**3GPP TSG-RAN2 Meeting #123 R2-230**

**Toulouse, France , 21st -25th August, 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **38.321** | **CR** | CRnum | **rev** | **-** | **Current version:** | 17.4.0 |  |
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| *For* [***HELP***](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)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Introduction of MT-SDT to MAC spec |
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| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | RAN2 |
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| ***Work item code:*** | NR\_MT\_SDT-Core |  | ***Date:*** | 2023-08-21 |
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| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *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 canbe 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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | * Issue1: Abbreviation should be added for MO-SDT and MT-SDT
* Issue2: The current spec is written in the background of MO-SDT. In this introduction of MT-SDT, it needs to be clarified that the small data transmission procedure can be triggered for either MO-SDT or MT-SDT.
* Issue3: We have agreed that CCCH message can be transmitted on CG-SDT without data when triggered by MT-SDT. The legacy conditions for SDT for logical channel restriction needs to be revised. Another agreement has been made during RAN2#122: ***LCH restrictions are checked for DRBs as in MO-SDT (if UL data is available during SDT procedure). Ensure CCCH can be transmitted in CG-SDT when MT-SDT is triggered in stage 3 discussion.***
* Issue4: it is still pending whether the legacy DVT condition is needed when the SDT procedure is triggered for MT-SDT

=================Update after RAN2#122======================* Issue5: RAN2#122 has agreed on the following ***A separate sdt-RSRP threshold for MT-SDT can be configured, at least in the case where MO-SDT is not configured in the cell***.
	+ When lagacy RACH is triggered for MT-SDT, the UE should check this RSRP condition. If the condition is not satisfied, the UE should indicate to the upper layer that the condition to trigger legacy RACH for MT-SDT cannot be satisfied.
* Issue6: RAN2#122 has agreed on the following ***RA-SDT resources are not used for MT-SDT initiation RACH***
	+ When checking the conditions for initiating RA-SDT during SDT type seleciton procedure, condition needs to be added that the SDT procedure is not triggered for MT-SDT
* Issue7: RAN2#122 has agreed on the following ***For both MO and MT-SDT, if the next CG-SDT resource is too far, then RACH resource can be selected first. This is checked at the point of initial resource selection (e.g. CG SDT selection). FFS what is too far and how this is configured. Assumption is that we will continue this discussion in SDT session.***
	+ Hence, a condition needs to be added for initiating CG-SDT for both MO-SDT and MT-SDT
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| ***Summary of change:*** | The following changes have been applied in the current CR* Change1: Add abbreviation for MT-SDT and MO-SDT
* Change2: Add the condition for the DVT condition that it is for legacy MO-SDT. FFS whether it is applicable for MT-SDT
* Change3: For the condition of *configuredGrantType1Allowed* for CG-SDT type selection, specify that it is only for the case when the SDT procedure is triggered for MO-SDT
* Change4: For the DVT condition, add the condition that it is used for MO-SDT and it is FFS whether it is applicable to MT-SDT as well.
* Change5: Add a new clause with RRC parameter and MAC procedure for the condition to initiate RACH procedure when triggered by RRC layer for MT-SDT
* Change6a: Clarify in the selection of the set of RA resource that SDT is not applicable for Random Access procedure triggered by upper layer for MT-SDT
* Change6b: When SDT procedure is triggered by upper layer for MT-SDT, RA-SDT cannot be used.
* Change7a: RRC parameter added for the condtion that “the next CG-SDT resource is not too far”
* Change7b: MAC procedure added for SDT procedure that the next CG-SDT resource cannot be too far when initiating CG-SDT for SDT procedure
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| ***Consequences if not approved:*** | The new feature MT-SDT can not be well supported by the MAC spec |
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| ***Clauses affected:*** | 3.2, 5.1.1b, 5.1.1x, 5.27.1 |
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|  | **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:*** | Ver0 in RAN2#122: R2-2304795Ver1 in RAN2#123: R2-230 |

====================================CHAGNE BEGIN====================================

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] 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].

