuquest, is it this RRCRelease in option.1 or other message?  It is suggested to send an LS to SA3 to confirm the overall procedure with subsequent data transmission from security perspective. |
| Ericsson | Y |  |
| Sony | Y |  |
| vivo | see comments | As the source company of R2-2100139 P11 (i.e. In NR SDT, the UE does not expect to be scheduled a DL UP data without integrity protection before scheduling for network verification information), firstly, we would like to clarify that our original intention is that network verification needs to be firstly performed before subsequent DL UP data transmission. This doesn’t mean the RRCRelease message has to be transmitted in the beginning before the subsequent data transfer. For example, as mention by LG, if there is no DL UP data, then the RRC Release message can still be transmitted at the end of the subsequent UL data transfer. Another example is that if integrity protection is configured for SDT-DRB, option 1 is also our preference.  Furthermore, we have a similar concern mentioned by Qualcomm that whether it is possible to transmit DL/UL UP data (which might be considered as subsequent data?) after the reception of the RRC Release message if option 1 is adopted. This is because the UE will not immediately perform the RRC procedure after the reception of RRC Release message (i.e. scheduling and transmission is still possible) according to the current RRC spec:  *1> delay the following actions defined in this sub-clause 60 ms from the moment the RRCRelease message was received or optionally when lower layers indicate that the receipt of the RRCRelease message has been successfully acknowledged, whichever is earlier;*  Last but not least, we think it is necessary to send an LS to SA3. |
| APT | Y, but | Option 1 can be the baseline. RRC release message can be used to terminate the whole SDT procedure. On top of that, it’s good to send the LS to SA3 for consulting on security aspect.  On the other hand, it seems the NW can also send the RRC release before the end of the SDT procedure if the RRC release can provide some configurations which are useful for the subsequent data transmission. Option 2 should not be precluded if there is benefit. |
| Fujitsu | Y | It is straightforward that RRC release would be sent after all SDT is compleated. |
| Samsung | Y |  |
| Intel | Y | RRC Release at the end is a clear mechanism to end the SDT session and move the UE back to INACTIVE. We think some explicit indication is needed for this. If this leaves a security issue for the SDT transfer itself, that can be addressed differently – with possibly another message at the beginning with IP. |
| NEC | Y, but | We can take option 1 as baseline. However, as we don’t have this case (receving DL data from a gNB that is not verified based on RRC message by the UE) before, an LS to SA3 is needed to consult if there is any security issue. If SA3 confirms that there is indeed security issue, we need to revives it to introduce one RRCRelease-like message in msg4/B using SRB1 with content FFS. |
| Xiaomi | Y |  |
| Apple | N | We share ASUSTeK’s view, and think both options should be supported and up to NW implementation. |
| Spreadtrum | Y | We think it’s better to send an explicit messge to end the data transmission procedure in inactive state. Also the network can modify the SDT configuration in this message. So option 1 is better. |

## 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. |
| Qualcomm | Y |  |
| Huawei, HiSilicon | Y | The network needs to be aware of which DRBs are resumed by the UE, so leaving this up to implementation is not a valid option. |
| Panasonic | Y |  |
| Lenovo | Y |  |
| Ericsson | Y |  |
| Sony | Y |  |
| vivo | See comments | We are wondering excluding option 3 and adopting option2 means that a new triggered RACH procedure will always stop the ongoing RACH procedure for SDT?  For example, when a RACH-SDT is ongoing and there is new arrival of non-SDT data, the UE will trigger a new RRC resume procedure and subsequently trigger a RACH procedure, so whether the legacy NOTE 1 from MAC spec is still valid?  *NOTE 1: If a new Random Access procedure is triggered while another is already ongoing in the MAC entity, it is up to UE implementation whether to continue with the ongoing procedure or start with the new procedure (e.g. for SI request).* |
| APT | Y |  |
| Fujitsu | Y |  |
| Samsung | Y |  |
| Intel | Y | We don’t think this should be left to UE implementation that could lead to different and unpredictable UE behaviours. |
| NEC | Y |  |
| Xiaomi | Y |  |
