**3GPP TSG-RAN2 Meeting #112-e R2-20yxxxx**

**e-Meeting, xx-yy, 2020**

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

**Title: Agreeable details of RRC-based solution for SDT (RACH and CG)**

**Agenda item:** **xxxx**

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

# Introduction

This document contains summary of email discussion to agree details of the RRC-based solution for small data transmission in INACTIVE:

* [Post111-e][925][R17 Small Data] Agreeable details of RRC-based solution (RACH and CG) (ZTE)

Scope:

• Develop further understanding of detailed steps for the RRC-based solution for both CG and RACH based schemes (e.g. contents of the first UL message, security aspects, and subsequent network and UE procedure etc).

• Identify any impacts to other WGs (e.g. RAN1)

Outcome: Report, Agreeable proposals and identified impacts to other groups

Deadline: Long

**Deadline for company comments:**

To allow sufficient time to summarise and submit the summary and proposals to the upcoming meeting, the following deadline for company comments is proposed:

**Tuesday Oct 13th 0700 UTC**

# Overall procedure for RRC-based small data transmission

## UE procedure upon moving to INACTIVE

Currently when the UE moves to INACTIVE state, the following are performed:

1. MAC is reset and default MAC cell group configuration is released
2. RLC entities for SRB1 are reestablished
3. All SRBs and DRBs are suspended, except SRB0

First question is whether any changes are needed for any of the above procedures to support SDT. Since some changes are expected for CG (e.g. handling of TAT timer and MAC configuration etc) compared to RACH, discussion for RACH and is separated for this issue:

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| **Q 2.1.1: For small data, for RACH based solutions (i.e. 2-step and 4-step RACH based SDT configured but no CG) are there any changes needed to the current procedure when UE moves to INACTIVE state?**  **i.e. can the UE perform the following actions**   * **MAC reset and default MAC cell group released** * **RLC entities for SRB1 reestablished** * **SRBs and DRBs are suspended except SR0**   **If any changes are needed for any of the above procedure, please elaborate.**  **Note: The goal of this question is to identify what aspects can be kept as it is and which aspects need updates and further discussion.** | | |
| **Company** | **Views: e.g.: All can be reused/Some changes needed (explanation)** | **Rapporteur summary** |
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| **Q 2.1.2: For small data, when CG based SDT resources are configured are there any changes needed to the current procedure when UE moves to INACTIVE state?**  **Specifically, are there any changes needed for the following existing procedures:**   * **MAC reset and default MAC cell group released (please comment on handling of TAT – e.g. whether the current TAT can be run in INACTIVE state or a new timer is needed and whether some MAC configuration specific to CG will need to be stored etc)** * **RLC entities for SRB1 reestablished** * **SRBs and DRBs are suspended except SR0**   **If any changes are needed for any of the above procedure, please elaborate.**  **Note: The goal of this question is to identify what aspects can be kept as it is and which aspects need updates and further discussion.** | | |
| **Company** | **Views: e.g.: All can be reused/Some changes needed (explanation)** | **Rapporteur summary** |
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## UE procedure upon initiating small data transmission

Currently, the NAS will provide an access category and resume cause is obtained. Based on this, the UE performs UAC procedure. The question is whether this procedure can be reused for small data transmission as well.

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| **Q 2.2.1: For RACH and CG, can the existing UAC procedure, to determine whether access attempt is allowed, be reused for small data transmission?** | | |
| **Company** | **Views: e.g.: Yes can be reused/Some changes needed (explanation)** | **Rapporteur summary** |
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## Handling of user plane and contents of first UL message

At RAN2#111e, the following agreement was made:

Agreement: *Small data transmission is configured by the network on a per DRB basis*

Currently, the UE only re-establishes and resumes SRB1 upon initiating Resume procedure. The DRBs are resumed only upon receiving the *RRCResume* message from the network. In case of small data, the intention is to also include user plane data in the first uplink message (i.e. before RRCResume is received by the UE). In order to be able to do this, the UE shall also re-establish and resume the DRBs which are subject to small data transmission per the agreement above. The following question is to confirm this understanding:

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| **Q 2.3.1: For both RACH and CG based solutions, upon initiating RESUME procedure, should the UE reestablish and resume the DRBs that are configured for small data transmission (along with the SRB1)?** | | |
| **Company** | **Views: Yes (DRBs should also be resumed) / No (explain)**  **Note: companies can also include any comments on changes (if any) to the PDCP suspend/resume operation** | **Rapporteur summary** |
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Currently, the first UL message will contain only the CCCH message in case of the legacy resume procedure. Assuming both SRB0 and DRBs are resumed for small data transmission per the above discussion, MAC will submit UL DRB data along with the CCCH data. In addition, MAC may also generate any MAC CEs (e.g. BSR) depending on the size of the available resources. Based on this, the following is discussed:

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| **Q 2.3.2: Do companies agree that the first UL message (i.e. MSG3 for 4-step RACH, MSGA payload for 2-step RACH and the CG transmission for CG) may contain the following contents (depending on the size of the message):**   * **CCCH message (i.e. RRCResumeRequest)** * **DRB data from one or more DRBs which are configured by the network for small data transmission** * **MAC CEs (e.g. BSR)** | | |
| **Company** | **Views: Yes / No (explain)** | **Rapporteur summary** |
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## Security framework

Currently, the UE uses the stored security context to generate the contents of *ResumeRequest* message and derives new security context (i.e. new keys) by using the NCC value received in the Release message. The question is whether this can be reused for both RACH and CG in case of RRC-based solution.

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| **Q 2.4.1: In case of RRC-based solution, for both RACH and CG based solutions, do companies agree that the contents of the RRCResumeRequest message (specifically the ResumeMAC-I) is generated using the stored security context – i.e same as Rel-16.** | | |
| **Company** | **Yes / No (explain)** | **Rapporteur summary** |
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Subsequently, the UE generates new keys using the stored security context and the NCC value received in the previous RRCRelease message and uses the new keys for the data transmission which happens after the reception of RRCResume message. However, in case of small data transmission, the DRB data may already be included in the first UL message per the discussion above. So, the question is whether the new keys can be generated and used for the data that is included in the first UL message.

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| **Q 2.4.2: For both RACH and CG based solutions, do companies agree that new keys are generated using the stored security context and the NCC value received in the previous RRCRelease message (i.e. same as legacy procedure) and these new keys are used for generating the data of DRBs that are configured for small data transmission.** | | |
| **Company** | **Yes / No (explain)** | **Rapporteur summary** |
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## Subsequent data transmission

At RAN2#111-e, the following agreement was made:

*Agreement: When UE is in RRC\_INACTIVE, it should be possible to send multiple UL and DL packets as part of the same SDT mechanism and without transitioning to RRC\_CONNECTED on dedicated grant. FFS on details and whether any indication to network is needed.*

Currently, in case of RACH (i.e. 2-step and 4-step RACH), upon successful completion of the RACH procedure (i.e. contention resolution), the UE will be monitoring C-RNTI search space for subsequent scheduling messages (both in UL and DL). The network can hence transmit DL messages and schedule the UE for further UL transmissions using the C-RNTI based scheduling. The question whether this can be used to allow multiple UL/DL messages per the above agreement.

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| **Q 2.5.1: For RACH based solutions, do companies agree that upon successful completion of contention resolution, the UE shall monitor C-RNTI search space for further UL and DL scheduling from the network?**  Note: the understanding is that with this approach, it is up to the network to whether to allow subsequent UL/DL messages or to send RRCResume message in DL (i.e. no further discussion is needed on this aspect). Companies can comment on this understanding too. | | |
| **Company** | **Yes / No (if No, explain then how to enable the multiple UL and DL packets without moving to connected)** | **Rapporteur summary** |
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Then, for CG case, there is no need for contention resolution since the assumption is that dedicated resources are used in the same serving cell. It is worth confirming this understanding first.

