**3GPP TSG-RAN WG2 Meeting #117 Electronic *R2-220xxxx***

**Elbonia, 21 February – 3 March 2022**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.300** | **CR** |  | **rev** | **7** | **Current version:** |  |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Introduction of SDT | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_SmallData\_INACTIVE-Core | | | | |  | ***Date:*** | | | 2022-03 |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | | 17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of SDT. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The agreements made in RAN2 for SDT are captured in this version.  RAN2#111-e:   1. The 2-step RACH or 4-step RACH should be applied to RACH based uplink small data transmission in RRC\_INACTIVE. 2. Small data transmission is configured by the network on a per DRB basis. 3. Data volume threshold is used for the UE to decide whether to do SDT or not. 4. UL/DL transmission following UL SDT without transitioning to RRC\_CONNECTED is supported. 5. 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.   RAN2#112-e:   1. For RACH based solutions, upon successful completion of contention resolution, the UE shall monitor the C-RNTI. 2. The configuration of configured grant resource can include one type 1 CG configuration. 3. The configuration of configured grant resource for UE small data transmission is valid only in the same serving cell. FFS for other CG validity criteria (e.g. timer, UL/SUL aspect, etc) 4. 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 at least the following contents (depending on the size of the message):   - CCCH message (needs to be included)  RAN2#113-e:   1. For CG-SDT the subsequent data transmission can use the CG resource or DG (i.e dynamic grant addressed to UE’s C-RNTI). 2. RAN2 design assumes that RRCRelease message is sent at the end to terminate the SDT procedure from RRC point of view. 3. 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 resources are 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 resources are 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 non-SDT resume procedure)  • If both 2 step RA-SDT and 4 step RA-SDT resources are configured on the UL carrier, RA type selection is performed based on RSRP threshold.   1. From RAN2 point of view, assume similar to PUR, that we introduce a TA validation mechanism for SDT based on RSRP change, i.e. RSRP-based threshold(s) are configured. Ask RAN1 to confirm. FFS on how to handle CG configuration when TA expires or when is invalid due to RSRP threshold. Details of the TA validation procedure can be further discussed. 2. UE releases CG-SDT resources when TAT expires in RRC\_Inactive state   RAN2#113Bis-e:   1. Switching from SDT to non-SDT is supported. 2. UE switches from SDT to non-SDT in following cases:    1. Case 1 (27/0): UE receive indication from network to switch to non-SDT procedure.    2. Network can send RRCResume. FFS whether network can send indication in RAR/fallbackRAR/DCI to switch to non-SDT procedure.    3. FFS Case 2 (18/9): Initial UL transmission (in msgA/Msg3/CG resources) fails configured number of times   RAN2#114-e:   1. CFRA is not supported for RA-SDT 2. CG-SDT resource can be configured on either initial BWP or separate SDT BWP. Ask RAN1 to confirm   RAN2#115-e:   1. DL SPS is not supported for SDT 2. Events that trigger a termination or failure of an ongoing SDT session 1) cell reselection, 2) expiry of the SDT failure detection timer, 3) when Max retx is reached in RLC. RLC AM max retransmission functionality remains unchanged. 3. When a UE detects a failure of an ongoing SDT session, UE transitions autonomously into RRC\_IDLE (as baseline solution). If time allows or have a ready solution we can consider further optimizations. 4. SDT related RACH resources are configured via system information, i.e., SIB1 5. RA-SDT can be configured on initial BWP. FFS for non-initial BWP   RAN2#116-e:   1. RAN2 changes the agreements and as a baseline we will focus on initial BWP for RA and CG SDT. FFS if further work on CG SDT for non-initial BWP will be needed, based on RAN1 consensus. 2. Highest N SSBs of all SSBs actually transmitted as indicated in SIB1 is used for RSRP based TA validation 3. LCH restrictions can be applied, re-using existing signalling, and it is up to gNB how restrictions are configured and MAC applies current specification rules) 4. If LCH restriction is applied for SDT, it is applied both for CG-SDT and RA-SDT. 5. The UE is allowed to initiate subsequent UL data transmission only after the reception of confirmation of initial transmission from the gNB 6. For SDT, ROHC continuity functionality can be configurable between the cell and RNA. Send LS to RAN3   RAN2#116Bis-e:   1. RAN2 confirms that SDT will be configured only on initial BWP and there is no L1 ACK feedback for CG-SDT. 2. Network can respond with RRCSetup or RRCReject to RRCResumeRequest for SDT and the UE behaviour upon reception of the RRCSetup or RRCReject message is the same as legacy. FFS if anything additional needs to be added for RRCReject (i.e. similar to EDT) 3. RSRP-based TA validation is only applicable for initial CG-SDT and not needed for retransmission of the initial CG-SDT. 4. For subsequent TB on CG, UE initiated retransmission is not supported. Dynamic scheduling can be supported like legacy.   RAN2#117-e:   1. If CG-SDT-TAT expires while the CG-SDT procedure is ongoing and if UE has not received a response from the network after the initial UL CG-SDT transmission, UE terminates ongoing SDT procedure (15/20). FFS follow-up UE behaviour (e.g. whether the UE triggers SDT failure and goes to IDLE mode). 2. For non-SDT data arrival indication, ResumeCause value is included in UAI as an optional IE (and hence is provided to the network if upper layers provide it to the AS). If NAS provides it the UE shall include it in resume cause. 3. For handling RACH failure (i.e. that Max RACH preamble transmission is reached) during SDT procedure, MAC indicates RACH problem indication to RRC. SDT failure is declared and UE moves to IDLE mode | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | SDT feature not introduced in Stage-2 TS. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 7.2, 9.2.6, XX | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*First Modified Subclause*

3.1 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], in TS 36.300 [2] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 36.300 [2].

5GC 5G Core Network

5GS 5G System

5QI 5G QoS Identifier

A-CSI Aperiodic CSI

AKA Authentication and Key Agreement

AMBR Aggregate Maximum Bit Rate

AMC Adaptive Modulation and Coding

AMF Access and Mobility Management Function

ARP Allocation and Retention Priority

BA Bandwidth Adaptation

BCH Broadcast Channel

BH Backhaul

BL Bandwidth reduced Low complexity

BPSK Binary Phase Shift Keying

C-RNTI Cell RNTI

CAG Closed Access Group

CAPC Channel Access Priority Class

CBRA Contention Based Random Access

CCE Control Channel Element

CD-SSB Cell Defining SSB

CFRA Contention Free Random Access

CG Configured Grant

CHO Conditional Handover

CIoT Cellular Internet of Things

CLI Cross Link interference

CMAS Commercial Mobile Alert Service

CORESET Control Resource Set

CPC Conditional PSCell Change

DAG Directed Acyclic Graph

DAPS Dual Active Protocol Stack

DFT Discrete Fourier Transform

DCI Downlink Control Information

DCP DCI with CRC scrambled by PS-RNTI

DL-AoD Downlink Angle-of-Departure

DL-SCH Downlink Shared Channel

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

E-CID Enhanced Cell-ID (positioning method)

EHC Ethernet Header Compression

ETWS Earthquake and Tsunami Warning System

FS Feature Set

GFBR Guaranteed Flow Bit Rate

HRNN Human-Readable Network Name

IAB Integrated Access and Backhaul

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

KPAS Korean Public Alarm System

LDPC Low Density Parity Check

MDBV Maximum Data Burst Volume

MIB Master Information Block

MICO Mobile Initiated Connection Only

MFBR Maximum Flow Bit Rate

MMTEL Multimedia telephony

MNO Mobile Network Operator

MPE Maximum Permissible Exposure

MT Mobile Termination

MU-MIMO Multi User MIMO

Multi-RTT Multi-Round Trip Time

NB-IoT Narrow Band Internet of Things

NCGI NR Cell Global Identifier

NCR Neighbour Cell Relation

NCRT Neighbour Cell Relation Table

NGAP NG Application Protocol

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

P-MPR Power Management Maximum Power Reduction

P-RNTI Paging RNTI

PCH Paging Channel

PCI Physical Cell Identifier

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PLMN Public Land Mobile Network