| Apple | See comments | Actually our proposal is that if the non-SDT data is arrived after the first SDT UL transmission, it’s up to UE implementation to continue current SDT procedure or trigger another SDT or legacy resume procedure.  We donot propose up to UE implementation to trigger the BSR or initiate the Connection resume procedure, our proposal is actually talking about whether the new RACH procedure triggered by new connection resume initiation is triggered immediately terminate the ongoing RACH procedure which is for SDT procedure. It’s related to the NOTE 1 in section 5.1.1 in MAC spec (copied below).  NOTE 1: If a new Random Access procedure is triggered while another is already ongoing in the MAC entity, it is up to UE implementation whether to continue with the ongoing procedure or start with the new procedure (e.g. for SI request). |
| Spreadtrum | Y |  |

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. |
| Qualcomm | Option 2 | It seems option 2 is simpler. UE terminates the current SDT procedure and initiates the connection resume procedure immediately. But we are open to discuss the option 1 to allow UE send an indication to network upon new data arrived for non-SDT DRB, as long as the indication is not the BSR MAC CE. |
| Huawei, HiSilicon | Option 2 | Whichever option we choose, we agree with OPPO that non-SDT DRBs should not be resumed to avoid issues with LCP, traffic multiplexing etc. We also understand that BSR will not really work for some bearer types as indicated by ZTE. Neither BSR nor new MAC CE will not work for the cae where the UE does not have an UL grant from the network. Therefore, we prefer triggering another RACH/RRC Resume procedure, which can cover all the scenarios. This procedure can be triggered by AS layer, no need to involve NAS and CT1. |
| Panasonic | Option 2 | It’s simpler and has a clear cut between the SDT and non-SDT traffic. The arrival of non-SDT traffic will trigger the legacy resume procedure with the legacy resume cause, while the arrival of SDT traffic will trigger the ‘new’ resume procedure (to piggyback small data) which might have a new resume cause. Nowaday the RRCResume procedure is not used for small data transmission purpose and therefore it is only triggered once. Once the RRCResume procedure is also used for small data transmission purpose, it should be fine to trigger another RRCResume procedure while there is already one on-going RRCResume procedure, as long as the first resume procedure is for small data transmission and the second one is for any legacy resume purpose. |
| Lenovo | Option.1 | We prefer a new MAC CE to indicate the non-SDT data available regarding above issues proposed by ZTE.  Option.2 will introduce further processing to the current SDT subsequent data transmission. |
| Ericsson | Option 2 | Including an indication of non-SDT data using a new MAC CE in the SDT transmission is more efficient solution than sending a new RRCResumeRequest. But this comes with complexity in defining triggers, format (BSR or other) and how when it is multiplexing performed. |
| Sony | Option 1 | We prefer that a UE should inform the network about the availability of non-SDT data in a separate indication in the uplink message without initiating another RACH procedure. |
| vivo | Option 2 | For UE simplicity, we prefer option 2.  For option 1, since the non-SDT DRBs are not resumed, it might be a bit complex for MAC to calculate the data size and perform the BSR procedure. In our understanding, a whole new SDT-specific BSR procedure needs to be newly designed, which requires a lot of normative work. |
| APT | Option 1 | We have the same understanding as rapporteur that NAS may not trigger a new resume procedure in this condition. In addition, we have agreed that SDT is transparent to NAS layer. How to determine whether there is SDT or non-SDT is based on AS. Thus, the corresponding handling should rely on AS layer.  For option 1, the details can be FFS. For example, whether non-SDT DRBs should also be resumed as SDT DRBs, whether triggering a new MAC CE or legacy BSR, etc. |
| Fujitsu | Option 2 | For non-SDT, RRC should be resumed. |
| Samsung | Option 1 |  |
| Intel | Option 1 | Option 1 is simplest as it is similar to fallback that will be supported. After reception of the “BSR”, network has the full flexibility to move the UE to CONNECTED or INACTIVE. Moving the UE to CONNECTED is also amore efficient way to handle this and also simple as the only difference is that the Resume message could be sent in the middle of an SDT session. Alternatively, network can move the UE back to INACTIVE and that will trigger a new Resume Request from the UE (similar to option 2).  With option 2 as we understand it, is not simpler and doesn’t provide network control. In our understanding of option 2, UE would not have received the new NCC and I-RNTI if UE aborts the SDT session and starts a new Resume. We have to address the security issue of sending the Resume Request message again before the UE has received the new NCC and I-RNTI. |
