**3GPP TSG-RAN WG2 Meeting #113-bise *R2-21xxxxx***

**E-meeting, 12th – 20th April 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **37.340** | **CR** | **xx** | **rev** | **x** | **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:***  | Introduction of SCG deactivation and activation-Option 1 |
|  |  |
| ***Source to WG:*** | ZTE Corporation, Sanechips |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | LTE\_NR\_DC\_enh2-Core |  | ***Date:*** |  2021-04-02 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-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 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)* |
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| ***Reason for change:*** | Introduction of SCG deactivation and activation.  |
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| ***Summary of change:*** | Introduction of SCG deactivation and activation.**Impact analysis**Impacted 5G architecture options:(NG)EN-DC, NR-DCImpacted functionality:SCG deactivation and activation |
|  |  |
| ***Consequences if not approved:*** | SCG deactivation and activation are not supported. |
|  |  |
| ***Clauses affected:*** | 5, 7.x, 10.x |
|  |  |
|  | **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 changes

# 5 Layer 1 related aspects

In MR-DC, two or more Component Carriers (CCs) may be aggregated over two cell groups. A UE may simultaneously receive or transmit on multiple CCs depending on its capabilities. The maximum number of configured CCs for a UE is 32 for DL and UL. Depending on UE's capabilities, up to 31 CCs can be configured for an E-UTRA cell group when the NR cell group is configured. For the NR cell group, the maximum number of configured CCs for a UE is 16 for DL and 16 for UL.

A gNB may configure the same Physical Cell ID (PCI) to more than one NR cell it serves. To avoid PCI confusion for MR-DC, NR PCIs should be allocated in a way that an NR cell is uniquely identifiable by a PCell identifier. This PCell is in the coverage area of an NR cell included in the MR-DC operation. In addition, NR PCIs should only be re-used in NR cells on the same SSB frequency sufficiently distant from each other. X2-C/Xn-C signalling supports disambiguation of NR PCIs by including the CGI of the PCell in respective X2AP/XnAP messages (e.g. SGNB ADDITION REQUEST/S-NODE ADDITION REQUEST) and by providing neighbour cell relationship via non-UE associated signaling (e.g. via the Xn Setup procedure or the NG-RAN node Configuration Update procedure).

NR-DC supports the case of no synchronization between PCell and PSCell. However, some UEs may support NR-DC only if slot-level synchronization between PCell and PSCell is ensured.

In NR-DC, power sharing is performed within frequency band with either semi-static or dynamic power sharing. With semi-static power sharing, the UE transmission power is split between MCG and SCG through configuration. With dynamic power sharing, when determining the UL transmission power of a SCG transmission, the UE takes into account transmission(s) on MCG overlapping with any part of the SCG transmission as specified in TS38.213[21].

In (NG)EN-DC and NR-DC, when SCG is deactivated as described in clause 10.x, the UE will not transmit PUSCH and SRS on SCG, and the UE is not required to monitor PDCCH on PSCell.

*Editor’s note: FFS whether other UL transmission on SCG is allowed when SCG is deactivated [Pending to RAN2].*

*Editor’s note: FFS TA handling when SCG is deactivated [Pending to RAN2].*

*Editor’s note: FFS whether/how RLM, BFD are supported when SCG is deactivated [Pending to RAN2].*

Next change

# 7 RRC related aspects

\*\*\* ignore non-related part \*\*\*

7.2 Measurements

If the measurement is configured to the UE in preparation for the Secondary Node Addition procedure described in clause 10.2, the Master node should configure the measurement to the UE.

In case of the intra-secondary node mobility described in clause 10.3, the SN should configure the measurement to the UE in coordination with the MN, if required.

The Secondary Node Change procedure described in clause 10.5 can be triggered by both the MN (only for inter-frequency secondary node change) and the SN. For secondary node changes triggered by the SN, the RRM measurement configuration is maintained by the SN which also processes the measurement reporting, without providing the measurement results to the MN.