PNI-NPN Public Network Integrated NPN

PO Paging Occasion

PRACH Physical Random Access Channel

PRB Physical Resource Block

PRG Precoding Resource block Group

PS-RNTI Power Saving RNTI

PSS Primary Synchronisation Signal

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QFI QoS Flow ID

QPSK Quadrature Phase Shift Keying

RA Random Access

RA-RNTI Random Access RNTI

RACH Random Access Channel

RANAC RAN-based Notification Area Code

REG Resource Element Group

RIM Remote Interference Management

RMSI Remaining Minimum SI

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RNTI Radio Network Temporary Identifier

RQA Reflective QoS Attribute

RQoS Reflective Quality of Service

RS Reference Signal

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSSI Received Signal Strength Indicator

RSTD Reference Signal Time Difference

SD Slice Differentiator

SDAP Service Data Adaptation Protocol

SDT Small Data Transmission

SFI-RNTI Slot Format Indication RNTI

SIB System Information Block

SI-RNTI System Information RNTI

SLA Service Level Agreement

SMC Security Mode Command

SMF Session Management Function

S-NSSAI Single Network Slice Selection Assistance Information

SNPN Stand-alone Non-Public Network

SNPN ID Stand-alone Non-Public Network Identity

SPS Semi-Persistent Scheduling

SR Scheduling Request

SRS Sounding Reference Signal

SRVCC Single Radio Voice Call Continuity

SS Synchronization Signal

SSB SS/PBCH block

SSS Secondary Synchronisation Signal

SST Slice/Service Type

SU-MIMO Single User MIMO

SUL Supplementary Uplink

TA Timing Advance

TPC Transmit Power Control

TRP Transmit/Receive Point

UCI Uplink Control Information

UL-AoA Uplink Angles of Arrival

UL-RTOA Uplink Relative Time of Arrival

UL-SCH Uplink Shared Channel

UPF User Plane Function

URLLC Ultra-Reliable and Low Latency Communications

V2X Vehicle-to-Everything

Xn-C Xn-Control plane

Xn-U Xn-User plane

XnAP Xn Application Protocol

*Next Modified Subclause*

7.2 Protocol States

RRC supports the following states which can be characterised as follows:

**- RRC\_IDLE**:

- PLMN selection;

- Broadcast of system information;

- Cell re-selection mobility;

- Paging for mobile terminated data is initiated by 5GC;

- DRX for CN paging configured by NAS.

- **RRC\_INACTIVE**:

- PLMN selection;

- Broadcast of system information;

- Cell re-selection mobility;

- Paging is initiated by NG-RAN (RAN paging);

- RAN-based notification area (RNA) is managed by NG- RAN;

- DRX for RAN paging configured by NG-RAN;

- 5GC - NG-RAN connection (both C/U-planes) is established for UE;

- The UE Inactive AS context is stored in NG-RAN and the UE;

- NG-RAN knows the RNA which the UE belongs to;

- Transfer of unicast data and/or signalling to/from the UE over radio bearers configured for SDT.

- **RRC\_CONNECTED**:

- 5GC - NG-RAN connection (both C/U-planes) is established for UE;

- The UE AS context is stored in NG-RAN and the UE;

- NG-RAN knows the cell which the UE belongs to;

- Transfer of unicast data to/from the UE;

- Network controlled mobility including measurements.

*Next Modified Subclause*

### 7.3.2 Scheduling

The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH, where they are dynamically carried on DL-SCH. The scheduling of SI messages part of Other SI is indicated by *SIB1*.

For UEs in RRC\_IDLE and RRC\_INACTIVE without an ongoing SDT procedure, a request for Other SI triggers a random access procedure (see clause 9.2.6) where MSG3 includes the SI request message unless the requested SI is associated to a subset of the PRACH resources, in which case MSG1 is used for indication of the requested Other SI. When MSG1 is used, the minimum granularity of the request is one SI message (i.e. a set of SIBs), one RACH preamble and/or PRACH resource can be used to request multiple SI messages and the gNB acknowledges the request in MSG2. When MSG 3 is used, the gNB acknowledges the request in MSG4.

For UEs in RRC\_CONNECTED, a request for Other SI may be sent to the network, if configured by the network, in a dedicated manner (i.e., via UL-DCCH) and the granularity of the request is one SIB. The gNB may respond with an *RRCReconfiguration* including the requested SIB(s). It is a network choice to decide which requested SIBs are delivered in a dedicated or broadcasted manner.

The Other SI may be broadcast at a configurable periodicity and for a certain duration. The Other SI may also be broadcast when it is requested by UE in RRC\_IDLE/RRC\_INACTIVE/RRC\_CONNECTED.

For a UE to be allowed to camp on a cell it must have acquired the contents of the Minimum SI from that cell. There may be cells in the system that do not broadcast the Minimum SI and where the UE therefore cannot camp.

*Next Modified Subclause*

9.2.6 Random Access Procedure

The random access procedure is triggered by a number of events:

- Initial access from RRC\_IDLE;

- RRC Connection Re-establishment procedure;

- DL or UL data arrival during RRC\_CONNECTED when UL synchronisation status is "non-synchronised";

- UL data arrival during RRC\_CONNECTED when there are no PUCCH resources for SR available;

- SR failure;

- Request by RRC upon synchronous reconfiguration (e.g. handover);

- Transition from RRC\_INACTIVE;

- To establish time alignment for a secondary TAG;

- Request for Other SI (see clause 7.3);

- Beam failure recovery;

- Consistent UL LBT failure on SpCell;

- SDT in RRC\_INACTIVE (see clause XX).

Two types of random access procedure are supported: 4-step RA type with MSG1 and 2-step RA type with MSGA. Both types of RA procedure support contention-based random access (CBRA) and contention-free random access (CFRA) as shown on Figure 9.2.6-1 below.

The UE selects the type of random access at initiation of the random access procedure based on network configuration:

- when CFRA resources are not configured, an RSRP threshold is used by the UE to select between 2-step RA type and 4-step RA type;

- when CFRA resources for 4-step RA type are configured, UE performs random access with 4-step RA type;

- when CFRA resources for 2-step RA type are configured, UE performs random access with 2-step RA type.

The network does not configure CFRA resources for 4-step and 2-step RA types at the same time for a Bandwidth Part (BWP). CFRA with 2-step RA type is only supported for handover.

The MSG1 of the 4-step RA type consists of a preamble on PRACH. After MSG1 transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble for MSG1 transmission is assigned by the network and upon receiving random access response from the network, the UE ends the random access procedure as shown in Figure 9.2.6-1(c). For CBRA, upon reception of the random access response, the UE sends MSG3 using the UL grant scheduled in the response and monitors contention resolution as shown in Figure 9.2.6-1(a). If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSG1 transmission.

The MSGA of the 2-step RA type includes a preamble on PRACH and a payload on PUSCH. After MSGA transmission, the UE monitors for a response from the network within a configured window. For CFRA, dedicated preamble and PUSCH resource are configured for MSGA transmission and upon receiving the network response, the UE ends the random access procedure as shown in Figure 9.2.6-1(d). For CBRA, if contention resolution is successful upon receiving the network response, the UE ends the random access procedure as shown in Figure 9.2.6-1(b); while if fallback indication is received in MSGB, the UE performs MSG3 transmission using the UL grant scheduled in the fallback indication and monitors contention resolution as shown in Figure 9.2.6-2. If contention resolution is not successful after MSG3 (re)transmission(s), the UE goes back to MSGA transmission.

