3GPP TSG-RAN WG3 #115-e R3-222481

21th Feb – 3rd Mar 2022

Online

Agenda Item: 24.2

Source: ZTE (moderator)

Title: Summary of Offline Discussion on CB: # SDT2\_CGbased

Document for: Approval

# Introduction

**CB: # SDT3\_CGbased**

**- How to indicate CG-SDT configuration kept in the gNB-DU?**

**- Whether and when gNB-DU shall be aware of the bearer type of SDT Bearer?**

**- How to handle fallback to RA-SDT or to normal Resume?**

**- E1AP impact only for CG-SDT?**

**- Capture agreements, clean up and provide TPs if agreeable**

(ZTE - moderator)

Summary of offline disc [R3-222481](Inbox%5CR3-222481.zip)

# For the Chairman’s Notes

<TBD>

# Discussion- Second round

<TBD>

# Discussion-First round

## Progress in the last meeting

Lower layer configuration for SDT DRBs, F1AP association, and F1 tunnel information are kept in gNB-DU when gNB-CU sends the UE to RRC\_INACTIVE.

Once the UE initiates RRC Resume procedure from another cell, the gNB-CU shall indicate to the gNB-DU to release the assigned CG-SDT resource.

When the gNB-DU receives the query indication, it should transfer the CG-SDT related resources within the DU to CU RRC Information IE. Introduce an SDT-MACPHY-Config IE to DU to CU RRC Information IE for the gNB-CU to generate the RRC Release message with CG-SDT config;

The gNB-CU notifies the gNB-DU to keep SDT RLC config and store CG resource for SDT when UE entering RRC inactive; *FFS on other parts of UE context info to be stored. FFS on signalling design*

gNB-DU shall store which bearers are CG-SDT bearers and the C-RNTI.

*The gNB-DU should be aware the bearer type of SDT Bearer, FFS on any enhancements are needed*

When the TAT-SDT expires, the gNB-DU initiates the UE Context Release Request procedure (details to be checked, FFS on new cause).

Proposal to add a new codepoint for SDT resume in the Bearer Context Status Change IE. Addition to be considered in the E1 output TP of “# SDT4\_Others”

When CG-SDT is configured but the UE selects RA-SDT or non-SDT procedure, the gNB-CU provides the old gNB-DU F1AP UE ID to the gNB-DU. The gNB-DU retrieves the old CG-SDT resource configuration and old UE context based on the old gNB-DU F1AP UE ID. *FFS on new F1AP UE association or old UE F1AP UE association.*

*To be continued…*

## How to indicate that CG-SDT configuration should be kept in the DU

There is currently an FFS on which F1AP message is used to send the UE to RRC\_INACTIVE while preserving part of the UE context in the gNB-DU due to CG-SDT configuration:

*Editor’s note: In the step 4/5, which F1AP procedure used to send the RRC release message to the UE is FFS.*

When network decides to stop SDT procedure, the gNB-CU shall send RRCRelease message to UE, change UE into RRC\_inactive mode. There are several candidate solutions on the table, to send the RRC release message to the UE.

1. UE context modification procedure
2. UE context release procedure
3. DL RRC Message Transfer

For RA-SDT, gNB-DU does not need to store SDT related information nor F1 tunnels. So, for RA-SDT and CG-SDT, it is proposed to use the same F1AP: UE context release procedure to send the RRC release message to the UE.

**Question 1: Which F1AP procedure to send the RRC release message to the UE?**

* Solution 1: UE context modification procedure
* Solution 2: UE context release procedure
* Solution 3: DL RRC Message Transfer
* Solution 4: Other, if any

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| **Company** | **sol-1, sol-2, sol-3** | **Comment** |
| ZTE | Sol 2 | Both solutions are workable, but since UE context release procedure shall be used for RA-SDT, we suggest to use the same procedure. |
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## Whether gNB-DU shall buffer UL SDT data

In the baseline CR, there is an editor note, as below.