Measurements can be configured independently by the MN and by the SN (intra-RAT measurements on serving and non-serving frequencies). The MN indicates the maximum number of frequency layers and measurement identities of intra-frequency and inter-frequency measurement that can be used in the SN to ensure that UE capabilities are not exceeded. In MR-DC, to assist MN to identify the measurement type, the SN indicates to the MN the list of SCG serving frequencies. In NR-DC, to assist SN to identify the measurement type, the MN indicates also to SN the list of MCG serving frequencies. The SN can also request the MN for new maximum values of the number of measurement identities that it can configure, and it is up to the MN whether to accommodate the SN request. If the SN receives from the MN a new value for the maximum number of measurement identities, is SN responsibility to ensure that its configured measurement identities to comply with the new limit.

If MN and SN both configure measurements on the same carrier frequency then the configurations need to be consistent (if the network wants to ensure these are considered as a single measurement layer). Each node (MN and SN) can configure independently a threshold for the SpCell quality. In (NG)EN-DC scenario, when the PCell quality is above the threshold configured by the MN, the UE is still required to perform inter-RAT measurements configured by the MN on the SN RAT (while it's not required to perform intra-RAT measurements); when the PSCell quality is above the threshold configured by the SN, the UE is not required to perform measurements configured by the SN. In NR-DC or NE-DC scenario, when the PCell quality is above the threshold configured by the MN, the UE is not required to perform measurements configured by the MN; when the PSCell quality is above the threshold configured by the SN, the UE is not required to perform measurements configured by the SN.

NOTE: The SN cannot renegotiate the number of frequency layers allocated by the MN in this version of the protocol.

In MR-DC, both the MN and the SN can configure CGI reporting. The MN can configure CGI reporting for intra-RAT and inter-RAT cells but the SN can only configure CGI reporting of intra-RAT cells. At any point in time, the UE can be configured with at most one CGI reporting configuration. For CGI reporting coordination, the SN sends the CGI measurement request and the embedded CGI reporting configuration to the MN. Optionally, the SN sends the unknown cell information to the MN. If there is no ongoing CGI reporting measurement on UE side, the MN forwards the SN CGI measurement configuration to UE. Otherwise the MN rejects the request by sending X2/Xn reject message. In case the SN indicates the unknown cell information, and the CGI information of the requested cell is already available in the MN, the MN can also reject the request, and sends the CGI information of the requested cell to the SN. The SN cannot configure the CGI measurement using the SRB3.

When SRB3 is not configured or the SCG is deactivated, reports for measurements configured by the SN are sent on SRB1. When SRB3 is configured and the SCG is not deactivated or suspended, reports for measurements configured by the SN are sent on SRB3.

Measurement results related to the target SN can be provided by MN to target SN at MN initiated SN change procedure. Measurement results of target SN can be forwarded from source SN to target SN via MN at SN initiated SN change procedure. Measurement results related to the target SN can be provided by source MN to target MN at Inter-MN handover with/without SN change procedure.

Measurement results according to measurement configuration from the MN are encoded according to SN RRC when they are provided by MN to SN in *SgNB Addition Request* message / *SN Addition Request* message. During SN initiated SN change procedure, measurement results according to measurement configuration from SN are encoded according to SN RRC when they are provided by MN to SN in *SgNB Addition Request* message / *SN Addition Request* message.

Per-UE or per-FR measurement gaps can be configured, depending on UE capability to support independent FR measurement and network preference. Per-UE gap applies to both FR1 (E-UTRA, UTRA-FDD and NR) and FR2 (NR) frequencies. For per-FR gap, two independent gap patterns (i.e. FR1 gap and FR2 gap) are configured for FR1 and FR2 respectively. The UE may also be configured with a per-UE gap sharing configuration (applying to per-UE gap) or with two separate gap sharing configurations (applying to FR1 and FR2 measurement gaps respectively) [8].