If the random access procedure with 2-step RA type is not completed after a number of MSGA transmissions, the UE can be configured to switch to CBRA with 4-step RA type.

** **

**(a) CBRA with 4-step RA type (b) CBRA with 2-step RA type**

** **

**(c) CFRA with 4-step RA type (d) CFRA with 2-step RA type**

**Figure 9.2.6-1: Random Access Procedures**

****

**Figure 9.2.6-2: Fallback for CBRA with 2-step RA type**

For random access in a cell configured with SUL, the network can explicitly signal which carrier to use (UL or SUL). Otherwise, the UE selects the SUL carrier if and only if the measured quality of the DL is lower than a broadcast threshold. UE performs carrier selection before selecting between 2-step and 4-step RA type. The RSRP threshold for selecting between 2-step and 4-step RA type can be configured separately for UL and SUL. Once started, all uplink transmissions of the random access procedure remain on the selected carrier.

When CA is configured, random access procedure with 2-step RA type is only performed on PCell while contention resolution can be cross-scheduled by the PCell.

When CA is configured, for random access procedure with 4-step RA type, the first three steps of CBRA always occur on the PCell while contention resolution (step 4) can be cross-scheduled by the PCell. The three steps of a CFRA started on the PCell remain on the PCell. CFRA on SCell can only be initiated by the gNB to establish timing advance for a secondary TAG: the procedure is initiated by the gNB with a PDCCH order (step 0) that is sent on a scheduling cell of an activated SCell of the secondary TAG, preamble transmission (step 1) takes place on the indicated SCell, and Random Access Response (step 2) takes place on PCell.

*Next Modified Subclause*

XX Small Data Transmission

Small Data Transmission (SDT) is a procedure allowing data and/or signalling transmission while remaining in RRC\_INACTIVE (i.e. without transitioning to RRC\_CONNECTED state). SDT is enabled on a radio bearer basis and is initiated by the UE only if less than a configured amount of UL data awaits transmission across all radio bearers for which SDT is enabled, the DL RSRP is above a configured threshold, and a valid SDT resource is available as specified in clause YYY of TS 38.321 [6].

Editor’s Note: MAC TS reference to be added once the section number is available.

SDT procedure is initiated with either a transmission over RACH (configured via system information) or over Type 1 CG resources (configured via dedicated signaling in *RRCRelease*). The SDT resources can be configured on initial BWP for both RACH and CG. RACH and CG resources for SDT can be configured on either or both of NUL and SUL carriers. The CG resources are valid only within the cell the UE received *RRCRelease* and transitioned to RRC\_INACTIVE state. For RACH, the network configures 2-step and/or 4-step RA resources for SDT. When both 2-step and 4-step RA resources for SDT are configured, the UE selects the RA type according to subclause 9.2.6. CFRA is not supported for SDT over RACH.

Once initiated, the SDT procedure is either:

- successfully completed after the UE is directed to RRC\_IDLE (via *RRCRelease*) or RRC\_INACTIVE (via *RRCRelease or RRCReject*) or to RRC\_CONNECTED (via *RRCResume or RRCSetup*); or

- unsuccessfully completed upon cell re-selection, expiry of the SDT failure detection timer, a MAC entity reaching a configured maximum PRACH preamble transmission threshold, or an RLC entity reaching a configured maximum retransmission threshold.

Upon unsuccessful completion of the SDT procedure, the UE transitions to RRC\_IDLE.

Editor’s Note: If CG-SDT-TAT expires while the CG-SDT procedure is ongoing and if UE has not received a response from the network after the initial UL CG-SDT transmission, UE terminates ongoing SDT procedure. FFS follow-up UE behaviour (e.g. whether the UE triggers SDT failure and goes to IDLE mode).

The initial PUSCH transmission during the SDT procedure includes at least the CCCH message. When using CG resources for initial SDT transmission, the UE can perform autonomous retransmission of the initial transmission if the UE does not receive confirmation from the network (dynamic UL grant or DL assignment) before a configured timer expires as specified in clause ZZZ of TS 38.321 [6]. After the initial PUSCH transmission, subsequent transmissions are handled differently depending on the type of resource used to initiate the SDT procedure:

- When using CG resources, the network can schedule subsequent UL transmissions using dynamic grants or they can take place on the following CG resource occasions. The DL transmissions are scheduled using dynamic assignments. The UE can initiate subsequent UL transmission only after reception of confirmation (dynamic UL grant or DL assignment) for the initial PUSCH transmission from the network. For subsequent UL transmission, the UE cannot initiate re-transmission over a CG resource.

- When using RACH resources, the network can schedule subsequent UL and DL transmissions using dynamic UL grants and DL assignments, respectively, after the completion of the RA procedure.

While the SDT procedure is ongoing, if data appears in a buffer of any radio bearer not enabled for SDT, the UE initiates a transmission of a non-SDT data arrival indication using UE assistance information message to the network and, if available, includes the resume cause.

SDT procedure over CG resources can only be initiated with valid UL timing alignment. The UL timing alignment is maintained by the UE based on a SDT-specific timing alignment timer configured by the network via dedicated signalling and, for initial CG-SDT transmission, also by DL RSRP of configured number of highest ranked SSBs which are above a configured RSRP threshold. Upon expiry of the SDT-specific timing alignment timer, the CG resources are released.

Logical channel restrictions configured by the network while in RRC\_CONNECTED state for radio bearers enabled for SDT, if any, are applied by the UE during SDT procedure.

The network may configure UE to apply ROHC continuity for SDT either when the UE initiates SDT in the cell where the UE received *RRCRelease* and transitioned to RRC\_INACTIVE state or when the UE initiates SDT in a cell of its RNA.

*End of Changes*

# Annex (not part of the specification): RAN2 agreements:

## RAN2#111-e

|  |
| --- |
| 1 Small data transmission with RRC message is supported as baseline for RA-based and CG based schemes  2 RRC-less can be studied for limited use cases (e.g. same serving cell and/or for CG) with lower priority  3 Context fetch and data forwarding with anchor re-location and without anchor re-location will be considered. FFS if there are problems with the scenario “without anchor relocation”.  4 From RAN2 perspective, stored “configuration” in the UE Context is used for the RLC bearer configuration for any SDT mechanism (RACH and CG).  5 The 2-step RACH or 4-step RACH should be applied to RACH based uplink small data transmission in RRC\_INACTIVE  6 The uplink small data can be sent in MSGA of 2-step RACH or msg3 of 4-step RACH.  7 Small data transmission is configured by the network on a per DRB basis  8 Data volume threshold is used for the UE to decide whether to do SDT or not. FFS how we calculate data volume.  FFS if an “additional SDT specific” RSRP threshold is further used to determine whether the UE should do SDT  9 UL/DL transmission following UL SDT without transitioning to RRC\_CONNECTED is supported  10 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. |

