**3GPP TSG-RAN WG2 Meeting #114-e *R2-2106783***

**Electronic Meeting, May 19th – 27th, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **37.340** | **CR** | **0274** | **rev** | **-** | **Current version:** | **16.5.0** |  |
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| *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)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | Clarification on RRC full config for PSCell change |
|  |  |
| ***Source to WG:*** | NTTDOCOMO INC., Ericsson, Nokia, Nokia Shanghai Bell, Intel, Samsung, Fujitsu, ZTE Corporation, Sanechips, NEC |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2021-05-04 |
|  |  |  |  |  |
| ***Category:*** | **A** |  | ***Release:*** | Rel-16 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | In R2-1804100, RAN2 requests RAN3 to create a RRC full config indication in X2 for SN to indicate the full config. After receving this RRC full config indication in SGNB ADDITION REQUEST ACKNOWLEDGE message in X2, MN releases and adds the NR SCG part of the configuration and generates drb-ToRleaseList for the SN terminated RBs towards the UE.After that, RAN3 introduced the RRC full config indication also in SGNB MODIFICATION REQUIRED and SGNB MODIFICATION REQUEST ACK messages for intra-CU inter-DU full config case (R3-183923, R3-183924), to cover the case where a target DU is not able to comprehend the SCG configuration of the source DU. In current TS36.331, for (NG)EN-DC, it is specified that if the target SgNB cannot comprehend the NR SCG configuration provided by the source SgNB, the MN releases and adds the NR SCG part of the configuration and generates *drb-ToReleaseList* for the SN terminated RBs towards the UE. This applies to SN addition/change (covered in R2-1804100), but it is unclear what is the MN behaviour for SN modification (introduced in R3-183923, R3-183924).For the SN modification case, since the PDCP termination point is not changed for intra-CU inter-DU PSCell change, there is typically no need to release the SN terminated RBs. For network implementation flexibility, SN modification including key change for an SN terminated DRB is allowed, upon security key change, the SN may choose between options to either release the radio bearer configuration or re-establish PDCP for the SN terminated radio bearers. |
|  |  |
| ***Summary of change:*** | 1. Add in case SN includes the indication of full RRC configuration in SgNB Modification Request Acknowledge or SgNB Modification Required message to MN e.g. comprehension failure upon intra CU inter DU change, MN performs release and add of the NR SCG part of the configuration but does not release SN terminated radio bearers towards the UE in 10.3.1.
2. Add in case the target SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE in 10.5.1 and 10.7.1.

**Impact Analysis**Impacted 5G architecture options: (NG)EN-DCImpacted functionality:* PSCell change

Inter-operability:There is no inter-opterability problem, since change is only related to network behavior which is not seen by UE. |
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| ***Consequences if not approved:*** | In case of release/add of the NR SCG part of the configuration for SN modification, it remains unclear whether MN takes the same action as the case of SN addition/change. |
|  |  |
| ***Clauses affected:*** | 10.3.1, 10.5.1, 10.7.1 |
|  |  |
|  | **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:*** |  |

*START OF CHANGE*

## 10.3 Secondary Node Modification (MN/SN initiated)

### 10.3.1 EN-DC

The Secondary Node Modification procedure may be initiated either by the MN or by the SN and be used to modify, establish or release bearer contexts, to transfer bearer contexts to and from the SN or to modify other properties of the UE context within the same SN. It may also be used to transfer an NR RRC message from the SN to the UE via the MN and the response from the UE via MN to the SN (e.g. when SRB3 is not used). In case of CPC, this procedure is used to configure or modify CPC configuration within the same SN.

The Secondary Node modification procedure does not necessarily need to involve signalling towards the UE.