A measurement gap configuration is always provided:

- In EN-DC, NGEN-DC and NE-DC, for UEs configured with E-UTRA inter-frequency measurements as described in table 9.1.2-2 in TS 38.133 [8];

- In EN-DC and NGEN-DC, for UEs configured with UTRAN and GERAN measurements as described in table 9.1.2-2 in TS 38.133 [8];

- In NR-DC, for UEs configured with E-UTRAN measurements as described in table 9.1.2-3 in TS 38.133 [8];

- In NR-DC, NE-DC, for UEs configured with UTRAN measurements as described in table 9.4.6.3-1 and 9.4.6.3-2 in TS 38.133 [8];

- In MR-DC, for UEs that support either per-UE or per-FR gaps, when the conditions to measure SSB based inter-frequency measurement or SSB based intra-frequency measurement as described in clause 9.2.4 in TS 38.300 [3] are met;

If per-UE gap is used, the MN decides the gap pattern and the related gap sharing configuration. If per-FR gap is used, in EN-DC and NGEN-DC, the MN decides the FR1 gap pattern and the related gap sharing configuration for FR1, while the SN decides the FR2 gap pattern and the related gap sharing configuration for FR2; in NE-DC and NR-DC, the MN decides both the FR1 and FR2 gap patterns and the related gap sharing configurations.

In EN-DC and NGEN-DC, the measurement gap configuration from the MN to the UE indicates if the configuration from the MN is a per-UE gap or an FR1 gap configuration. The MN also indicates the configured per-UE or FR1 measurement gap pattern and the gap purpose (per-UE or per-FR1) to the SN. Measurement gap configuration assistance information can be exchanged between the MN and the SN. For the case of per-UE gap, the SN indicates to the MN the list of SN configured frequencies in FR1 and FR2 measured by the UE. For the per-FR gap case, the SN indicates to the MN the list of SN configured frequencies in FR1 measured by the UE and the MN indicates to the SN the list of MN configured frequencies in FR2 measured by the UE.

In NE-DC, the MN indicates the configured per-UE or FR1 measurement gap pattern to the SN. The SN can provide a gap request to the MN, without indicating any list of frequencies.

In NR-DC, the MN indicates the configured per-UE, FR1 or FR2 measurement gap pattern and the gap purpose to the SN. The SN can indicate to the MN the list of SN configured frequencies in FR1 and FR2 measured by the UE.

In (NG)EN-DC and NR-DC, SMTC can be used for PSCell addition/PSCell change to assist the UE in finding the SSB in the target PSCell. In case the SMTC of the target PSCell is provided by both MN and SN it is up to UE implementation which one to use.

CLI measurements can be configured for NR cells in all MR-DC options. In EN-DC and NGEN-DC, only the SN can configure CLI measurements. In NE-DC, only the MN can configure CLI measurements. In NR-DC, both the MN and the SN can configure CLI measurements, and the MN informs the SN about the maximum number of CLI measurement resources that can be configured by the SN to ensure that the total number of CLI measurement resources does not exceed the UE capabilities.

Next change

## 7.x Deactivated SCG

To enable reasonable UE battery consumption when MR-DC is configured, an activation/deactivation mechanism of SCG is supported. While the SCG is deactivated, there is no transmission via SCG RLC bearers. Only the NR SCG can be deactivated. While the SCG is deactivated, all SCG SCell(s) are in deactivated state. The network can configure the SCG as activated or deactivated upon PSCell addition, PSCell change, RRC Resume or handover. The network can trigger SCG RRC reconfiguration (e.g. PSCell change) while the SCG is deactivated.

*Editor’s Note: FFS whether SCell can be added/reconfigured/released when SCG is deactivated [Pending to RAN2].*

Both MN configured and SN configured RRM measurements are supported while the SCG is deactivated.

*Editor’s Note: FFS whether the network can configure the UE to stop certain configured RRM rmeasurements when SCG is deactivated [Pending to RAN2].*

SCG activation can be requested by the MN, by the SN and by the UE. SCG deactivation can be requested by the MN and by the SN.

*Editor’s Note: FFS whether the UE can trigger SCG deactivation, and whether the UE can provide some assistance information for deactivation of SCG [Pending to RAN2].*

Next change

# 10 Multi-Connectivity operation related aspects

\*\*\* ignore non-related part \*\*\*

10.2 Secondary Node Addition

10.2.1 EN-DC

The Secondary Node Addition procedure is initiated by the MN and is used to establish a UE context at the SN to provide resources from the SN to the UE. For bearers requiring SCG radio resources, this procedure is used to add at least the first cell of the SCG. This procedure can also be used to configure an SN terminated MCG bearer (where no SCG configuration is needed). Figure 10.2.1-1 shows the Secondary Node Addition procedure.