## RAN2#112-e

|  |
| --- |
| 1 For small data, for RACH and CG based solutions when the UE receives RRC release with Suspend config, the UE at least performs the following actions (i.e. same action as in legacy):  - MAC is reset and default MAC cell group configuration is released  - RLC entities for SRB1 are re-established  - SRBs and DRBs are suspended except SRB0  NOTE: SDT termination will be discussed with later papers  2 For both RACH and CG based solutions, upon initiating RESUME procedure for SDT initiation (i.e. for first SDT transmission), the UE shall re-establish at least the SDT PDCP entities and resume the SDT DRBs that are configured for small data transmission (along with the SRB1). FFS for non-SDT DRBs. FFS on implicit vs. explicit. FFS on whether we a new Resume cause. FFS on whether we need to deal with suppressing PDCP status report  3 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 at least the following contents (depending on the size of the message):  - CCCH message (needs to be included)  LCP can be used to determine to priority of the content below that may be included  - DRB data from one or more DRBs which are configured by the network for small data transmission  - MAC CEs – (e.g. BSR). FFS other MAC CEs  - Padding bits  FFS if we need to ensure that SDT data only is included. Depends on whether the UE initiates legacy/normal resume  4 For RACH and CG, the existing UAC procedure to determine whether access attempt is allowed, will be reused for SDT.  5 SDT is transparent to NAS layer (i.e. NAS generates one of the existing resume causes and AS decides SDT vs non-SDT access)  6 In case of RRC-based solution, for both RACH and CG based solutions, the CCCH message contains ResumeMAC-I generated using the stored security key for RRC integrity protection – i.e same as Rel-16.  7 For both RACH and CG based solutions, 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 SDT.  8 For RACH based solutions, upon successful completion of contention resolution, the UE shall monitor the C-RNTI.  9 Determine if RAN1 LS is needed later – current list of possible questions input on the coreset/search space for the C-RNTI (i.e. is it common or dedicated)  10: 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  FFS if common configuration should be allowed  11: If the RACH resource i.e. (RO+preamble combination) is different between SDT and non-SDT then there is no further need for any differentiation between MSG2/MSGB for SDT vs non-SDT  12: Define a new timer. FFS whether it has the same definition as T319 or it is restarted every UL/DL  13 The configuration of configured grant resource for UE uplink small data transfer is contained in the RRCRelease message. FFS if other dedicated messages can configure CG in INACTIVE CG. Configuration is only type 1 CG with no contention resolution procedure for CG.  14 The configuration of configured grant resource can include one type 1 CG configuration. FFS if multiple configured CGs are allowed  15 A new TA timer for TA maintenance specified for configured grant based small data transfer in RRC\_INACTIVE should be introduced. FFS on the procedure, the validity of TA, and how to handle expiration of TA timer. The TA timer is configured together with the CG configuration in the RRCRelease message.  16 The configuration of configured grant resource for UE small data transmission is valid only in the same serving cell. FFS for other CG validity criteria (e.g. timer, UL/SUL aspect, etc)  17 The UE can use configured grant based small data transfer if at least the following criteria is fulfilled (1) user data is smaller than the data volume threshold; (2) configured grant resource is configured and valid; (3) UE has valid TA. FFS for the candidate beam criteria.  18 From RAN2 point of view: An association between CG resources and SSBs is required for CG-based SDT. FFS up to RAN1 how the association is configured or provided to the UE. Send an LS to RAN1 to start the discussion on how the association can be made. Mention that one option RAN2 considered was explicit configuration with RRC Release message  19 A SS-RSRP threshold is configured for SSB selection. UE selects one of the SSB with SS-RSRP above the threshold and selects the associated CG resource for UL data transmission. |

## RAN2#113-e

|  |
| --- |
| 1. CG-SDT resource configuration is provided to UEs in RRC\_Connected only within the RRCRelease message, i.e. no need to also include it in RRCReconfiguration message  2. CG-PUSCH resources can be separately configured for NUL and SUL. FFS if we allow them at the same time. This depends on the alignments CRs for Rel-16.  3. RRCRelease message is used to reconfigure or release the CG-SDT resources while UE is in RRC\_INACTIVE  4. For CG-SDT the subsequent data transmission can use the CG resource or DG (i.e dynamic grant addressed to UE’s C-RNTI). Details on C-RNTI, can be the same as the previous C-RNTI or may be configured explicitly by the network can be discussed in stage 3  5. TAT-SDT is started upon receiving the TAT-SDT configuration from gNB, i.e. RRCrelease message, and can be (re)started upon reception of TA command.  6. From RAN2 point of view, assume similar to PUR, that we introduce a TA validation mechanism for SDT based on RSRP change, i.e. RSRP-based threshold(s) are configured. Ask RAN1 to confirm. FFS on how to handle CG configuration when TA expires or when is invalid due to RSRP threshold. Details of the TA validation procedure can be further discussed.  7. As a baseline assumption, it’s a network configuration issue whether to support multiple CG-SDT configurations per carrier in RRC\_INACTIVE (i.e. we will not restrict network configuration for now).  8. FFS Discuss further in stage 3 how to specify the agreement that CG-SDT resources are only valid in one cell (i.e. cell in which RRCRelease is received)  9. UE releases CG-SDT resources when TAT expires in RRC\_Inactive state  10. For RA-SDT, up to two preamble groups (corresponding to two different payload sizes for MSGA/MSG3) may be configured by the network  11. 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  12. RAN2 continues to progress the work based the separate RACH resources for SDT (i.e. explicit mechanisms to support common resources won’t be pursued unless there is sufficient support for this. However, use of common RACH resources will not be precluded if possible via implementation  13. RAN2 design assumes that RRCRelease message is sent at the end to terminate the SDT procedure from RRC point of view. The RRCRelease sent at the end of the SDT may contain the CG resource (as per previous agreement). Write an LS to SA3 to explain SDT procedure and agreement.  14. The UE behaviour for handling of non-SDT data arrival after sending the first UL data packet is fully specified (i.e. not left to UE implementation)  15. FFS RAN2 will consider the additional option of using DCCH message to indicate arrival of non-SDT data (details to be discussed). Discussion will continue on all three options.  16. FFS: RSRP threshold to select between SDT and non-SDT procedure.  17. FFS also whether this 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. FFS when the RSRP threshold check is made  18. FFS If both carriers can be selected and CG resources are available on one carrier only, does the UE select the carrier with CG?  19. For SDT, UE performs UL carrier selection (i.e. if SUL is configured in the cell, UL carrier selected based on RSRP threshold). FFS whether the RSRP threshold for carrier selection is specific to SDT)  20. 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 resources are 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 resources are 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 non-SDT resume procedure)  • If both 2 step RA-SDT and 4 step RA-SDT resources are configured on the UL carrier, RA type selection is performed based on RSRP threshold.  - FFS whether RSRP threshold for RA type selection is common or different for SDT and non SDT.  - FFS what validity includes if we need to deal with CG resource availability delay?  **Working assumptions**  1. Support configuring of SRB1 and SRB2 for small data transmission for carrying RRC and NAS messages.  2. Upon initiating RRC Resume procedure for SDT initiation (i.e. for first SDT transmission), the UE shall also resume SRB2 that is configured for SDT, in addition to SDT DRBs that are configured for SDT  3. RAN2 recommends to include SRB2 in WID |