*Editor’s note: Before step 8, it is FFS whether the UL small data/UL NAS PDU shall be buffered at gNB-DU until gNB-CU-CP verifies successfully via UE’s I-RNTI.*

There are two candidate solutions on the table.

1. The gNB-DU buffers UL SDT data
2. The gNB-CU-UP buffers UL SDT data

For RA-SDT procedure, the gNB-DU has to buffer UL SDT data before F1 tunnel establishment. But, for CG-SDT procedure, the gNB-DU already stores CG-SDT resources and F1 tunnels. It seems feasible to directly forward UL SDT data without buffering.

In case of the candidate solution 1, after the verification, the gNB-CU can send the UE CONTEXT MODIFICATION REQUEST message to the gNB-DU to indicate the successful verification of UE sending the buffered UL SDT data. Meanwhile, shall initiate E1AP procedure (e.g., Bearer context modification) to inform the gNB-CU-UP to resume SDT DRB and send the UL SDT data.

In case of the candidate solution 2, after the gNB-CU-UP verifies UE, it shall initiate E1AP procedure (e.g., Bearer context modification) to inform the gNB-CU-UP to resume SDT DRB and send the buffered UL SDT data.

**Solution 1 needs to use additional F1AP procedure than solution 2 which is not needed. Solution 1 is similar to RA-SDT method. Solution 2 needs the gNB-CU-UP to buffer UL SDT data.**

**Question 2: Whether the UL small data/UL NAS PDU shall be buffered at gNB-DU until gNB-CU-CP verifies successfully via UE’s I-RNTI?**

* Solution 1: The gNB-DU buffers UL SDT data
* Solution 2: The gNB-CU-UP buffers UL SDT data
* Solution 3: Other, if any

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| **Company** | **sol-1, sol-2, sol-3** | **Comment** |
| ZTE | Prefer sol 1 (sol 2 is also fine if feasible) | We wonder if gNB-CU-UP can buffer the receiving UL data or has to discard the receiving UL data before the gNB-CU-CP indicates SDT bearer status changed to “ResumeforSDT”. If it can, then solution 2 is also fine to us.Solution 1 is same as the RA-SDT procedure, but is needs additional F1AP message. |
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## When gNB-DU shall be aware of the bearer type of SDT Bearer

This issue is based on the following progress in the last meeting.

*The gNB-DU should be aware the bearer type of SDT Bearer, FFS on any enhancements are needed*

In [6], it observes that if the full UE context is kept in gNB-DU, DU does not necessarily to be aware of the SDT bearer type, and if only the SDT related UE context is kept in gNB-DU, gNB-DU should be aware of the SDT bearer type.

For a FFS on whether to keep other UE context at the gNB-DU, we think that based on to current RAN3 agreement, the gNB-DU has the sufficient information to support the CG-SDT when the UE in RRC\_INACTIVE initiates the CG-SDT. It seems that there is no requirement to keep other UE context at gNB-DU. For a FFS on whether to maintain a full UE context in gNB-DU, the gNB-DU does not need to store the information related to the non-SDT bearer since this information is not used by the UE and gNB-DU during the CG-SDT. For the case where the CG-SDT resource is configured but the UE selects the RA-SDT procedure, the information related to the non-SDT bearer is not used. When the CG-SDT resource is configured but the UE initiates the non-SDT procedure, the gNB-CU initiates the UE Context Setup procedure. Therefore, the gNB-CU can provide the information of all RBs including SDT bearers and non-SDT bearers to the gNB-DU when sending the UE to RRC\_CONNECTED state.

**The gNB-DU only needs to keep SDT related UE context and SDT related F1 connection.**

Then, we shall confirm that which node to decide bearer type of SDT bearer (both CG-SDT and RA-SDT)

**It is the gNB-CU to decide bearer type of both RA-SDT bearer and CG-SDT bearer.**

Based on the above proposal, when network will configure RA-SDT bearer, because the new receiving gNB-DU can be different from the old anchor gNB when UE initiates a SDT procedure, the gNB-DU does not need to be aware of bearer type of RA-SDT bearer.