AP Aperiodic

BFR Beam Failure Recovery

BSR Buffer Status Report

BWP Bandwidth Part

CE Control Element

CG Cell Group

CG-SDT Configured Grant-based SDT

CI-RNTI Cancellation Indication RNTI

CSI Channel State Information

CSI-IM CSI Interference Measurement

CSI-RS CSI Reference Signal

CS-RNTI Configured Scheduling RNTI

DAPS Dual Active Protocol Stack

DCP DCI with CRC scrambled by PS-RNTI

DL-PRS DownLink-Positioning Reference Signal

G-CS-RNTI Group Configured Scheduling RNTI

G-RNTI Group RNTI

IAB Integrated Access and Backhaul

INT-RNTI Interruption RNTI

LBT Listen Before Talk

LCG Logical Channel Group

LCP Logical Channel Prioritization

MBS Multicast/Broadcast Services

MCCH MBS Control Channel

MCCH-RNTI MBS Control Channel RNTI

MCG Master Cell Group

MO-SDT Mobile Originated SDT

MPE Maximum Permissible Exposure

MTCH MBS Traffic Channel

MT-SDT Mobile Terminated SDT

NSAG Network Slice AS Group

NUL Normal Uplink

NZP CSI-RS Non-Zero Power CSI-RS

PDB Packet Delay Budget

PEI-RNTI Paging Early Indication RNTI

PHR Power Headroom Report

PS-RNTI Power Saving RNTI

PTAG Primary Timing Advance Group

PTM Point to Multipoint

PTP Point to Point

QCL Quasi-colocation

PPW PRS Processing Window

PRS Positioning Reference Signal

RA-SDT Random Access-based SDT

RS Reference Signal

SCG Secondary Cell Group

SDT Small Data Transmission

SFI-RNTI Slot Format Indication RNTI

SI System Information

SL-RNTI Sidelink RNTI

SLCS-RNTI Sidelink Configured Scheduling RNTI

SpCell Special Cell

SP Semi-Persistent

SP-CSI-RNTI Semi-Persistent CSI RNTI

SPS Semi-Persistent Scheduling

SR Scheduling Request

SS Synchronization Signals

SSB Synchronization Signal Block

STAG Secondary Timing Advance Group

SUL Supplementary Uplink

TAG Timing Advance Group

TCI Transmission Configuration Indicator

TPC-SRS-RNTI Transmit Power Control-Sounding Reference Signal-RNTI

TRIV Time Resource Indicator Value

TRP Transmit/Receive Point

TRS CSI-RS for tracking

U2N UE-to-Network

UCI Uplink Control Information

V2X Vehicle-to-Everything

ZP CSI-RS Zero Power CSI-RS

=====================================NEXT CHANGE===================================

5.1.1b Selection of the set of Random Access resources for the Random Access procedure

The MAC entity shall:

1> if the BWP selected for Random Access procedure is configured with both set(s) of Random Access resources with *msg3-Repetitions* set to *true* and set(s) of Random Access resources without *msg3-Repetitions* set to *true* and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg3*; or

1> if the BWP selected for Random Access procedure is only configured with the set(s) of Random Access resources with *msg3-Repetitions* set to *true*:

2> assume Msg3 repetition is applicable for the current Random Access procedure.

1> else:

2> assume Msg3 repetition is not applicable for the current Random Access procedure.

NOTE 1: Void.

1> if contention-free Random Access Resources have not been provided for this Random Access procedure and one or more of the features including RedCap and/or Slicing and/or SDT and/or MSG3 repetition is applicable for this Random Access procedure:

NOTE 2: The applicability of SDT is determined by MAC entity according to clause 5.27. The applicability of *NSAG-ID* is determined by upper layers when the Random Access procedure is initiated. The applicability of RedCap is also determined by upper layers when Random Access procedure is initiated and it is applicable to the Random Access procedures initiated by PDCCH orders and any Random Access procedure initiated by the MAC entity.

NOTE 3: SDT is not applicable for the Random Access procedure initiated by upper layers for MT-SDT,

2> if none of the sets of Random Access resources are available for any feature applicable to the current Random Access procedure (as specified in clause 5.1.1c):

3> select the set(s) of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if there is one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure:

3> select this set of Random Access resources for this Random Access procedure.