## RAN2#113Bis-e

|  |
| --- |
| 1. 1 RSRP threshold is used to select between SDT and non-SDT procedure, if configured (RSRP refers to the same RSRP measured for carrier selection).  2 RSRP threshold to select between SDT and non-SDT procedure is used for both CG-SDT and RA-SDT  3 RSRP threshold to select between SDT and non-SDT procedure is same for both CG-SDT and RA-SDT  4 RSRP threshold for carrier selection is specific to SDT (i.e. separately configured for SDT). This is optional for the network.  5 Confirm that cell selection mechanism is not modified  6 RSRP threshold for RA type selection is specific to SDT (i.e. separately configured for SDT)  7 Data volume threshold is the same for CG-SDT and RA-SDT (can be checked further in stage 3 if we obtain majority support)  8 FFS on the order and missing pieces (e.g. failure, fallback) of the high level procedure. The details of the procedures are left for stage 3. FFS on the procedure below, but copied for information.  A. Upon arrival of data only for DRB/SRB(s) for which SDT is enabled, the high level procedure for selection between SDT and non SDT procedure is as follows:  If CG-SDT criteria is met: UE selects CG-SDT. UE initiate SDT procedure  Else if RA-SDT criteria is met: UE selects RA-SDT. UE initiate SDT procedure  Else: UE initiate non SDT procedure.  B. CG-SDT criteria is considered met, if all of the following conditions are met,  1) available data volume <= data volume threshold  2) RSRP is greater than or equal to a configured threshold  FFS 3) CG-SDT resources are configured on the selected UL carrier and are valid  C. RA-SDT criteria is considered met, if all of the following conditions are met,  1) available data volume <= data volume threshold  2) RSRP is greater than or equal to a configured threshold  3) 4 step RA-SDT resources are configured on the selected UL carrier and criteria to select 4 step RA SDT is met; or 2 step RA-SDT resources are configured on the selected UL carrier and criteria to select 2 step RA SDT is met  9 Switching from SDT to non-SDT is supported.  10 FFS Switching from CG-SDT to RA-SDT is not allowed  11 UE switches from SDT to non-SDT in following cases:  - Case 1 (27/0): UE receive indication from network to switch to non-SDT procedure.  - Network can send RRCResume. FFS whether network can send indication in RAR/fallbackRAR/DCI to switch to non-SDT procedure.  - FFS Case 2 (18/9): Initial UL transmission (in msgA/Msg3/CG resources) fails configured number of times  12 gNB can only configure MN terminated MCG bearer type for SDT  13 Non-SDT radio bearers are only resumed upon receiving RRCResume (same as today)  14 Down-scope to two solutions (CCCH or DCCH) and ask SA3 about security issues (explain that CCCH message will be repeated in same cell and ask if there is a question)  15 The UE performs PDCP re-establishment implicitly, i.e. without explicit indication for PDCP re-establishment, when the UE initiates SDT procedure.  16 As in legacy, whether to support ROHC continuity is explicitly configured by the network.  17 PDCP duplication is not supported for SDT  18 connected mode DRX is not supported for SDT  19 PHR functionality is supported for SDT. FFS on PHR procedure  20 SR resource is not configured for SDT. When the BSR is triggered by SDT data, the UE will trigger RA because SR resource is not available, same as legacy  21 SDT failure detection timer is started upon initiation of SDT procedure  22 T319 legacy is not started if RRCResumeRequest or RRCResumeRequest1 is transmitted for SDT  23 T319 legacy stop conditions also apply to SDT failure detection timer  24 RRC re-establishment procedure is not supported for SDT  25 An LS is sent to SA3 to verify feasibility/impacts of re-using same NCC/I-RNTI value temporarily for RRC Resume procedure in new cell during SDT procedure (include same cell question from 502]  26 FFS - RAN2 to select between the following options for cell re-selection during ongoing SDT procedure next meeting: 1) UE transitions to IDLE, possibly performing high-layer retransmission (8/25); or 2) UE remains in INACTIVE and sends RRC Resume to new cell  27 FFS Upon SDT failure detection timer expiry, the same procedure as T319 expiry is used (e.g. transition to IDLE as in the case of expiry of the T319 timer and attempts RRC connection setup) (18/8)  28 CG-SDT resources can be configured at the same time on NUL and SUL  29 Implicit release of CG-SDT resource is not supported  30 UE start a window after CG/DG transmission for CG-SDT. FFS whether to design a new timer or to reuse an existing timer.  31 Support retransmission by dynamic grant for CG-SDT.  32 Support multiple HARQ processes for uplink CG-SDT.  33 CG resource availability delay is not considered as a criterion for CG validation.  34 UL carrier selection is performed before CG-SDT selection  35 FFS CG-SDT resource can be configured on BWPs other than initial BWP |

## RAN2#114-e

|  |
| --- |
| 1. CFRA is not supported for RA-SDT  2. The separate search space is common to the UEs performing RA-SDT. Inform RAN1 of this agreement  3. Working assumption: UE-specific search space is configured for UEs performing CG-SDT. RAN2 asks RAN1 whether this working assumption can be confirmed  4. The UE needs to monitor paging after UE initiates SDT for system information change, PWS. FFS for other cases  5. CG-SDT resource can be configured on either initial BWP or separate SDT BWP. Ask RAN1 to confirm  6. FFS CS-RNTI based dynamic retransmission is reused for CG-SDT  7. Release of CG-SDT configuration by system information indication is not supported  8. RAN2 thinks that some feedback may be beneficial in case CG is used for subsequent transmission. RAN2 assumes that existing mechanism can be used.  9. For initial CG transmission, UE does not select any SSB if none of the SSBs’ RSRP is above the RSRP threshold. FFS if re-evaluation for every CG transmission is necessary |