**The gNB-DU does not need to be aware of bearer type of RA-SDT bearer.**

When gNB-CU configures CG-SDT, it shall inform the gNB-DU by F1AP message. Based on e.g., [1] [4] and [14], there several candidate solutions.

1. If CG-SDT to be configured, the gNB-CU sends UE context modification request message including the list of SDT bearers (DRB and SRB), as well as CG-SDT query information.
2. If CG-SDT to be configured, the gNB-CU sends UE context set up request message including the list of SDT bearers (DRB and SRB), as well as CG-SDT query information.
3. If CG-SDT to be configured, the gNB-CU sends F1AP message (e.g., UE context release command message) including the list of SDT bearers (DRB and SRB), as well as RRCRelease message when UE into RRC\_inactive mode.
4. Considering that that this is not a dynamic characteristics, have an indication in the UE Context Setup Request.
5. If the full UE context is kept in gNB-DU, gNB-DU does not necessarily to be aware of the SDT bearer type

For solution 1/2, it is benefit for gNB-DU to configure CG-SDT resources for this UE, because the gNB-DU can configure suitable CG-SDT resources based on the quantity and quality (e.g., QoS) of the CG-SDT bearers to be configured. However, the gNB-CU shall additionally add a new IE (e.g., CG-SDT configuration indicator) to gNB-DU via UE context release command message when UE into RRC\_Inactive.

For solution 3, it is benefit for gNB-CU to inform this message directly then the additional IE used in method 1 is not needed. However, the gNB-DU has to blindly configure CG-SDT resources when receiving “CG-SDT query indicator” from gNB-CU.

**The gNB-DU should be aware the bearer type of SDT Bearer which includes SDT DRB identity list and/or SRB**

**Question 3: Do companies agree with the following proposals?**

**Proposal 1: It is the gNB-CU to decide bearer type of both RA-SDT bearer and CG-SDT bearer.**

**Proposal 2: The gNB-DU only needs to keep SDT related UE context and SDT related F1 connection.**

**Proposal 3: The gNB-DU does not need to be aware of bearer type of RA-SDT bearer.**

**Proposal 4: The gNB-DU needs to be aware of bearer type of CG-SDT bearer**

**Proposal 5: CG-SDT bearer includes SDT DRB identity list and/or SRB**

**Proposal 6: If CG-SDT bearer to be configured, the gNB-DU should be aware the bearer type of SDT Bearer which includes SDT DRB identity list and SRB if any**

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| **Company** | **P1, P2, …** | **Comment** |
| ZTE | Yes for all Proposals |  |
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**Question 4: If CG-SDT bearer to be configured, when gNB-DU shall be aware of the bearer type SDT Bearer (SDT DRB identity list and SRB)?**

* Solution 1: The gNB-CU sends **UE context modification request** message including SDT Bearers (as well as CG-SDT query information). When UE into RRC\_inactive, it shall additionally add a new IE (e.g., *CG-SDT configuration indicator, CG-SDT Kept Indicator*) to gNB-DU via **UE context release command** message.
* Solution 2: The gNB-CU sends **UE context set up request** message including SDT Bearers, as well as CG-SDT query information
* Solution 3: The gNB-CU sends F1AP message (e.g., **UE context release command message**) including SDT Bearers, as well as RRCRelease message when UE into RRC\_inactive mode.
* Solution 4: Considering that that this is not a dynamic characteristics, the gNB-CU has an indication in the **UE Context Setup Request**
* Solution 5: If the full UE context is kept in gNB-DU, DU does not necessarily to be aware of the SDT bearer type
* Solution 6: Other, if any

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| **Company** | **Sol-1, 2, ...** | **Comment** |
| ZTE | Sol 1 | In our view, the gNB-DU shall be aware of CG-SDT bearer list when it is asked to configure suitable CG-SDT resource. On the contrary, without CG-SDT bearer list, it cannot configure suitable CG-SDT when receiving “CG-SDT qurery information” |
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## Fallback to RA-SDT or to normal Resume