**MN initiated SN Modification**



Figure 10.3.1-1: SN Modification procedure - MN initiated

The MN uses the procedure to initiate configuration changes of the SCG within the same SN, e.g. the addition, modification or release of SCG bearer(s) and the SCG RLC bearer of split bearer(s), as well as configuration changes for SN terminated MCG bearers. Bearer termination point change is realized by adding the new bearer configuration and releasing the old bearer configuration within a single MN initiated SN Modification procedure for the respective E-RAB. The MN uses this procedure to perform handover within the same MN while keeping the SN. The MN also uses the procedure to query the current SCG configuration, e.g. when delta configuration is applied in an MN initiated SN change. The MN also uses the procedure to provide the S-RLF related information to the SN. The MN may not use the procedure to initiate the addition, modification or release of SCG SCells. The SN may reject the request, except if it concerns the release of SN terminated bearer(s) or the SCG RLC bearer of MN terminated bearer(s), or if it is used to perform handover within the same MN while keeping the SN. Figure 10.3.1-1 shows an example signalling flow for an MN initiated SN Modification procedure.

1. The MN sends the *SgNB Modification Request* message, which may contain bearer context related or other UE context related information, data forwarding address information (if applicable) and the requested SCG configuration information, including the UE capability coordination result to be used as basis for the reconfiguration by the SN. In case a security key update in the SN is required, a new *SgNB Security Key* is included. In case of SCG RLC re-establishment for E-RABs configured with an MN terminated bearer with an SCG RLC bearer for which no bearer type change is performed, the MN provides a new UL GTP tunnel endpoint to the SN. The SN shall continue sending UL PDCP PDUs to the MN with the previous UL GTP tunnel endpoint until it re-establishes the RLC and use the new UL GTP tunnel endpoint after re-establishment. In case of PDCP re-establishment for E-RABs configured with an SN terminated bearer with an MCG RLC bearer for which no bearer type change is performed, the MN provides a new DL GTP tunnel endpoint to the SN. The SN shall continue sending DL PDCP PDUs to the MN with the previous DL GTP tunnel endpoint until it performs PDCP re-establishment and use the new DL GTP tunnel endpoint starting with the PDCP re-establishment.

2. The SN responds with the *SgNB Modification Request Acknowledge* message, which may contain SCG radio resource configuration information within a NR RRC configuration message and data forwarding address information (if applicable). In case of a security key update (with or without PSCell change), for E-RABs configured with the MN terminated bearer option that require X2-U resources between the MN and the SN, for which no bearer type change is performed, the SN provides a new DL GTP tunnel endpoint to the MN. The MN shall continue sending DL PDCP PDUs to the SN with the previous DL GTP tunnel endpoint until it performs PDCP re-establishment or PDCP data recovery, and use the new DL GTP tunnel endpoint starting with the PDCP re-establishment or data recovery. In case of a security key update (with or without PSCell change), for E-RABs configured with the SN terminated bearer option that require X2-U resources between the MN and the SN, for which no bearer type change is performed, the SN provides a new UL GTP tunnel endpoint to the MN. The MN shall continue sending UL PDCP PDUs to the SN with the previous UL GTP tunnel endpoint until it re-establishes the RLC and use the new UL GTP tunnel endpoint after re-establishment.

NOTE x: In case SN includes the indication of full RRC configuration in *SgNB Modification Request Acknowledge* message to MN e.g. comprehension failure upon intra-CU inter-DU change, MN performs release and add of the NR SCG part of the configuration but does not release SN terminated radio bearers towards the UE.

3-5. The MN initiates the RRC connection reconfiguration procedure, including the NR RRC configuration message. The UE applies the new configuration, synchronizes to the MN (if instructed, in case of intra-MN handover) and replies with *RRCConnectionReconfigurationComplete*, including a NR RRC response message, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

6. Upon successful completion of the reconfiguration, the success of the procedure is indicated in the *SgNB Reconfiguration Complete* message.

7. If instructed, the UE performs synchronisation towards the PSCell of the SN as described in SgNB addition procedure. Otherwise, the UE may perform UL transmission after having applied the new configuration.

8. If PDCP termination point is changed for bearers using RLC AM, and when RRC full configuration is not used, the SN Status Transfer takes place between the MN and the SN (Figure 10.3.1-1 depicts the case where a bearer context is transferred from the MN to the SN).

NOTE 0: The SN may not be aware that a SN terminated bearer requested to be released is reconfigured to a MN terminated bearer. The SN Status for the released SN terminated bearers with RLC AM may also be transferred to the MN.

9. If applicable, data forwarding between MN and the SN takes place (Figure 10.3.1-1 depicts the case where a bearer context is transferred from the MN to the SN).

10. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the E-RABs to be released and for the E-RABs for which the S1 UL GTP Tunnel endpoint was requested to be modified.

NOTE 1: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related bearer is stopped.

11. If applicable, a path update is performed.

**SN initiated SN Modification with MN involvement**



Figure 10.3.1-2: SN Modification procedure - SN initiated with MN involvement

The SN uses the procedure to perform configuration changes of the SCG within the same SN, e.g. to trigger the release of SCG bearer(s) and the SCG RLC bearer of split bearer(s) (upon which the MN may release the bearer or maintain current bearer type or reconfigure it to an MCG bearer, either MN terminated or SN terminated), and to trigger PSCell change (e.g. when a new security key is required or when the MN needs to perform PDCP data recovery). The MN cannot reject the release request of SCG bearer and the SCG RLC bearer of a split bearer. Figure 10.3.1-2 shows an example signalling flow for an SN initiated SgNB Modification procedure, with MN involvement.

1. The SN sends the *SgNB Modification Required* message including a NR RRC configuration message, which may contain bearer context related, other UE context related information and the new SCG radio resource configuration. For bearer release or modification, a corresponding E-RAB list is included in the *SgNB Modification Required* message. In case of change of security key, the *PDCP Change* *Indication* indicates that a S-KgNB update is required. In case the MN needs to perform PDCP data recovery, the *PDCP Change* *Indication* indicates that PDCP data recovery is required.

NOTE x: In case SN includes the indication of full RRC configuration in *SgNB Modification Required* message to MN e.g. comprehension failure upon intra-CU inter-DU change, MN performs release and add of the NR SCG part of the configuration but does not release SN terminated radio bearers towards the UE.

The SN can decide whether the change of security key is required.

2/3. The MN initiated SN Modification procedure may be triggered by the *SN Modification Required* message (e.g. to provide information such as data forwarding addresses, new SN security key, measurement gap, etc...)

NOTE 2: If only SN security key is provided in step 2, the MN does not need to wait for the reception of step 3 to initiate the RRC connection reconfiguration procedure.

4. The MN sends the *RRCConnectionReconfiguration* message including a NR RRC configuration messageto the UE including the new SCG radio resource configuration.

5. The UE applies the new configuration and sends the *RRCConnectionReconfigurationComplete* message, including an encoded NR RRC response message, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

6. Upon successful completion of the reconfiguration, the success of the procedure is indicated in the *SgNB Modification Confirm* message containing the encoded NR RRC response message, if received from the UE.

7. If instructed, the UE performs synchronisation towards the PSCell of the SN as described in SN addition procedure. Otherwise, the UE may perform UL transmission after having applied the new configuration.

8. If PDCP termination point is changed for bearers using RLC AM, and when RRC full configuration is not used, the SN Status Transfer takes place between the MN and the SN (Figure 10.3.1-2 depicts the case where a bearer context is transferred from the SN to the MN).

NOTE 2a: The SN may not be aware that a SN terminated bearer requesting to release is reconfigured to a MN terminated bearer. The SN Status for the released SN terminated bearers with RLC AM may also be transferred to the MN.

9. If applicable, data forwarding between MN and the SN takes place (Figure 10.3.1-2 depicts the case where a bearer context is transferred from the SN to the MN).

10. The SN sends the *Secondary RAT Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the E-RABs to be released.

NOTE 3: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related bearer is stopped.

11. If applicable, a path update is performed.

**Unchanged part is ommited**

*NEXT CHANGE*

## 10.5 Secondary Node Change (MN/SN initiated)

### 10.5.1 EN-DC

The Secondary Node Change procedure is initiated either by MN or SN and used to transfer a UE context from a source SN to a target SN and to change the SCG configuration in UE from one SN to another.

NOTE 1: Inter-RAT SN change procedure with single RRC reconfiguration is not supported in this version of the protocol (i.e. no transition from EN-DC to DC).

The Secondary Node Change procedure always involves signalling over MCG SRB towards the UE.