| NEC | Option 2 | For Option 1, agree with LG that it will result in huge discussion in RAN2.  Option 2 is the simplest solution which mainly rely on existing procedure. Only some clarification/discussion on the resume cause is needed. As for the repeated security token, we see no issue for it, as current procedure already allows it, e.g. UE sends RRC Resume Request in one cell, and receives RRCReject as response, then if the UE initiate RRC Resume in the same cell, the same security token will be transmitted again. |
| Xiaomi | Option 2 | We think that the current RRCspecification already allows the UE to trigger a new RRCResume procedure when the data for the suspended non-SDT DRB arrives. |
| Apple | Option 1 | We agree with rapporteur’s analysis. For option 2, there are several issues we need to be clarified first. And if the non-SDT data arrival is during the subsequent transmission period, it’s a new case if we carry the CCCH message (RRC ResumeRequest) via UL dedicated grant. |
| Spreadtrum | Option 2 | For option 1, considering the non-SDT with/without MCG path scenarios, new trigger condition and format shall be defined. Option 2 will be simpler than it. For option 2, the AS will trigger the releated resume message for the suspended non-SDT DRBs. |

## 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:

|  |
| --- |
| **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. |
| Qualcomm | Y, but | We are fine with the oringal agreement [CB] 2 and 3.  But whether needs additional RSRP threshold to select SDT and non-SDT needs further discussion. |
| Huawei, HiSilicon | Y, but | We support the modifications proposed by Nokia and removal of “as in legacy” statements, which are confusing (e.g. do they refer to the parameter only or to the whole procedure of the selection?).  We understand that proposal from OPPO is one example of how the procedure can work, but the possible agreements do not preclude this. It would be good to agree on these more general statements first and discuss the details later. |
| Panasonic | Y | In general we agree the sequence clarified by the rapporteur. Regarding the 1st agreement (FFS), we are not sure whether such RSRP threshold is needed or not. Usually the UE determines to perform the SDT or legacy resume procedure based on the packet size, the remaining data in the buffer, the traffic characteristic, or its own implementation. There seems to be no clear benefit to force an UE to perform legacy resume instead of SDT when the RSRP becomes poor. Anyway an Inactive UE with poor RSRP might have already triggered the cell reselection and camped to another cell before triggering the SDT procedure. |
| Lenovo | Y |  |
| E/// | Y | Our view on the overall procedure is same as rapporteur.  RSRP threshold in step 1 may not be needed in all cases. If used it needs to be set to guarantee that SDT can be performed in some way. For the CG case, this selection would be done for the first transmission (containing the RRCResume), subsequent transmissions would only check the TA. Need to consider possibility of different thresholds in NUL/SUL. Could have RAN1 implications. |
| Sony | Y, but | We do not think point 1 is needed: “FFS:RSRP threshold to select between SDT and non-SDT RA procedure. FFS whether this threshold is CG/RA-SDT specific.”  We think a UE select SDT procedure based on availability of SDT data (i.e. SDT DRBs) and also checking SDT data volume threshold, hence, no need for RSRP threshold. |
| vivo | Partially yes | Considering that both RRC-based SDT and RRC-less SDT are supported, we might have to consider the selection between RRC based and RRC-less in the overall procedure. For example, the RRC layer firstly determines whether SDT can be triggered and determine whether to perform the RRC-based SDT procedure.  Based on this, in potential proposal 1, it might be better to also add FFS selection between RRC-based and RRC-less. For potential proposals 2/3, we are generally okay if they are for the RRC based solutions. |
| APT | Y, but | For the overall procedure, we share the same view as rapporteur.  For the additionl RSRP threhosld to select between SDT and non-SDT, it seems no need to introduce. For RA case, since there is subsequent data transmission in SDT, the payload size for Msg3 is not expected to be much larger than legacy, so the additional RSRP threshold is not needed. For CG case, it has been agreed that there is association between CG resources and SSBs. If the UE would transmit small data via CG, the UE should select a SSB based on the SS-RSRP. Thus, we can rely on SS-RSRP threshold for CG. If there is no SSB above the SS-RSRP, whether the UE should perfrom non-SDT or other behaviors can be FFS. |