## RAN2#115-e

|  |
| --- |
| 1. Data volume used for SDT selection criteria is calculated as the total sum of Buffer Size across SDT RBs (i.e. same approach as BSR)  2. At initiation of SDT procedure, the PDCP status report is not triggered even if the RB is configured with statusReportRequired  3. If ROHC is configured, the area scope of ROHC continuity is specified in the specification, i.e. gNB configuration is not needed  4. For SDT procedure selection, Same data volume threshold is used for CG-SDT and RA-SDT  5. The BSR configuration used for SDT can be different from the BSR configuration used in RRC\_CONNECTED.  6. [CB] FFS Whether the BSR configuration used for SDT is configured by gNB or used from default configuration needs further discussion. (gNB 10 / default 11)  7. Legacy PHR triggers are applied for SDT  8. DL SPS is not supported for SDT  9. DataInactivityTimer is not supported for SDT.  10. RLC polling is supported for SDT.  11. The UE performs RLC re-establishment implicitly, i.e. without explicit indication for RLC re-establishment, when the UE initiates SDT procedure.  12. At initiation of SDT procedure, the RRC indicates to the PDCP to disable the PDCP status report, e.g. by de-configuring statusReportRequired (i.e. UE internally indicates). FFS how PDCP status reporting is enabled.  13. The LCP priority of PHR MAC CE in SDT is same as in RRC\_CONNECTED, i.e. the PHR MAC CE in SDT is prioritized over SDT data  14. During the SDT procedure, all the triggered PHRs are cancelled if all SDT data are included in the UL grant, if there is NO room in the MAC PDU to fit the PHR.  15. Working assumption: LCH restrictions can be applied, re-using existing signalling. It is up to gNB how restrictions are configured and MAC applies current specification rules. Revisit next meeting if we have technical issues.  16. No new solution is defined to prevent data loss or duplication for the scenario where the anchor relocation is required in the middle of an SDT session, i.e. network can release UE back into RRC\_INACTIVE  17. PDCP entities of only the non-SDT RBs are re-established (i.e. not for the SDT RBs) when the UE moves from RRC\_INACTIVE with SDT session ongoing to RRC CONNECTED.  18. Events that trigger a termination or failure of an ongoing SDT session 1) cell reselection, 2) expiry of the SDT failure detection timer, 3) when Max retx is reached in RLC. RLC AM max retransmission functionality remains unchanged.  19. When a UE detects a failure of an ongoing SDT session, UE transitions autonomously into RRC\_IDLE (as baseline solution). If time allows or have a ready solution we can consider further optimizations.  20. SDT related RACH resources are configured via system information, i.e., SIB1  21. Explicit indication (other than RA-SDT configuration) to enable/disable RA-SDT is not supported  22. At least the following parameters can be RA-SDT specific.  - SSB selection related parameters, i.e., rsrp-ThresholdSSB, msgA-RSRP-ThresholdSSB.  - Power control related parameters, i.e., preambleReceivedTargetPower/gA-PreambleReceivedTargetPower, powerRampingStep/msgA-PreamblePowerRampingStep, msg3-DeltaPreamble/msgA-DeltaPreamble.  - Preamble group related parameters, i.e., msg3-DeltaPreamble/msgA-DeltaPreamble, messagePowerOffsetGroupB for 2-step RA-SDT and 4-step RA-SDT.  23. For shared ROs case, all the following configurations can be allowed: (28/28)  • 4-step RA-SDT shares ROs with 4-step RA and/or 2-step RA  • 2-step RA-SDT shares ROs with 4-step RA and/or 2-step RA  • 2-step RA-SDT shares ROs with 4-step RA-SDT and/or 4-step RA and/or 2-step RA.  24. For the RA-SDT preamble group selection, the UE should consider SDT data size plus MAC subheader in addition to CCCH SDU size plus MAC subheader and pathloss, same in legacy. FFS whether any additional things on top of legacy criteria is needed.  25. The fallbackRAR reception as legacy 2-step RACH is supported in 2-step RA-SDT, i.e., fallback from 2-step RA-SDT to 4-step RA-SDT when fallbackRAR is received  26. As legacy, UE can be configured to switch from 2-step RA-SDT to 4-step RA-SDT after N times of MsgA transmission  27. Send an LS to RAN1 to provide overall relevant agreements. Check if the PUCCH resources used for HARQ-ACK during subsequent SDT transmissions (applicable for both RA and CG). Ask if other L1 PHY resources may be needed for subsequent SDT transmission, for example RAN2 thinks we can use the common resources (PDCCH and PUCCH) for RA and ask if we need others.  - Add that RAN2 discussed RA-SDT configuration on non-initial BWP. There was a large number of companies supporting and other companies expressed concerns on complexity and paging monitoring. Ask RAN1 if they have any concerns from their side. NOTE that RAN2 agreed for CG-SDT we already agreed to dedicated BWP and why we decided to support it.  28. UE suspends all UL transmissions and triggers RACH if any UL transmission is needed (same as in connected mode) when TAT expires during RA-SDT procedure  29. RA-SDT can be configured on initial BWP. FFS for non-initial BWP  30. RA prioritization related parameters cannot be configured for RA-SDT, i.e., powerRampingStepHighPriority, scalingFactorBI  31. UE selects any SSBs if there is no qualified SSB for RA-SDT, like in legacy. No optimizations are considered.  32. Switching from SDT to non-SDT via RAR/fallbackRAR/DCI sent by network is not supported for RA-SDT  33. No new timer (other than the SDT failure detection timer) is introduced to control the PDCCH monitoring during subsequent transmissions in RA-SDT  34. If none of the SSBs’ RSRP is above the RSRP threshold of CG-SDT criteria in the type selection phase, UE should select RA-SDT if RA-SDT criteria is met  35. MAC PDU rebuilding is not required (unless we find a case that is needed)  36. During subsequent CG transmission phase (i.e. after the UE has received response from NW) UE can initiate at least legacy RACH procedure (e.g. trigger due to no UL resources). No MAC PDU rebuilding is required. FFS if the RA-SDT RA resources can be used for subsequent data.  a. At least the following conditions are agreed: (1) no qualified SSB when the evaluation is performed; (2) when TA is invalid; (3) when SR is triggered due to lack of UL resource  37. UE should release CG-SDT resource (if stored) when UE initiates RRC resume procedure from another cell which is different from the cell in which the RRCRelease is received.  38. The C-RNTI previously configured in RRC\_CONNECTED state is used for UE to monitor PDCCH in CG-SDT.  39. 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  40. During the subsequent new CG transmission phase, for the purpose of CG resource selection, UE re-evaluates the SSB for subsequent CG transmission. FFS what happens if no SSBs are valid or if no sample is available  41. From RAN2 perspective, at least the following parameters should be included in the CG-SDT configuration. FFS whether these parameters are common for multiple CG-SDT configurations or per CG-SDT configuration.  • The new TA timer in RRC\_INACTIVE;  • The RSRP change threshold for TA validation mechanism in SDT (details dependent on RAN1);  • The SSB RSRP threshold for beam selection (i.e. UE selects the beam and associated CG resource for data transmission). |

## RAN2#116-e

|  |
| --- |
| 1. The statusReportRequired is automatically enabled at termination of SDT procedure, i.e. PDCP status report is temporarily disabled during SDT procedure. (22/22)  2. BSR format enhancements are not considered for SDT. (21/23)  3. BSR calculation take suspended RBs into consideration during SDT. (21/23)  4. If NAS data arrives at PDCP layer of suspended RBs, the NAS data should be just stored in PDCP SDU buffer without further processing. (23/23). How to ensure this is up to UE implementation, and no spec change is needed.  5. PDCP header is not considered for the SDT data volume calculation. (23/23). No spec change is needed.  6. Buffered packets in PDCP/RLC entities should be counted in SDT data volume calculation. (21/23). Whether and how to avoid any buffered packets in PDCP/RLC entities at the time of SDT data volume calculation is FFS.  7. The legacy TAT (i.e. timeAlignmentTimerCommon in SIB) is used for UL timing maintenance during RA-SDT procedure. (21/23)  8. The legacy TAT (i.e. timeAlignmentTimerCommon in SIB) starts/restarts when RAR TAC or TAC MAC CE is received, regardless of SDT procedure. No spec change is needed. (23/23)  9. CG-SDT resource is not released even if the legacy TAT expires. (23/23)  10. The token bucket mechanism is applied for SDT. (21/23)  11. Confirm that PHR is triggered at initiation of SDT procedure based on the existing PHR trigger. All the triggered PHRs are cancelled if all SDT data are included in the UL grant, if there is NO room in the MAC PDU to fit the PHR.  12. The R15/R16 PUSCH skipping mechanism is supported for CG-SDT  13. PHR is configured only by default MAC Cell Group configuration  14. BSR is configured only by default MAC Cell Group configuration  15. For SDT, ROHC continuity functionality can be configurable between the cell and RNA. Send LS to RAN3  16. LCH restrictions can be applied, re-using existing signalling, and it is up to gNB how restrictions are configured and MAC applies current specification rules)  17. If LCH restriction is applied for SDT, it is applied both for CG-SDT and RA-SDT.  18. FFS whether the logicalChannelSR-DelayTimer is not applied for logical channels configured with SDT  19. The NAS data can arrive at PDCP layer even if the RB is suspended. When does the NAS deliver UL data to AS is up to UE implementation. No spec changes are needed  20. If NAS data does not arrive at PDCP layer of suspended RBs, the SDT data volume is calculated by UE implementation. No spec changes are needed. A NOTE can be added to clarify calculation of data volume and can be discussed in the running CR.  21. FFS if the size of CCCH message is considered in SDT data volume calculation  22. Highest N SSBs of all SSBs actually transmitted as indicated in SIB1 is used for RSRP based TA validation  23. The Rel-16 CG configuration mechanism in licensed band is reused the baseline for CG-SDT.  24. At least for initial transmission we will have a mechanism to allow the UE to transmit the message again. FFS for retransmission for subsequent.  25. The UE uses/selects the same HARQ process for retransmission  26. The “CG-SDT timer” starts at the first “valid” PDCCH occasion from the end of the CG-SDT PUSCH transmission. The first “valid” PDCCH occasion is defined in RAN1  27. The “CG-SDT timer” can be started/restarted during for initial and subsequent transmissions  28. The UE restarts the “CG-SDT timer” at least:  • upon the PUSCH retransmission indicated by the CS-RNTI PDCCH  • after each CG-SDT transmission  29. The “CG-SDT timer” stops at least:  • When the UE receives RRC feedback messages (e.g. RRCResume, RRCSetup, RRCRelease and RRCReject)  30. The Rel-16 calculation on the HARQ process ID of the CG type-1 for licensed band is reused as the baseline for CG-SDT  31. The UE is allowed to initiate subsequent UL data transmission only after the reception of confirmation of initial transmission from the gNB  32. The UE can use multiple CG resources for the HARQ initial transmission as Rel-16 in the subsequent CG transmission phase  33. The following CG-SDT configurations are per UE:  - The new TA timer in RRC\_INACTIVE  - The RSRP change threshold for TA validation mechanism in SDT  - The SSB RSRP threshold for beam selection  34. RAN2 changes the agreements and as a baseline we will focus on initial BWP for RA and CG SDT. FFS if further work on CG SDT for non-initial BWP will be needed, based on RAN1 consensus.  35. Assumption that we won’t have L1 feedback as a functionality. Discuss subsequent and autonomous CG transmissions with email discussion. |