**MN initiated SN Change**



Figure 10.5.1-1: SN Change – MN initiated

Figure 10.5.1-1 shows an example signalling flow for the MN initiated Secondary Node Change:

1/2. The MN initiates the SN change by requesting the target SN to allocate resources for the UE by means of the SgNB Addition procedure. The MN may include measurement results related to the target SN. If forwarding is needed, the target SN provides forwarding addresses to the MN. The target SN includes the indication of the full or delta RRC configuration.

NOTE 2: The MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration before step 1.

NOTE x: In case the target SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE.3. If the allocation of target SN resources was successful, the MN initiates the release of the source SN resources including a Cause indicating SCG mobility. The Source SN may reject the release. If data forwarding is needed the MN provides data forwarding addresses to the source SN. If direct data forwarding is used for SN terminated bearers, the MN provides data forwarding addresses as received from the target SN to source SN. Reception of the *SgNB Release Request* message triggers the source SN to stop providing user data to the UE and, if applicable, to start data forwarding.

4/5. The MN triggers the UE to apply the new configuration. The MN indicates to the UE the new configuration in the *RRCConnectionReconfiguration* message including the NR RRC configuration message generated by the target SN. The UE applies the new configuration and sends the *RRCConnectionReconfigurationComplete* message, including the encoded NR RRC response message for the target SN, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

6. If the RRC connection reconfiguration procedure was successful, the MN informs the target SN via *SgNBReconfigurationComplete* message with the encoded NR RRC response message for the target SN, if received from the UE.

7. If configured with bearers requiring SCG radio resources, the UE synchronizes to the target SN.

8. For SN terminated bearers using RLC AM, the source SN sends the SN Status Transfer, which the MN sends then to the target SN, if needed.

9. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the *SgNB Release Request* message from the MN.

10. The source SN sends the *Secondary RAT* *Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 3: The order the SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN is not defined. The SN may send the report when the transmission of the related bearer is stopped.

11-15. If applicable, a path update is triggered by the MN.

16. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

**SN initiated SN Change**



Figure 10.5.1-2: SN Change – SN initiated

Figure 10.5.1-2 shows an example signalling flow for the Secondary Node Change initiated by the SN:

1. The source SN initiates the SN change procedure by sending *SgNB Change Required* message which contains target SN ID information and may include the SCG configuration (to support delta configuration) and measurement results related to the target SN.

2/3. The MN requests the target SN to allocate resources for the UE by means of the SgNB Addition procedure, including the measurement results related to the target SN received from the source SN. If forwarding is needed, the target SN provides forwarding addresses to the MN. The target SN includes the indication of the full or delta RRC configuration.

NOTE x: In case the target SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE.4/5. The MN triggers the UE to apply the new configuration. The MN indicates the new configuration to the UE in the *RRCConnectionReconfiguration* message including the NR RRC configuration message generated by the target SN. The UE applies the new configuration and sends the *RRCConnectionReconfigurationComplete* message, including the encoded NR RRC response message for the target SN, if needed. In case the UE is unable to comply with (part of) the configuration included in the *RRCConnectionReconfiguration* message, it performs the reconfiguration failure procedure.

6. If the allocation of target SN resources was successful, the MN confirms the release of the source SN resources. If data forwarding is needed the MN provides data forwarding addresses to the source SN. If direct data forwarding is used for SN terminated bearers, the MN provides data forwarding addresses as received from the target SN to source SN. Reception of the *SgNB Change Confirm* message triggers the source SN to stop providing user data to the UE and, if applicable, to start data forwarding.

7. If the RRC connection reconfiguration procedure was successful, the MN informs the target SN via *SgNB Reconfiguration Complete* message with the encoded NR RRC response message for the target SN, if received from the UE.

8. The UE synchronizes to the target SN.

9. For SN terminated bearers using RLC AM, the source SN sends the SN Status Transfer, which the MN sends then to the target SN, if needed.

10. If applicable, data forwarding from the source SN takes place. It may be initiated as early as the source SN receives the *SgNB Change Confirm* message from the MN.

11. The source SN sends the *Secondary RAT* *Data Usage Report* message to the MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 4: The order the source SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SgNB may send the report when the transmission of the related bearer is stopped.

12-16. If applicable, a path update is triggered by the MN.

17. Upon reception of the *UE Context Release* message, the source SN releases radio and C-plane related resources associated to the UE context. Any ongoing data forwarding may continue.