2> else (i.e. there are one or more sets of Random Access resources available that are configured with indication(s) for a subset of all features triggering this Random Access procedure):

3> select a set of Random Access resources from the available set(s) of Random Access resources based on the priority order indicated by upper layers as specified in clause 5.1.1d for this Random Access Procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and RedCap is applicable for the current Random Access procedure and there is one set of Random Access resources available that is only configured with RedCap indication:

2> select this set of Random Access resources for this Random Access procedure.

1> else:

2> select the set of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for the current Random Access procedure.

=====================================NEXT CHANGE===================================

### 5.1.1x Condition for initiating Random Access procedure for MT-SDT

RRC configures the following parameters for the conditions to initiate Random Access procedure for MT-SDT:

- *rsrp-ThresholdMT-SDT*: an RSRP threshold for Random Access procedure for MT-SDT.

Before the Random Access procedure is initiated for MT-SDT by the upper layer according to TS 38.331 [5], the MAC entity shall:

1. if the downlink pathloss reference is less than *rsrp-ThresholdMT-SDT*:

2> indicate to the upper layer that the condition for initiating Random Access procedure for MT-SDT cannot be fulfilled.

1> else:

2> indicate to the upper layer that the condition for initiating Random Access procedure for MT-SDT is fulfilled.

=====================================NEXT CHANGE===================================

### 5.27.1 General

The MAC entity may be configured by RRC with SDT and the SDT procedure may be initiated by RRC layer for MO-SDT or MT-SDT. The SDT procedure can be performed either by Random Access procedure with 2-step RA type or 4-step RA type (i.e., RA-SDT) or by configured grant Type 1 (i.e., CG-SDT).

RRC configures the following parameters for SDT procedure:

- *sdt-DataVolumeThreshold*: data volume threshold for the UE to determine whether to perform SDT procedure;

- *sdt-RSRP-Threshold*: RSRP threshold for UE to determine whether to perform SDT procedure;

Editor’s NOTE: It needs to be further discussed whether the MT-SDT RSRP threshold can be applicable for the cases when CG-SDT is triggered for MT-SDT according to the following agreement: *9. A separate sdt-RSRP threshold for MT-SDT can be configured, at least in the case where MO-SDT is not configured in the cell.*

- *offsetToNextCG-OccasionThreshold*: time threshold for the UE to determine whether to perform CG-SDT;

- *cg-SDT-RSRP-ThresholdSSB*: an RSRP threshold configured for SSB selection for CG-SDT.

The MAC entity shall, if initiated by the upper layers for SDT procedure:

1> if the data volume of the pending UL data across all RBs configured for SDT is less than or equal to *sdt-DataVolumeThreshold* when the procedure is initiated for MO-SDT as in TS 38.331 [5]; and

NOTE 1: For SDT procedure, the MAC entity also considers the suspended RBs configured with SDT for data volume calculation. It is up to the UE's implementation how the UE calculates the data volume for the suspended RBs. Size of the CCCH message is not considered for data volume calculation

Editor’s NOTE: Whether the above condition is needed is dependent on the further discussion on *FFS 3a: Check for DVT (if UL data becomes available in UL)*.

1> if the RSRP of the downlink pathloss reference is higher than *sdt-RSRP-Threshold*; or

1> if *sdt-RSRP-Threshold* is not configured:

2> if the Serving Cell is configured with supplementary uplink as specified in TS 38.331 [5]; and

2> if the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdSSB-SUL*:

3> select the SUL carrier.

2> else:

3> select the NUL carrier.