When CG-SDT is configured but the UE selects RA-SDT or non-SDT procedure, the gNB-CU provides the old gNB-DU F1AP UE ID to the gNB-DU. The gNB-DU retrieves the old CG-SDT resource configuration and old UE context based on the old gNB-DU F1AP UE ID. *FFS on new F1AP UE association or old UE F1AP UE association.*



Figure 1

**Step 2:** The UE will reconnect and the gNB-DU will use a new F1 signaling connection by Initial UL RRC Message Transfer message towards the gNB-CU CP.

**Step 3:** The gNB-CUfind this UE is “old” UE via I-RNTI

**Step 4:** The gNB-CU sends F1AP request message including ***old gNB-DU F1AP UE ID***, by e.g., UE context set up request message.

**Step 5:** The gNB-DU sends F1AP response message.

In Step 4, some papers suggest to reuse the maintained F1-C/F1-U tunnel in case of CG-SDT fall back to RA-SDT or non-SDT at the same gNB. More, [10] suggest that the gNB-CU sends the UE CONTEXT MODIFICATION REQUEST message to the gNB-DU using the old F1AP association and provide the newly revived new UE DU F1AP ID as a new optional IE. The gNB-DU associates the new C-RNTI to the UE context, discards the new UE DU F1AP ID and the old C-RNTI.

In Step 5, [4] thinks that it is the gNB-DU to find the old context and the gNB-DU can then report back in the UE Context Setup Response message the stored CG-SDT configuration.

**Question 5: Companies are kindly invited to answar the following questions (options, IEs and solutions)**

Step 4: gNB-CU sends F1AP request message

* Option 1: UE context set up request message

(Note: new F1AP association, then old F1AP association shall be released by CU initiated UE context release command message)

* Option 2: UE context modification request message

 (Note: old F1AP association, then no need to set up a new F1 tunnel and release the old F1 tunnel. However, it is new usage of *UE context modification request* after *Initial UL RRC message Transfer*)

* Option 3: Add the CG-SDT configuration into the F1 Initial UL RRC Message Transfer (seen in [4])

This request message shall includes ***old gNB-DU F1AP UE ID.***

* Candidate IE 1: old gNB-DU F1AP UE ID only
* Candidate IE 2: old gNB-CU F1AP UE ID and old gNB-DU F1AP UE ID pair

Step 5: The gNB-DU sends F1AP response message

* Solution 1: The gNB-CU finds the UE context, then gNB-DU does not include CG-SDT resource to gNB-CU via F1AP response message.
* Solution 2: The gNB-DU finds the UE context, then gNB-DU shall include CG-SDT resource to gNB-CU via F1AP response message

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| **Company** | **Option 1/2/3****Candidate IE 1/2****Solution 1/2** | **Comment** |
| ZTE | Both option 1 and 2IE 2Solution 1 | As legacy, after receiving Initial UL RRC Message Transfer message, the CU shall trigger UE context set up procedure. But for this SDT case, it can be enhanced to use UE context modification procedure by using the old F1AP association.IE2 can provide more information then IE 1It is gNB-CU to find the UE context, so solution 1 is reasonable. |
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## Whether it is needed to introduce a new Caus value

When the TAT-SDT expires, the gNB-DU initiates the UE Context Release Request procedure (details to be checked, FFS on new cause)

In the current F1AP specification, the appropriate cause value shall be indicated for the UE context release request message, as below.

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| *The gNB-DU controlling a UE-associated logical F1-connection initiates the procedure by generating a* ***UE CONTEXT RELEASE REQUEST*** *message towards the affected gNB-CU node.* *The UE CONTEXT RELEASE REQUEST message shall indicate* ***the appropriate cause value****.*  |

In some papers, it states that in order to increase KPI, it is proposed to add a new cause value.