**Unchanged part is ommited**

*NEXT CHANGE*

## 10.7 Inter-Master Node handover with/without Secondary Node change

### 10.7.1 EN-DC

Inter-Master Node handover with/without MN initiated Secondary Node change is used to transfer context data from a source MN to a target MN while the context at the SN is kept or moved to another SN. During an Inter-Master Node handover, the target MN decides whether to keep or change the SN (or release the SN, as described in clause 10.8).

NOTE 1: Void.



Figure 10.7.1-1: Inter-MN handover with/without MN initiated SN change

Figure 10.7.1-1 shows an example signaling flow for inter-Master Node handover with or without MN initiated Secondary Node change:

NOTE 2: For an inter-Master Node handover without Secondary Node change, the source SN and the target SN shown in Figure 10.7.1-1 are the same node.

1. The source MN starts the handover procedure by initiating the X2 Handover Preparation procedure including both MCG and SCG configuration. The source MN includes the (source) SN UE X2AP ID, SN ID and the UE context in the (source) SN in the *Handover Request* message.

NOTE 3: The source MN may trigger the MN-initiated SN Modification procedure (to the source SN) to retrieve the current SCG configuration before step 1.

2. If the target MN decides to keep the SN, the target MN sends *SN Addition Request* to the SN including the SN UE X2AP ID as a reference to the UE context in the SN that was established by the source MN. If the target MN decides to change the SN, the target MN sends the *SgNB Addition Request* to the target SN including the UE context in the source SN that was established by the source MN.

3. The (target) SN replies with *SN Addition Request Acknowledge*. The (target) SN may include the indication of the full or delta RRC configuration.

NOTE x: In case the target SN includes the indication of the full RRC configuration, the MN performs release of the SN terminated radio bearer configuration and release and add of the NR SCG configuration part towards the UE.

4. The target MN includes within the *Handover Request Acknowledge* message a transparent container to be sent to the UE as an RRC message to perform the handover, and may also provide forwarding addresses to the source MN. The target MN indicates to the source MN that the UE context in the SN is kept if the target MN and the SN decided to keep the UE context in the SN in step 2 and step 3.

5. The source MN sends *SN Release Request* to the (source) SN including a Cause indicating MCG mobility. The (source) SN acknowledges the release request. The source MN indicates to the (source) SN that the UE context in SN is kept, if it receives the indication from the target MN. If the indication as the UE context kept in SN is included, the SN keeps the UE context.

6. The source MN triggers the UE to apply the new configuration.

7/8. The UE synchronizes to the target MN and replies with *RRCConnectionReconfigurationComplete* message.

9. If configured with bearers requiring SCG radio resources, the UE synchronizes to the (target) SN.

10. If the RRC connection reconfiguration procedure was successful, the target MN informs the (target) SN via *SgNB Reconfiguration Complete* message.

11a. The SN sends the *Secondary RAT* *Data Usage Report* message to the source MN and includes the data volumes delivered to and received from the UE over the NR radio for the related E-RABs.

NOTE 4: The order the source SN sends the *Secondary RAT Data Usage Report* message and performs data forwarding with MN/target SN is not defined. The SgNB may send the report when the transmission of the related bearer is stopped.

11b. The source MN sends the *Secondary RAT Report* message to MME to provide information on the used NR resource.

12. For bearers using RLC AM, the source MN sends the SN Status Transfer, including, if needed, SN Status received from the source SN to the target MN. The target forwards the SN Status to the target SN, if needed.

13. If applicable, data forwarding takes place from the source side. If the SN is kept, data forwarding may be omitted for SN-terminated bearers kept in the SN.

14-17. The target MN initiates the S1 Path Switch procedure.

NOTE 5: If new UL TEIDs of the S-GW are included, the target MN performs the MN initiated SN Modification procedure to provide them to the SN.

18. The target MN initiates the UE Context Release procedure towards the source MN.

19. Upon reception of the *UE Context Release* message, the (source) SN releases C-plane related resources associated to the UE context towards the source MN. Any ongoing data forwarding may continue. The SN shall not release the UE context associated with the target MN if the UE context kept indication was included in the *SgNB* *Release Request* message in step 5.

*END OF CHANGE*