2> if CG-SDT is configured on the selected UL carrier, and TA for CG-SDT is valid according to clause 5.27.2 in the first available CG occasion for initial CG-SDT transmission with CCCH message according to clause 5.8.2; and

2> if the offset between the initiation of the SDT procedure and the next CG-SDT occasion is less than *offsetToNextCG-OccasionThreshold*, if configured; and

2> if the SDT procedure is initiated for MO-SDT as in TS 38.331 [5], for each RB having data available for transmission, *configuredGrantType1Allowed*, if configured, is configured with value *true* for the corresponding logical channel; and

2> if at least one SSB configured for CG-SDT with SS-RSRP above *cg-SDT-RSRP-ThresholdSSB* is available:

Editor’s NOTE: It is still FFS how to refine the definition of "how far" according to the current agreement. *For both MO and MT-SDT, if the next CG-SDT resource is too far, then RACH resource can be selected first. This is checked at the point of initial resource selection (e.g. CG SDT selection). FFS what is too far and how this is configured. Assumption is that we will continue this discussion in SDT session. CONFIRM with main session [CB]*.

3> indicate to the upper layers that the conditions for initiating SDT procedure are fulfilled;

3> perform CG-SDT procedure on the selected UL carrier according to clause 5.8.2.

2> else if a set of Random Access resources for RA-SDT is configured and can be selected according to clause 5.1.1b on the selected UL carrier; and

2> if the SDT procedure is initiated for MO-SDT as in TS 38.331 [5]:

3> if *cg-SDT-TimeAlignmentTimer* is running, consider *cg-SDT-TimeAlignmentTimer* as expired and perform the corresponding actions in clause 5.2;

3> indicate to the upper layers that the conditions for initiating SDT procedure are fulfilled.

2> else:

3> indicate to the upper layers that the conditions for initiating SDT procedure are not fulfilled.

1> else:

2> indicate to the upper layers that the conditions for initiating SDT procedure are not fulfilled.

If RA-SDT is selected above and after the Random Access procedure is successfully completed (see clause 5.1.6), the UE monitors PDCCH addressed to C-RNTI received in random access response until the RA-SDT procedure is terminated. If CG-SDT is selected above and after the initial transmission for CG-SDT is performed, the UE monitors PDCCH addressed to C-RNTI as stored in UE Inactive AS context as specified in TS 38.331 [5] and CS-RNTI until the CG-SDT procedure is terminated.

NOTE 2: When the UE determines if there is an SSB with SS-RSRP above *cg-SDT-RSRP-ThresholdSSB*, the UE uses the latest unfiltered L1-RSRP measurement.

===============================CHANGE ENDS=========================================

# Annex A: Collections of agreements for MT-SDT

## RAN2#120 20221114-20221118

**Agreements**

1. For RAN paging, MT-SDT indication (at least one bit) is explicitly included per UE via a paging message. FFS if more information for MT-SDT are needed FFS what the indication will be called. FFS signalling details
2. Rel-18 MT-SDT after the MT-SDT paging trigger is detected, RA-SDT and CG SDT solutions/procedures specified in Rel-17 is re-used as a baseline. The detailed triggers will be discussed on case by case. FFS on resources used for access
3. UE can use non-SDT random access resources for accessing the network for an MT-SDT transfer. The UE can also use the configured grant resources and/or MO-RA resources.
4. The network should be able to differentiate why the UL access was triggered, i.e. implicit or explicit indication by the UE.
5. MT-SDT is data that belongs to bearers that are configured for SDT. FFS whether the configuration is MO-SDT or MT-SDT specific. The network can only trigger MT-SDT if the data belongs to those bearers.
6. It is possible for the network to configure only MT-SDT without MO-SDT RA resources and/or CG-SDT. Subsequent UL/DL data belonging to SDT bearers while in INACTIVE is allowed like MO-SDT procedure. FFS stage 3 details
7. New Resume cause in RRC resume will be introduced, one code point MT-SDT indication

## RAN2#121 20230227-20230303

**Agreement:**

1. Include a one-bit indication in paging to trigger MT-SDT. We will ensure that the CCCH message can be transmitted over CG.
2. Indication is per UE. FFS on signalling.
3. In case condition for paging triggered MT-SDT is not fulfilled the UE initiates RRC Resume procedure. Resume cause FFS
4. Upon receiving MT-SDT trigger, the UE shall initiate SDT procedure if the following checks are satisfied (all these same as Rel-17)

- FFS 3a: Check for DVT (if UL data becomes available in UL)

- 3b: Check for SDT RSRP threshold

- 3c: Check for TA validation before selecting CG (if applicable)

- 3d: Check for SSB level RSRP threshold for CG resource (if applicable)

5. When UE resumes for MT-SDT, UE resumes all RBs configured for SDT

6. RBs configured for SDT are common for MO-SDT and MT-SDT

7. If there is valid CG-SDT resources, the UE should use CG-SDT to transmit the response. FFS on whether we need to optimize for case when CG periodicity is too long

8. To confirm that when SDT is initiated due to MT-SDT, UE can exchange subsequent DL/UL SDT data on the resumed RBs. This clarifies the RB behaviour of related RAN2#120 agreement.