But, in [8], it states that the TAT-SDT is separately maintained by the gNB-DU and the UE. Upon the timer expires, they both release the CG-SDT resource by themselves. No F1 impact is identified and gNB-CU does not have any new actions. Hence, it is unnecessary to introduce a new cause.

**Question 6: Whether it is needed to introduce a new Caus value?**

* Yes. The new Cause value shall be defined as e.g., in [7]

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| TAT-SDT Expiry | The gNB-DU triggers UE Context Release Request to due TAT-SDT timer expiries. |

* No. No need to introduce a new Cause value

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| **Company** | **Yes/No** | **Comment** |
| ZTE | Yes | New cause value is benefit  |
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## Fix current BLCR

**TS 38.401 BLCR**

In [8], it states that as defined in TS 38.401 section 8.9.6.1, during the RRC Connected to RRC Inactive state transition, the gNB-CU-CP should trigger Bearer Context Modification Request with suspend indication towards the gNB-CU-UP.

**In CG-SDT TS 38.401 BL CR, before triggering step 4 towards the gNB-DU, the gNB-CU-CP should trigger Bearer Context Modification Request with suspend indication towards the gNB-CU-UP.**

In [11], it states that after step 10, the green arrow for UL NAS PDU was drawn to be delivered to 5GC via CU-UP, which is not correct. UL NAS PDU is delivered to AMF directly from CU-CP.

**For CG SDT procedure in 38.401 BLCR, after step 10, fix UL NAS PDU green arrow so that it is forwarded to 5GC directly from CU-CP (not through CU-UP).**

As a result, if an RRC message carrying UL NAS PDU was multiplexed together with RRCResumeRequst, the receiving DU just needs to forward that RRC message to CU-CP via UL RRC MESSAGE TRANSFER, like RRCResumeRequest being forwarded via UL RRC MESSAGE TRANSFER in step 8.

**For CG SDT procedure in 38.401 BLCR, after step 8, add the optional UL RRC MESSAGE TRANSFER procedure to carry an RRC message if multiplexed together with RRCResumeRequest.**

**Question 7: Do companies agree with the following proposals to fix TS38.401 BLCR?**

**Proposal 7: In CG-SDT TS 38.401 BL CR, before triggering step 4 towards the gNB-DU, the gNB-CU-CP should trigger Bearer Context Modification Request with suspend indication towards the gNB-CU-UP.**

**Proposal 8: For CG SDT procedure in 38.401 BLCR, after step 10, fix UL NAS PDU green arrow so that it is forwarded to 5GC directly from CU-CP (not through CU-UP).**

**Proposal 9: For CG SDT procedure in 38.401 BLCR, after step 8, add the optional UL RRC MESSAGE TRANSFER procedure to carry an RRC message if multiplexed together with RRCResumeRequest.**

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| **Company** | **P7, P8, P9** | **Comment** |
| ZTE | Agree with all proposals |  |
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**TS 38.473 BLCR**

In some contributions, e.g. [8], it suggest to introduce the new IE.

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| **RAN2#115e agreement:**42. CS-RNTI based dynamic retransmission mechanism can be reused for CG-SDT. FFS whether CS-RNTI is the same one as the one previously configured in RRC\_CONNECTED or a new CS-RNTI one is provided to the UE**RAN2#116bis-e agreement:**9. CS-RNTI for CG-SDT is provided to the UE in *RRCRelease* message. |

According to RAN2 agreement, the CS-RNTI is provided to the UE in *RRCRelease* message. If the UE initiates the CG-SDT, the UE needs to monitor PDCCH with CS-RNTI for scheduling the retransmission. Therefore, the gNB-DU needs to store the CS-RNTI for the timely scheduling operation.

**If gNB-CU decides to configure CG-SDT bearer, the gNB-DU shall store the CS-RNTI for CG-SDT.**

In [9], it states that first editor’s note can be resolved based on the agreement “Introduce an *SDT-MACPHY-Config* IE to *DU to CU RRC Information* IE for the gNB-CU to generate the RRC Release message with CG-SDT config” in RAN3 #114bis-e meeting. This agreement is already reflected into the current CG-SDT BLCR to TS 38.473. Therefore, this editor’s note can be removed.