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**Figure 10.2.1-1: Secondary Node Addition procedure**

1. The MN decides to request the SN to allocate resources for a specific E-RAB, indicating E-RAB characteristics (E-RAB parameters, TNL address information corresponding to bearer type). In addition, for bearers requiring SCG radio resources, MN indicates the requested SCG configuration information, including the entire UE capabilities and the UE capability coordination result. In this case, the MN also provides the latest measurement results for SN to choose and configure the SCG cell(s). The MN may request the SN to allocate radio resources for split SRB operation. The MN always provides all the needed security information to the SN (even if no SN terminated bearers are setup) to enable SRB3 to be setup based on SN decision. In case of bearer options that require X2-U resources between the MN and the SN, the MN provides X2-U TNL address information for the respective E-RAB, X2-U DL TNL address information for SN terminated bearers, X2-U UL TNL address information for MN terminated bearers. In case of SN terminated split bearers the MN provides the maximum QoS level that it can support. The MN may request the SCG to be activated or deactivated. The SN may reject the request.

NOTE 1: For split bearers, MCG and SCG resources may be requested of such an amount, that the QoS for the respective E-RAB is guaranteed by the exact sum of resources provided by the MCG and the SCG together, or even more. For MN terminated split bearers, the MNs decision is reflected in step 1 by the E-RAB parameters signalled to the SN, which may differ from E-RAB parameters received over S1.

NOTE 2: For a specific E-RAB, the MN may request the direct establishment of an SCG or a split bearer, i.e., without first having to establish an MCG bearer. It is also allowed that all E-RABs can be configured as SN terminated bearers, i.e. there is no E-RAB established as an MN terminated bearer.

2. If the RRM entity in the SN is able to admit the resource request, it allocates respective radio resources and, dependent on the bearer option, respective transport network resources. For bearers requiring SCG radio resources, the SN triggers Random Access so that synchronisation of the SN radio resource configuration can be performed. The SN decides the PSCell and other SCG SCells and provides the new SCG radio resource configuration to the MN in a *NR RRC configuration* message contained in the *SgNB Addition Request Acknowledge* message. In case of bearer options that require X2-U resources between the MN and the SN, the SN provides X2-U TNL address information for the respective E-RAB, X2-U UL TNL address information for SN terminated bearers, X2-U DL TNL address information for MN terminated bearers. For SN terminated bearers, the SN provides the S1-U DL TNL address information for the respective E-RAB and security algorithm. If SCG radio resources have been requested, the SCG radio resource configuration is provided. If the MN requested the SCG to be activated or deactivated, the SN indicates whether the SCG is activated or deactivated.

NOTE 3: For the SN terminated split bearer option, the SN may either decide to request resources from the MN of such an amount, that the QoS for the respective E-RAB is guaranteed by the exact sum of resources provided by the MN and the SN together, or even more. The SNs decision is reflected in step 2 by the E-RAB parameters signalled to the MN, which may differ from E-RAB parameters received in step 1. The QoS level requested from the MN shall not exceed the level that the MN offered when setting up the split bearer in step 1.

NOTE 4: In case of MN terminated bearers, transmission of user plane data may take place after step 2.

NOTE 5: In case of SN terminated bearers , data forwarding and the SN Status Transfer may take place after step 2.

3. The MN sends to the UE the *RRCConnectionReconfiguration* message including the NR RRC configuration message, without modifying it.

4. The UE applies the new configuration and replies to MN with *RRCConnectionReconfigurationComplete* message, 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.

5. The MN informs the SN that the UE has completed the reconfiguration procedure successfully via *SgNB ReconfigurationComplete* message, including the encoded NR RRC response message, if received from the UE.

6. If configured with bearers requiring SCG radio resources, the UE performs synchronisation towards the PSCell of the SN. The order the UE sends the *RRCConnectionReconfigurationComplete* message and performs the Random Access procedure towards the SCG is not defined. The successful RA procedure towards the SCG is not required for a successful completion of the RRC Connection Reconfiguration procedure.