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| **Q 2.5.2: In case of CG, do companies agree that there is no need for contention resolution since dedicated resources are used in the same serving cell – i.e. no cell change?** | | |
| **Company** | **Yes / No (explain)** | **Rapporteur summary** |
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Then, since same serving cell is used for CG, it is possible for the UE to be configured with a UE ID to be used for the new resume procedure. This could be same as the C-RNTI used in the previous RRC-Connection or some other UEID configured by the network (e.g. SDT-RNTI) etc. Companies are invited to comment on which UE ID the UE will monitor after sending the initial UL message on the configured CG resources.

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| **Q 2.5.3: For CG based solution, do companies agree that after transmitting the first UL message on the CG resource, the UE shall monitor a configured UE RNTI? If yes, which RNTI is this (options are: old C-RNTI, some other RNTI configured by the network – such as SDT-RNTI, other options – please elaborate)** | | |
| **Company** | **Yes, UE shall monitor an RNTI – clarify which RNTI / No explanation** | **Rapporteur summary** |
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# Other aspects with potential impact to other WGs

## Resource configuration

For RACH based solution, a few companies mentioned that separate RACH resources can be configured for SDT. The question is whether both separate and shared RACH resources are allowed for SDT and if so, how to distinguish MSG2/MSGB for SDT from normal legacy MSG2/MSGB. The overall design here may impact RAN1 and hence it is worth having an initial discussion on this earlier so as to trigger the necessary investigations in RAN1 if any.

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| **Q 3.1.1: For RACH based solution, do companies agree that the following options should be allowed for SDT**   * **Shared RACH resources between SDT and non-SDT** * **Separate RACH resources between SDT and non-SDT** | | |
| **Company** | **Yes, both should be allowed / No (explain)** | **Rapporteur summary** |
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| **Q 3.1.2: Do companies agree that the MSG2/MSGB for SDT needs to be distinguished from the normal MSG2/MSGB? If the answer is yes, please also explain how to distinguish this (e.g. separate RNTI, Corset and/or search space etc)** | | |
| **Company** | **Yes, MSG2 and MSGB should be distinguished from legacy (explain how) / No (explain)** | **Rapporteur summary** |
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## Cell reselection and failure handling

Currently, RLM and beam failure detection are not applicable before *RRCResume* is received and UE relies on T319 for detecting failures. The first question is whether the T319 is to be extended to support SDT and the subsequent question then is whether we can rely on the T319 for detecting SDT failure.

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| **Q 3.2.1: Do companies agree that T319 should be extended to support SDT and if yes, by how much** | | |
| **Company** | **Yes (provide value range) / No (explain)** | **Rapporteur summary** |
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| **Q 3.2.2: Do companies agree that we can rely on T319 expiry for failure handling and no need to have RLM/beam failure detection during STD?** | | |
| **Company** | **Yes (we can rely on T319) / No (explain)** | **Rapporteur summary** |
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Finally, currently cell reselection is possible while T319 is running. If this happens, UE moves to IDLE mode. The question is whether the same approach can be adopted with SDT (in which case there will be potentially data loss) or if some optimisation is needed to avoid data loss in this case.

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| **Q 3.2.3: How to handle cell reselection during T319 for the case of SDT**  **Option 1: No optimizations (UE moves to IDLE mode) this will result in data loss and it is up to higher layers in the UE to recover the lost data**  **Option 2: RAN2 will define solutions to potentially recover the lost data (companies can provide basic details of the mechanisms)** | | |
| **Company** | **Option 1 / Option 2 with comments** | **Rapporteur summary** |
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# Conclusion and proposals

TBD

# References

1. R2-2008124, Report for Rel-16 (NR-U, Power Savings and 2-step RACH) and Rel-17 (IIoT and Small Data), Session Chair (InterDigital), 3GPP TSG-RAN WG2 Meeting #111-e

# Annex (contact details for email discussions)

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| Company | Contact name | Contact email |
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