**Remove the editor’s note “FFS on the details of CG-SDT resource configuration” in CG-SDT BL CR to TS 38.473.**

Second editor’s note is related to the gNB-DU awareness of CG-SDT bearers. Based on RAN2 progress and running TS38.331CR, this editor’s note can be also removed, and the CG-SDT configuration shall not be per DRB basis

**Remove the editor’s note “Whether CG-SDT Query Indication IE is per DRB basis or not is FFS” in CG-SDT BL CR to TS 38.473. CG-SDT Query Indication IE is not per DRB basis.**

**Question 8: Do companies agree with the following proposals to fix TS38.473 BLCR?**

**Proposal 10: If gNB-CU decides to configure CG-SDT bearer, the gNB-DU shall store the CS-RNTI for CG-SDT.**

**Proposal 11: Remove the editor’s note “FFS on the details of CG-SDT resource configuration” in CG-SDT BL CR to TS 38.473.**

**Proposal 12: Remove the editor’s note “Whether CG-SDT Query Indication IE is per DRB basis or not is FFS” in CG-SDT BL CR to TS 38.473. CG-SDT Query Indication IE is not per DRB basis.**

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| **Company** | **P10, P11, P12** | **Comment** |
| ZTE | Agree with all proposals | For the proposal 12, this is decided by RAN2. When we check RAN2 38331 running CR, it is per UE not per DRB. |
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# Conclusion, Recommendations [if needed]

If needed

# References

1. [R3-221794](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-221794.zip) Discussion on left issues for CG-SDT (ZTE, China Telecom, Ericsson)
2. [R3-221795](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-221795.zip) (TP for CG-SDT BLCR to TS 38.473) Left issue for CG-SDT (ZTE, China Telecom, Ericsson)
3. [R3-221801](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-221801.zip) (TP for CG-SDT BL CR to TS 38.401) Procedures for F1 CG-SDT procedures(Ericsson, ZTE, China Telecom)
4. [R3-221818](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-221818.zip) (TP for TS 38.401) Conclusions on CG-based SDT (Nokia, Nokia Shanghai Bell)
5. [R3-221819](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-221819.zip) (TP for TS 38.473) Conclusions on CG-based SDT (Nokia, Nokia Shanghai Bell)
6. [R3-221897](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-221897.zip) (TP for SDT BL CRs) On CG based SDT (CATT)
7. [R3-221996](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-221996.zip) (TP to CG-SDT TS 38.473 BL CR) New Cause in the UE Context Release Request message (Lenovo, Motorola Mobility)
8. [R3-222172](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-222172.zip) (TP to CG-SDT BL CR of TS 38.401) Leftover issues on CG-SDT (Huawei)
9. [R3-222239](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-222239.zip) (TP for CG-SDT BL CR to TS 38.473) Support of CG-SDT in F1 (LG Electronics)
10. [R3-222318](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-222318.zip) (TP to CG-SDT BL CR of TS38.473) Discussion on CG-based small data transmission (Samsung)
11. [R3-222354](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-222354.zip) (TP for CG-SDT BL CR for TS 38.401/473/470) Toward the completion of CG-SDT (Intel Corporation)

Note: The following three papers are moved into 24.4, to discuss E1AP issue.

1. [R3-222050](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-222050.zip) Discussion on remaining issues on E1 impact on SDT (China Telecom Corporation Ltd.)
2. [R3-222051](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-222051.zip) TP to TS38.463 on the support of SDT in E1 interface (China Telecom Corporation Ltd.)
3. [R3-222240](../../%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98/TSGR3_115-e/Docs/R3-222240.zip) (TP for RA-SDT BL CR to TS 38.463) Support of SDT in E1 (LG Electronics)