*Editor’s note: If the SCG is not activated, it is FFS whether the UE performs random access.*

7. If PDCP termination point is changed to the SN for bearers using RLC AM, and when RRC full configuration is not used, the MN sends the SN Status Transfer.

8. For SN terminated bearers moved from the MN, dependent on the bearer characteristics of the respective E-RAB, the MN may take actions to minimise service interruption due to activation of EN-DC (Data forwarding).

9-12. If applicable, the update of the UP path towards the EPC is performed.

10.2.2 MR-DC with 5GC

The Secondary Node (SN) Addition procedure is initiated by the MN and is used to establish a UE context at the SN in order to provide resources from the SN to the UE. For bearers requiring SCG radio resources, this procedure is used to add at least the initial SCG serving cell of the SCG. This procedure can also be used to configure an SN terminated MCG bearer (where no SCG configuration is needed). Figure 10.2.2-1 shows the SN Addition procedure.

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**Figure 10.2.2-1: SN Addition procedure**

1. The MN decides to request the target SN to allocate resources for one or more specific PDU Sessions/QoS Flows, indicating QoS Flows characteristics (QoS Flow Level QoS parameters, PDU session level TNL address information, and PDU session level Network Slice info). In addition, for bearers requiring SCG radio resources, MN indicates the requested SCG configuration information, including the entire UE capabilities and the UE capability coordination result. In this case, the MN also provides the latest measurement results for SN to choose and configure the SCG cell(s). The MN may request the SN to allocate radio resources for split SRB operation. In NGEN-DC and NR-DC, the MN always provides all the needed security information to the SN (even if no SN terminated bearers are setup) to enable SRB3 to be setup based on SN decision. The MN may request the SCG to be activated or deactivated.

 For MN terminated bearer options that require Xn-U resources between the MN and the SN, the MN provides Xn-U UL TNL address information. For SN terminated bearers, the MN provides a list of available DRB IDs. The S-NG-RAN node shall store this information and use it when establishing SN terminated bearers. The SN may reject the request.

 For SN terminated bearer options that require Xn-U resources between the MN and the SN, the MN provides in step 1 a list of QoS flows per PDU Sessions for which SCG resources are requested to be setup upon which the SN decides how to map QoS flows to DRB.

NOTE 1: For split bearers, MCG and SCG resources may be requested of such an amount, that the QoS for the respective QoS Flow is guaranteed by the exact sum of resources provided by the MCG and the SCG together, or even more. For MN terminated split bearers, the MN decision is reflected in step 1 by the QoS Flow parameters signalled to the SN, which may differ from QoS Flow parameters received over NG.

NOTE 2: For a specific QoS flow, the MN may request the direct establishment of SCG and/or split bearers, i.e. without first having to establish MCG bearers. It is also allowed that all QoS flows can be mapped to SN terminated bearers, i.e. there is no QoS flow mapped to an MN terminated bearer.

2. If the RRM entity in the SN is able to admit the resource request, it allocates respective radio resources and, dependent on the bearer type options, respective transport network resources. For bearers requiring SCG radio resources the SN triggers UE Random Access so that synchronisation of the SN radio resource configuration can be performed. The SN decides for the PSCell and other SCG SCells and provides the new SCG radio resource configuration to the MN within an SN RRC configuration message contained in the *SN Addition Request Acknowledge* message. If the MN requested the SCG to be activated or deactivated, the SN indicates whether the SCG is activated or deactivated. In case of bearer options that require Xn-U resources between the MN and the SN, the SN provides Xn-U TNL address information for the respective DRB, Xn-U UL TNL address information for SN terminated bearers, Xn-U DL TNL address information for MN terminated bearers. For SN terminated bearers, the SN provides the NG-U DL TNL address information for the respective PDU Session and security algorithm. If SCG radio resources have been requested, the SCG radio resource configuration is provided.

NOTE 3: In case of MN terminated bearers, transmission of user plane data may take place after step 2.

NOTE 4: In case of SN terminated bearers, data forwarding and the SN Status Transfer may take place after step 2.

NOTE 5: For MN terminated bearers for which PDCP duplication with CA is configured in NR SCG side, the MN allocates up to 4 separate Xn-U bearers and the SN provides a logical channel ID for primary or split secondary path to the MN.