| Fujitsu | Y, and | It is good to clarify some pre-condition as pointed out by LGE i.e. SDT and non-SDT selection, NUL/SUL selection, and so on. The necessity of RSRP threshold can be consulted with RAN1. |
| Samsung | Y |  |
| Intel | Y, but | We agree with the overall selection sequence. Whether step 1 and 3 can be done sequentially if the RSRP threshold for CG/RACH are different could need further discussion. |
| NEC | Y | The above procedure (not includeing the FFS part) can be baseline. |
| Xiaomi | Y, but | The above procedure can be baseline, but it is not clear how the UE fallbacks to the legacy resume procedure when the MAC justifies that no SDT resource can be selected. Given that if the UE selects SDT procedure before carrier selection, the RRC would have already resumed the SDT-DRB before the carrier selection. |
| Apple | Y, but | We think the first step should be the selection between SDT and normal RRCresume procedure. |
| Spreadtrum | Y, but | We support the original [CB] 2 and 3which were made during the online discussion.  But for additional RSRP threshold for SDT and non-SDT selection shall be further discussion. The SDT can be triggered only the SDT RBs’ data arrives. For CG-SDT, its configuration validation rule was discussed. TA validation based on RSRP change is one of it. So no need to introduce additional RSRP threshold for CG-SDT. The RSRP threshold can be used for 4-step RA-SDT and 2-step RA-SDT selection. |

# References

1. R2-2100139 Discussion on User Plane Aspect of Small Data Transmission vivo
2. R2-2100140 Duscussion on RRC-Controlled Small Data Transmission vivo
3. R2-2100141 Supporting Small Data Transmission via RA Procedure vivo
4. R2-2100142 Supporting Small Data Transmission via CG Configuration vivo
5. R2-2100145 Details of Configured Grant based Small Data Transmission Samsung Electronics Co., Ltd
6. R2-2100146 User Plane Common Aspects of RACH and CG based SDT Samsung Electronics Co., Ltd
7. R2-2100147 Control Plane Common Aspects of RACH and CG based SDT Samsung Electronics Co., Ltd
8. R2-2100148 Details of RACH bsaed Small Data Transmission Samsung Electronics Co., Ltd
9. R2-2100282 Discussion on SDT UP issues OPPO
10. R2-2100283 Discussion on SDT CP issues OPPO
11. R2-2100284 Discussion on RACH based SDT OPPO
12. R2-2100285 Discussion on CG based SDT OPPO
13. R2-2100294 User plane common aspects of SDT CATT
14. R2-2100295 Considerations on control plane common aspects CATT
15. R2-2100296 Considerations on transition into RRC\_CONNECTED during subsequent SDT CATT
16. R2-2100297 Analysis on CG-based SDT CATT
17. R2-2100365 Common User plane aspects for SDT Intel Corporation
18. R2-2100366 Common Control plane aspects for SDT Intel Corporation
19. R2-2100367 Fallback, RACH resource partitioning and identification of SDT access Intel Corporation
20. R2-2100368 Handling of configured grant for SDT Intel Corporation
21. R2-2100413 Fallback issue for 2-step RA based small data transmission SHARP Corporation
22. R2-2100419 Identified issue in [Post111-e][926]: CA and PDCP CA duplication Fujitsu
23. R2-2100420 Open issue in [Post112-e][550][STD]: PDCCH monitoring Fujitsu
24. R2-2100668 Discussion on the general aspects for small data transmission Spreadtrum Communications
25. R2-2100669 Discussion on small data transmission for RACH-based scheme Spreadtrum Communications
26. R2-2100749 Handling of new arriving data during SDT NEC
27. R2-2100764 Some open issues of SDT procedure Potevio Company Limited
28. R2-2100775 Discussion on beam operations for small data enhancements Google Inc.
29. R2-2100777 Discussion on CG-based small data transmission Google Inc.
30. R2-2100782 Separate BWP for Small Data Transmission LG Electronics
31. R2-2100784 CG Resource validity and MAC PDU rebuilding on SDT LG Electronics
32. R2-2100817 T319-like timer for the SDT procedure PANASONIC R&D Center Germany
33. R2-2100826 Discussion on how to handle cell reselection for the case of SDT ITRI
34. R2-2100906 Discussion on subsequent SDT in NR, and timer handling Sony
35. R2-2100907 Discussion on context fetch and anchor relocation Sony
36. R2-2100908 Details of RA-based schemes for SDT in NR Sony
37. R2-2100909 Details of CG-based scheme for SDT in NR Sony
38. R2-2100930 Report from email discussion [POST112-e][550][SDT] Further details of CG aspects Lenovo, Motorola Mobility