[R2-2302101](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_121%5CDocs%5CR2-2302101.zip) [AT120][306][R18 MT-SDT] summary of offline discussion (ZTE)

**Agreements**

1. Specify an RRC procedure for RRCResume for MT-SDT initiation without checking for availability of UL data (i.e. if MT-SDT is initiated first the resume cause will be set to MT-SDT)
2. UE is allowed to initiate either MO-SDT based resume or non-SDT based resume at any point (before initation RRCResumeRequest for MT-SDT) using separate procedures
3. If MT-SDT procedure is initiated, for RACH during subsequent data transfer (i.e. RACH triggered due to SR), UE uses only the non-SDT RACH resources (i.e. like legacy)

## RAN2#122 20230522-20230526

**Agreements:**

1. Allow support of only MT-SDT in a cell. A separate SIB configuration will be introduced. FFS what is put in there.
2. For paging indication signalling, a new list of paging records for MT-SDT indication is optionally included in paging message using non critical extension. Each record in this list optionally includes 1 bit MT-SDT indication. UE identity and access type are not included in paging record of this list.
3. gNB may include MT-SDT indication in paging message only if UE’s I-RNTI is included in the paging message (i.e. MT-SDT is only used by RAN initiated paging).
4. UE selects '0' as the Access Category when the resumption of the RRC connection is triggered by response to the MT-SDT triggering in a PAGING message
5. MT-SDT is only applicable to the legacy MT-Access use case (i.e. it is not applicable to access identities 1, 2 and 11-15).
6. SRB2 can be used for MT-SDT (i.e. similar to MO-SDT)
7. No additional enhancement is needed specifically for RedCap UE to monitor paging for MT-SDT
8. When RRC resume is triggered due to MT-SDT and in the case the condition for paging triggered MT-SDT is not fulfilled, the UE initiates RRC Resume procedure with Resume cause “mt-Access”.
9. A separate sdt-RSRP threshold for MT-SDT can be configured, at least in the case where MO-SDT is not configured in the cell.

Agreements:

1. RRC explicitly indicates to MAC whether resume is trigged due to MT-SDT
2. LCH restrictions are checked for DRBs as in MO-SDT (if UL data is available during SDT procedure). Ensure CCCH can be transmitted in CG-SDT when MT-SDT is triggered in stage 3 discussion.
3. Assumption is that if the UE has UL data the UE can still check and trigger MO-SDT (it is up to UE implementation)
4. RA-SDT resources are not used for MT-SDT initiation RACH
5. In case CG-SDT resources cannot be used or are not available for MT-SDT, UE uses non-SDT RACH for RA-based MT-SDT. FFS whether new triggers are defined
6. There is no need to define new Rel-18 CG configurations specific to MT-SDT.
7. When the UE is configured with both MO and MT SDT the radio bearer configuration is common for both.
8. For both MO and MT-SDT, if the next CG-SDT resource is too far, then RACH resource can be selected first. This is checked at the point of initial resource selection (e.g. CG SDT selection). FFS what is too far and how this is configured. Assumption is that we will continue this discussion in SDT session. **CONFIRM with main session [CB]**

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| [R2-2305350](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2305350.zip) SDT Enhancements for Configured grants [SDT-Enh-CG] Ericsson, Intel Corporation, T-Mobile USA, ZTE Corporation discussion Rel-18 TEI18* Agreeable, under condition that RAN1 impact is very small (e.g. update of a table): Extend the maximum periodicity for CG-SDT to cover longer periodicities.
* Send LS to R1 ask about impact.
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