## RAN2#116Bis-e

|  |
| --- |
| 1. RAN2 confirms that SDT will be configured only on initial BWP and there is no L1 ACK feedback for CG-SDT. ASK RAN1 to confirm whether it is different from initial BWP and that there is no conflict with the agreement  2. For both DRBs and SRBs configured with SDT, RAN2 confirm that at the time of SDT data volume calculation, there should be no buffered packets in PDCP/RLC entities that will not be transmitted during SDT procedure  3. For DRBs configured with SDT, PDCP suspend is performed upon reception of RRCRelease message including suspendConfig so that PDCP PDUs are discarded, and PDCP SDUs already stored are considered in SDT data volume calculation. No specification change is needed.  4. For both DRBs and SRBs configured with SDT, RLC entity should be re-established upon reception of RRCRelease message including suspendConfig  5. For both DRBs and SRBs configured with SDT, the UE autonomously re-establishes RLC entities for both DRBs and SRBs upon reception of RRCRelease message including suspendConfig  6. RB level restriction (e.g. sdt-DRB-List) is applied for both CG-SDT and RA-SDT. For CG-SDT, existing LCH restriction (i.e. configuredGrantType1Allowed or allowedCG-List) can be further applied.  7. For CG-SDT resource validation, the UE compares the RSRP at the time of initiating CG-SDT procedure with the RSRP stored at the time when RRCRelease message is received  8. As baseline, the CG-SDT-TAT is stopped when a) UE enters RRC connected, and b) UE receives RRC Release at the end of SDT procedure and RRC Release does not include/configure CG resources. FFS if there is any impact to this agreement as a result of delta signalling  9. The CG-SDT-TAT does not stop at initiation of CG-SDT procedure  10. The CG-SDT-TAT does not stop at initiation of RA-SDT procedure  11. The CG-SDT-TAT does not stop at initiation of legacy RA procedure  12. The logicalChannelSR-DelayTimer is supported and configurable by SIB. All logical channels configured with SDT are configured with a same timer value. The logicalChannelSR-Mask is supported.  13. The size of CCCH message is not considered in SDT data volume calculation  14. If contention resolution fails during RA procedure (for both legacy RA and RA-SDT), the UE restores the NTA value used before RAR TAC is received  15. FFS and leave it to rapporteur If RAR TAC is received during RA-SDT procedure, the CG-SDT-TAT restarts at successful contention resolution  16. FFS and leave it to rapporteur If RAR TAC is received during legacy RA procedure, the CG-SDT-TAT restarts at successful contention resolution  17. FFS for SRBs, whether to discard PDCP SDUs upon reception of RRCRelease message including suspendConfig  18. SDT Failure Detection Timer has an extended duration to accommodate subsequent SDT procedure.  19. UE is does not monitor paging message during SDT procedure (UE monitors paging occasions for SI change notification and emergency notification as per previous agreement.)  20. Do not support on demand SI during SDT procedure.  21. UE shall not perform any periodic RNA update during SDT procedure. The rapporteur will find a simple solution to capture this in the RRC, aiming to follow legacy behavior (i.e. keep T380 running).  22. RRCReconfiguration and RRCReconfigurationComplete are not supported during an SDT session  23. The NW can NOT configure whether UL NAS transmission is allowed over SRB1 using SDT procedure  24. ULInformationTransfer (including NAS message) over SRB2 configured for SDT can be sent during SDT procedure if configured.  25. Network can respond with RRCSetup or RRCReject to RRCResumeRequest for SDT and the UE behaviour upon reception of the RRCSetup or RRCReject message is the same as legacy. FFS if anything additional needs to be added for RRCReject (i.e. similar to EDT)  26. During the SDT procedure (i.e. while SDT timer is running), UE monitors SI change indication in any paging occasion at least once per modification period (i.e. same as legacy RRC\_CONNECTED).  27. During the SDT procedure (i.e. while SDT timer is running), ETWS or CMAS capable UEs monitors PWS notification in any paging occasion at least once every defaultPagingCycle (i.e. same as legacy RRC\_CONNECTED).  28. Delta signaling can be supported in RRC signaling and will be considered CR drafting  29. Network can respond with RRCRelease with/without suspendConfig to RRCResumeRequest for SDT and the UE behaviours upon reception of the RRCRelease message is the same as legacy. RAN3 enhancements can be discussed if RAN3 sends LS.  30. RSRP-based TA validation is only applicable for initial CG-SDT and not needed for retransmission of the initial CG-SDT.  31. No additional NTA is defined for CG-SDT procedure  32. Upon expiry of CG-SDT-TAT , UE should (a) clears all SDT configured grant, (b) flushes HARQ buffer and (c) continue to maintain NTA.  33. Stick to the previous agreement: subsequent new transmission on CG-SDT is supported. Support ACK for first TB by dynamic scheduling of uplink new transmission for the same HARQ process (like legacy, no new mechanisms).  34. For subsequent TB on CG, UE initiated retransmission is not supported. Dynamic scheduling can be supported like legacy.  35. Subsequent downlink transmission can serve as an implicit acknowledgement for initial CG-SDT but not for subsequent CG-SDT.  36. ConfiguredGrantTimer is reused for CG-SDT for prohibiting the HARQ process for new uplink transmissions  37. Do not perform SSB reselection for retransmission for initial CG-SDT  38. CS-RNTI for CG-SDT is provided to the UE in RRCRelease message.  39. UE does not perform UL carrier reselection for subsequent CG-SDT transmission over CG-SDT resources within one CG-SDT procedure  40. Once a UL carrier is selected for a specific CG-SDT transmission, the UE should perform autonomous retransmission on the same uplink carrier on initial CG  41. There is no restriction on the candidate values of CG period. FFS on values for CG periods and time offset  42. Do not support multiple CG occasions per CG period.  43. If (a) the thresholds for SSB selection and SSB subset selection for TA-validation are different and (b) the highest beam measurement is below the configured threshold, the beam with the highest beam measurement value is used for TA validation  44. CG-SDT timer for initial transmission should be stopped when PDCCH addressed to C-RNTI and CS-RNTI is received. When timer expires the UE is allowed to retransmit for initial CG. CG-SDT is used for controlling retransmissions  45. UE does not use RA-SDT resources during ongoing CG-SDT session |