39. R2-2101111 Consideration on CG based small data transmission Lenovo, Motorola Mobility
40. R2-2101112 Consideration on CP issues for small data transmission Lenovo, Motorola Mobility
41. R2-2101136 The UP common issues for small data transmissions Lenovo, Motorola Mobility
42. R2-2101137 Analysis on open issues of RA based SDT Lenovo, Motorola Mobility
43. R2-2101138 Consideration on CG based small data transmission Lenovo, Motorola Mobility
44. R2-2101145 Handling of non-SDT DRB MediaTek Inc.
45. R2-2101146 Subsequent Transmission of Small data in INACTIVE MediaTek Inc.
46. R2-2101147 Aspects specific to CG based schemes Nokia, Nokia Shanghai Bell
47. R2-2101151 RRC-less SDT over CG MediaTek Inc.
48. R2-2101158 Configured grant based small data transmission ZTE Corporation, Sanechips
49. R2-2101159 Consideration on RACH based small data transmission ZTE Corporation, Sanechips
50. R2-2101160 User plane common aspects of SDT ZTE Corporation, Sanechips
51. R2-2101161 Control plane common aspects of SDT ZTE Corporation, Sanechips
52. R2-2101162 Email discussion summary #551: Common aspects between CG and RACH ZTE Corporation, Sanechips
53. R2-2101174 RACH configuration for SDT Ericsson
54. R2-2101175 Details of CG based SDT Ericsson
55. R2-2101176 Common aspects for SDT Ericsson
56. R2-2101177 CP aspects for SDT Ericsson
57. R2-2101183 User plane common aspects for SDT Huawei, HiSilicon
58. R2-2101184 Control plane common aspects for SDT Huawei, HiSilicon
59. R2-2101203 User Plane common aspects Nokia, Nokia Shanghai Bell
60. R2-2101204 Details on RACH specific schemes Nokia, Nokia Shanghai Bell
61. R2-2101213 Small data transmission with CG-based scheme Huawei, HiSilicon
62. R2-2101214 Small data transmission with RA-based scheme Huawei, HiSilicon
63. R2-2101221 Remaining issues on user plane aspects of NR small data transmission Qualcomm Incorporated
64. R2-2101223 Remaining issues on control plane aspects of NR small data transmission Qualcomm Incorporated
65. R2-2101231 Discussion on RACH based NR small data transmission Qualcomm Incorporated
66. R2-2101233 Discussion on CG based NR small data transmission Qualcomm Incorporated
67. R2-2101311 SDT control plane aspects Nokia, Nokia Shanghai Bell
68. R2-2101368 Subsequent data transmission for SDT Apple
69. R2-2101369 Control plane aspects on SDT procedure Apple
70. R2-2101370 Non-SDB handling during the SDT procedure Apple
71. R2-2101371 CG based SDT procedure Apple
72. R2-2101407 RRC-less SDT NEC Telecom MODUS Ltd.
73. R2-2101466 CG resource release for SDT ETRI
74. R2-2101505 RACH-based SDT precedure InterDigital
75. R2-2101506 CG-based SDT selection and configuration InterDigital
76. R2-2101507 Subsequent small data transmission InterDigital
77. R2-2101513 Subsequent data transmission and indication for non-SDT DRBs LG Electronics Inc.
78. R2-2101578 Small data transmission failure timer InterDigital, Asia Pacific Telecom, Ericsson, ETRI, FGI, Sharp, Sony
79. R2-2101619 SDT type selection and switch procedure CMCC
80. R2-2101620 Remaining issues on RACH based scheme CMCC
81. R2-2101621 Anchor relocation and context fetch CMCC
82. R2-2101622 Consideration on CG resource configuration CMCC
83. R2-2101674 Collision between SDT and RACH Beijing Xiaomi Mobile Software
84. R2-2101675 Discussion on the RRC-less SDT Beijing Xiaomi Mobile Software
85. R2-2101676 Retransmission issue not included in the CG email discussion Beijing Xiaomi Mobile Software
86. R2-2101750 Handling non-SDT data arrival during subsequent SDT ASUSTeK
87. R2-2101751 Discussion on RO configuration between SDT and legacy RA ASUSTeK
88. R2-2101752 Beam selection for CG-SDT ASUSTeK
89. R2-2101753 Discussion on RNTI for CG-based SDT ASUSTeK
90. R2-2101835 Discussion on CG-SDT configuration Asia Pacific Telecom, FGI
91. R2-2101837 Beam operation for CG-SDT Asia Pacific Telecom, FGI
92. R2-2101867 Handling of the subsequent data ITL
93. R2-2101947 New timer for SDT failure detection LG Electronics Inc.
94. R2-2102230 Handling of non-SDT DRB MediaTek,

# Annex (contact details for email discussions)

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