 For SN terminated bearers for which PDCP duplication with CA is configured in NR MCG side, the SN allocates up to 4 separate Xn-U bearers and the MN provides a logical channel ID for primary or split secondary path to the SN via an additional MN-initiated SN modification procedure.

2a. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message.

3. The MN sends the *MN RRC reconfiguration* message to the UE including the SN RRC configuration message, without modifying it.

4. The UE applies the new configuration and replies to MN with *MN RRC reconfiguration complete* message, including an SN RRC response message for SN, if needed. In case the UE is unable to comply with (part of) the configuration included in the *MN RRC reconfiguration* message, it performs the reconfiguration failure procedure.

5. The MN informs the SN that the UE has completed the reconfiguration procedure successfully via *SN Reconfiguration Complete* message, including the SN RRC response message, if received from the UE.

6. If configured with bearers requiring SCG radio resources, the UE performs synchronisation towards the PSCell configured by the SN. The order the UE sends the *MN RRC reconfiguration complete* message and performs the Random Access procedure towards the SCG is not defined. The successful RA procedure towards the SCG is not required for a successful completion of the RRC Connection Reconfiguration procedure.

*Editor’s note: If the SCG is not activated, it is FFS whether the UE performs random access.*

7. If PDCP termination point is changed to the SN for bearers using RLC AM, and when RRC full configuration is not used, the MN sends the SN Status Transfer.

8. For SN terminated bearers or QoS flows moved from the MN, dependent on the characteristics of the respective bearer or QoS flow, the MN may take actions to minimise service interruption due to activation of MR-DC (Data forwarding).

9-12. If applicable, the update of the UP path towards the 5GC is performed via a PDU Session Path Update procedure*.*

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. This procedure may be initiated by the MN to request the SN to deactivate or activate the SCG.

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

**MN initiated SN Modification**

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**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 also uses this procedure to activate or deactivate the SCG, possibly upon receiving an Acitivity Notification from 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. The MN may request the SCG to be activated or deactivated. 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). If the MN requested the SCG to be activated or deactivated, the SN indicates whether the SCG is activated or deactivated. 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.

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.

*Editor’s note: In step 3, it is FFS whether lower layer signalling can be sent instead of RRC signalling.*

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.

*Editor’s note: If the SCG was not already activated before the initiation of this SN modification procedure, it is FFS whether the UE performs random access.*

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**

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**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.

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.

**SN initiated SN Modification without MN involvement**

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**Figure 10.3.1-3: SN modification - SN initiated without MN involvement**

The SN initiated modification without MN involved procedure is used to modify the configuration within SN in case no coordination with MN is required, including the addition/modification/release of SCG SCell and PSCell change (e.g. when the security key does not need to be changed and the MN does not need to be involved in PDCP recovery). The SN may initiate the procedure to configure or modify CPC configuration within the same SN. Figure 10.3.1-3 shows an example signalling flow for SN initiated SN modification procedure, without MN involvement. The SN can decide whether the Random Access procedure is required.

1. The SN sends the *RRCReconfiguration* message to the UE through SRB3. The UE applies the new configuration. In case the UE is unable to comply with (part of) the configuration included in the *RRCReconfiguration* message, it performs the reconfiguration failure procedure.

2. If instructed, the UE performs synchronisation towards the PSCell of the SN.

3. The UE replies with the *RRCReconfigurationComplete* message.

3a. In case of CPC, the UE maintains connection with source PSCell after receiving CPC configuration, and starts evaluating the CPC execution conditions for candidate PSCell(s). If at least one CPC candidate PSCell satisfies the corresponding CPC execution condition, the UE detaches from the source PSCell, applies the stored corresponding configuration for the selected candidate PSCell and synchronises to that candidate PSCell. The UE completes the CPC execution procedure by sending an *RRCReconfigurationComplete* message to the new PSCell.

**Transfer of an NR RRC message to/from the UE (when SRB3 is not used)**

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**Figure 10.3.1-4: Transfer of an NR RRC message to/from the UE**

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is not used.