## RAN2#117-e

|  |
| --- |
| 1. Downlink RSRP reference at the time of receiving RRCRelease with suspendConfig for the RSRP-based TA validation is determined by the MO configured for the cell where the UE is released from RRC\_CONNECTED to RRC\_INACTIVE. FFS if there is any issues from RAN4 raised  2. Consider cg-SDT-TimeAlignmentTimer to be expired and perform the procedure in 5.2 (Maintenance of uplink time alignment) at MAC reset. Ensure in the CR that the configuration is not released (i.e. remove notification from MAC CR to release the configuration). FFS impacts for delta configuration.  3. For autonomous re-tx, fix the RV to be 0 for both the initial and retransmission of initial CG-SDT transmission. Inform RAN1?  4. [CB] Adopt the same sdt-RSRP-ThresholdSSB-SUL used in MAC for uplink carrier selection for RA-SDT and CG-SDT. FFS relationship with RACH partitioning discussion and how to enable this in RRC configuration. FFS if threshold is common for a feature combination  5. [CB cover it in email discussion] UE triggers SDT failure when the number of preamble transmission in RA-SDT exceeds the threshold preambleTransMax. (20/21) FFS for RACH triggered during subsequent transmission for both CG-SDT and RA-SDT.  6. CG-SDT resources are not used during an RA-SDT. Consider the CG-SDT-TAT as expired at the initiation of an RA-SDT procedure  7. UE stops the legacy TAT when contention resolution is successful for RACH triggered during CG-SDT  8. Similar to legacy, any pdcch addressed to C-RNTI for initial CG transmission should be treated as a confirmation of successful initial CG transmission regardless of HARQ PID  9. The UE determines the LCG associated with an SDT DRB from the stored configuration in the UE context (i.e. from LogicalChannelConfig in RLC-BearerConfig stored for the DRB)  10. It is up to the network how to configure the logicalChannelSR-Mask value for LCHs of DRBs configured for SDT.  11. UE-autonomous switching from RA-SDT to normal/legacy RACH after a configured number of failures is not supported.  12. Existing values for of ra-ContentionResolutionTimer and msgB-ResponseWindow can be reused for SDT. No need to introduce new configuration values. (17/20)  13. Confirm earlier agreement: During subsequent CG transmission phase (i.e. after the UE has received response from NW), if there is no available SSB above the configured RSRP CG-SDT threshold, the HARQ entity doesn’t use the CG-SDT resource, and the UE triggers SR when there is no valid UL grant (UE falls back to legacy RA for SR) (19/20).  14. During subsequent CG transmission phase (i.e. after the UE has received response from NW), if there at least one available SSB above the configured RSRP CG-SDT threshold, it is up to UE implementation to select an SSB above the RSRP threshold (19/20).  15. For RA initiated after CG-SDT, the UE multiplexes a C-RNTI MAC CE instead of RRC resume request in Msg3 or MsgA (20/20)  16. If CG-SDT-TAT expires while the CG-SDT procedure is ongoing and if UE has not received a response from the network after the initial UL CG-SDT transmission, UE terminates ongoing SDT procedure (15/20). FFS follow-up UE behaviour (e.g. whether the UE triggers SDT failure and goes to IDLE mode).  17. UE performs SDU discard for SRBs at the reception of RRCRelease with SDT configuration. (20/20)  18. Proposal 15: No support expressed for the following proposals:  - Allow the UE to rebuild the TB upon transmitting it again on CG-SDT, for the benefit of updating the BSR MAC CE (1/20)  - SDT DRBs that cannot be multiplexed on SDT resources available in the current SDT procedure due to LCH restrictions are considered as non-SDT DRBs for the duration of the SDT procedure (2/20)  - [CB tomorrow depending on DCCA] UE does not update nor increase Bj while in Inactive state, i.e. between the reception time of RRC release message and the initiation of the SDT procedure (1/20)  - Allow the UE to switch to RA-SDT (if the RA-SDT criteria is met) when the initial TB is not successfully transmitted in the initial phase of CG-SDT (2/20)  - maintain uplink timing alignment by gradually adjusting uplink timing when there is a DL timing difference from the DL timing reference observed by the UE (1/20)  - power ramping for CG-SDT retransmissions, i.e. after the expiry of the cg-SDT-retransmissionTimer (1/20)  19. Reference RSRP value for RSRP-based TA validation in MAC is captured by referring to RAN4 procedural text, e.g. MAC considers the TA valid if "The change in the RSRP of the downlink pathloss reference calculated as specified in 38.133 section 5.x [11] is less than cg-SDT-RSRP-ChangeThreshold."  20. Capture in current CR where the beam consolidation procedure text for RSRP-based TA validation in RRC – minimize impact to the spec and if it doesn’t work well, rapporteurs can decided at the end  21. The UE restarts the CG-SDT-TAT when the contention resolution is successful for a legacy RACH procedure initiated during CG-SDT procedure (due to absence of UL resource).  22. When CG-TAT expires, MAC shall release the CG resources. RRC keeps the CG configuration (for delta signalling).  23. Add a condition that RNAU is only initiated if Txxx (i.e. the new SDT timer) is not running  24. The UE is not required to perform/log measurements during SDT  25. The UE is not required to perform Idle/inactive measurements in section 5.7.8 of RRC during SDT. Check the details of this requirements  26. Delta signalling is based on the previous SDT configuration (i.e. only applicable to SDT operation and will be released when the UE moves to connected and hence delta configuration based on connected mode CG configuration is not supported). FFS other details  27. for ROHC continuity, update the running CR as follows:  28. “the cell for ROHC continuity is the PCell where the UE receives the RRCRelease message”  29. DataVolumeThreshold is configured only in SIB1.  30. RA-SDT is defined as an optional capability per UE without need for xDD and FRx differentiation.  31. For handling RRC Reject during SDT procedure, No change (i.e. EDT behaviour is followed). LS to SA3?  32. SDT cannot be triggered if there is non-SDT data buffered at PDCP/RLC.  33. SDT can be configured only for SRB (i.e. without resuming any DRB). Define the sdt-DRB-List-r17 with the list starting in 0, or as SetupRelease type.  34. If UE detects an SDT failure of ongoing SDT session for the transfer of NAS message, RRC informs NAS about the failure for NAS message transfer. Discuss further if any specification change is needed or not. [CB] LS to CT1?  35. If T380 expires and UE receives RRCReject during SDT procedure, in order to keep the periodic RNAU: UE sets the variable pendingRNA-Update to true.  36. CG-SDT is defined as an optional capability per UE with the need for xDD and FRx differentiation  37. Separate capability is not needed for multiple CG-SDT configured grants (reuse the UE capability signalling for multiple CG)  38. When SDT is initiated, RRC will not indicate the selected carrier to MAC  39. Note that says: “UE shall avoid a consecutive SDT procedures with a different payload but same security key” is not added to specification.  40. The nrofSS-BlocksToAverage configuration in SIB2 is reused for the RSRP change based TA validation. nrofSS-BlocksToAverage configuration is not supported in RRC Release.  41. As a baseline, for handling the DL non-SDT data/signalling arrival during SDT procedure without anchor relocation: network use RAN paging to trigger the following-up RRC resume procedure after UE is moved to Inactive state.  42. UE supporting CG-SDT need not support 4-step RA-SDT (i.e. these capabilities are independent)  43. DVT is configured as follows: ENUMERATED {byte32, byte100, byte200, byte400, byte600, byte800, byte1000, byte2000, byte4000, byte8000, byte9000, byte10000, byte12000, byte24000, byte48000, byte96000}  44. Do not support long CG-SDT periodicities (anything longer than existing values for CG).  45. For non-SDT data arrival indication, ResumeCause value is included in UAI as an optional IE (and hence is provided to the network if upper layers provide it to the AS). If NAS provides it the UE shall include it in resume cause.  46. Separate capability is needed for SRB (i.e. for NAS messages)  47. SDT error detection timer (t3xx) is configured as follows:  48. t3XX ENUMERATED {ms100, ms200, ms300, ms400, ms600, ms1000, ms2000, ms3000, ms4000, spare6, spare5, spare4, spare3, spare2, spare1} . FFS for longer values (i.e. 6s)  49. LS to CT1 can be sent (LS text discussion to happen offline after the more urgent stage-3 CRs are finalised)  50. For handling RACH failure (i.e. that Max RACH preamble transmission is reached) during SDT procedure, MAC indicates RACH problem indication to RRC. SDT failure is declared and UE moves to IDLE mode  51. CCCH solution will no longer be pursued for non-SDT data arrival for Rel-17 |