1. The SN initiates the procedure by sending the SgNB Modification Required to the MN.

2. The MN forwards the NR RRC message to the UE in the *RRCConnectionReconfiguration* message.

3. The UE applies the new configuration and replies with the *RRCConnectionReconfigurationComplete* message.

3a. If CPC is configured in the *RRCConnectionReconfiguration,* the UE maintains the connection with the source PSCell after receiving the CPC configuration, and starts evaluating the CPC execution conditions for the candidate PSCell(s). If at least one CPC candidate PSCell satisfies the corresponding CPC execution condition, the UE detaches from the source PSCell, applies the stored corresponding configuration for the selected candidate PSCell and synchronises to that candidate PSCell. The UE completes the CPC execution procedure by sending an *ULInformationTransferMRDC* message to the MN which includes an embedded *RRCReconfigurationComplete* message to the new PSCell.

4. The MN forwards the NR RRC response message, if received from the UE, to the SN in the *SgNB Modification Confirm* message.

5. 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.

10.3.2 MR-DC with 5GC

The SN Modification procedure may be initiated either by the MN or by the SN and be used to modify the current user plane resource configuration (e.g. related to PDU session, QoS flow or DRB) or to modify other properties of the UE context within the same SN. It may also be used to transfer an 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 NGEN-DC and NR-DC, the RRC message is an NR message (i.e., *RRCReconfiguration*) whereas in NE-DC it is an E-UTRA message (i.e., *RRCConnectionReconfiguration*). In case of CPC, this procedure is used to configure or modify CPC configuration within the same SN. The CPC configuration cannot be used to configure target PSCell in NE-DC. This procedure may be initiated by the MN to request the SN to deactivate or activate the SCG.

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

**MN initiated SN Modification**

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**Figure 10.3.2-1: SN Modification procedure - MN initiated**

The MN uses the procedure to initiate configuration changes of the SCG within the same SN, including addition, modification or release of the user plane resource configuration. The MN uses this procedure to perform handover within the same MN while keeping the SN, when the SN needs to be involved (i.e. in NGEN-DC). 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 or to provide additional available DRB IDs to be used for SN terminated bearers. The MN also uses this procedure to activate to deactivate the SCG, possibly upon receiving an Acitivity Notification from 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 the user plane resource configuration, or if it is used to perform handover within the same MN while keeping the SN. Figure 10.3.2-1 shows an example signalling flow for an MN initiated SN Modification procedure.

1. The MN sends the *SN Modification Request* message, which may contain user plane resource configuration related or other UE context related information, PDU session level Network Slice info and the requested SCG configuration information, including the UE capabilities 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 *SN Security Key* is included. If the MN requested the SCG to be activated or deactivated, the SN indicates whether the SCG is activated or deactivated.

2. The SN responds with the *SN Modification Request Acknowledge* message, which may contain new SCG radio configuration information within an SN RRC reconfiguration message*,* and data forwarding address information (if applicable).

NOTE 1: For MN terminated bearers to be setup for which PDCP duplication with CA is configured in NR SCG side, the MN allocates up to 4 separate Xn-U bearers and the SN provides a logical channel ID for primary or split secondary path to the MN.

 For SN terminated bearers to be setup for which PDCP duplication with CA is configured in NR MCG side, the SN allocates up to 4 separate Xn-U bearers and the MN provides a logical channel ID for primary or split secondary path to the SN via an additional MN-initiated SN modification procedure.

2a. When applicable, the MN provides data forwarding address information to the SN. For SN terminated bearers using MCG resources, the MN provides Xn-U DL TNL address information in the *Xn-U Address Indication* message.

3/4. The MN initiates the RRC reconfiguration procedure, including an *SN RRC reconfiguration* message. The UE applies the new configuration, synchronizes to the MN (if instructed, in case of intra-MN handover) and replies with *MN RRC reconfiguration complete* message,including an SN RRC response message, if needed. In case the UE is unable to comply with (part of) the configuration included in the *MN RRC reconfiguration* message, it performs the reconfiguration failure procedure.

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

6. 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.

*Editor’s note: If the SCG was not already activated before the initiation of this SN modification procedure, it is FFS whether the UE performs random access.*

7. 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 10.3.2-1 depicts the case where a bearer context is transferred from the MN to the SN).

8. If applicable, data forwarding between MN and the SN takes place (Figure 10.3.2-1 depicts the case where a user plane resource configuration related context is transferred from the MN to the SN).

9. 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 as described in clause 10.11.2.

NOTE 2: 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 QoS flow is stopped.

10. If applicable, a PDU Session path update procedure is performed.

**SN initiated SN Modification with MN involvement**

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**Figure 10.3.2-2: 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 modification/release of the user plane resource configuration and to trigger PSCell changes (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 PDU session/QoS flows. The SN also uses the procedure to request the MN to provide more DRB IDs to be used for SN terminated bearers or to return DRB IDs used for SN terminated bearers that are not needed any longer. Figure 10.3.2-2 shows an example signalling flow for SN initiated SN Modification procedure.

1. The SN sends the *SN Modification Required* message including an SN RRC reconfiguration message, which may contain user plane resource configuration related context, other UE context related information and the new radio resource configuration of SCG. In case of change of security key, the *PDCP Change* *Indication* indicates that an SN security key update is required. In case the MN needs to perform PDCP data recovery, the *PDCP Change* *Indication* indicates that PDCP data recovery is required.

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

2/3. The MN initiated SN Modification procedure may be triggered by *SN Modification Required* message, e.g. when an SN security key change needs to be applied.

NOTE 3: For SN terminated bearers to be setup for which PDCP duplication with CA is configured in NR MCG side, the SN allocates up to 4 separate Xn-U bearers and the MN provides a logical channel ID for primary or split secondary path to the SN via the nested MN-initiated SN modification procedure.

4. The MN sends the *MN RRC reconfiguration* message to the UE including the SN RRC reconfiguration message with the new SCG radio resource configuration.

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

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

7. If instructed, the UE performs synchronisation towards the PSCell configured by the SN as described in SN Addition procedure. Otherwise, the UE may perform UL transmission directly 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 10.3.2-2 depicts the case where a bearer context is transferred from the SN to the MN).

9. If applicable, data forwarding between MN and the SN takes place (Figure 10.3.2-2 depicts the case where a user plane resource configuration related 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 as described in clause 10.11.2.

NOTE 4: 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 QoS flow is stopped.

11. If applicable, a PDU Session path update procedure is performed.

**SN initiated SN Modification without MN involvement**

This procedure is not supported for NE-DC.

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**Figure 10.3.2-3: SN Modification – SN initiated without MN involvement**

The SN initiated SN modification procedure without MN involvement is used to modify the configuration within SN in case no coordination with MN is required, including the addition/modification/release of SCG SCell and PSCell change (e.g. when the security key does not need to be changed and the MN does not need to be involved in PDCP recovery). The SN may initiate the procedure to configure or modify CPC configuration within the same SN. Figure 10.3.2-3 shows an example signalling flow for SN initiated SN modification procedure without MN involvement. The SN can decide whether the Random Access procedure is required.

1. The SN sends the *SN RRC reconfiguration* message to the UE through SRB3.

2. The UE applies the new configuration and replies with the *SN RRC reconfiguration complete* message. In case the UE is unable to comply with (part of) the configuration included in the *SN RRC reconfiguration* message, it performs the reconfiguration failure procedure.

3. 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.

**SN initiated Conditional SN Modification (CPC) without MN involvement (SRB3 is used)**

This procedure is supported for the MR-DC options except for NE-DC.

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**Figure 10.3.2-3a: SN Modification – SN-initiated without MN involvement and when CPC is configured and SRB3 is used.**

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is used and CPC is configured.

1. The SN sends the *SN RRC reconfiguration* including CPC configuration message to the UE through SRB3.

2. The UE applies the new configuration. The UE starts evaluating the CPC execution conditions for the candidate PSCell(s). The UE maintains connection with the source PSCell and replies with the *RRCReconfigurationComplete* message to the SN via SRB3.

3. If at least one CPC candidate PSCell satisfies the corresponding CPC execution condition, the UE detaches from the source PSCell, applies the stored configuration corresponding to that selected candidate PSCell and synchronises to that candidate PSCell.

4. The UE completes the CPC execution procedure by sending an *RRCReconfigurationComplete* message to the new PSCell.

**Transfer of an NR RRC message to/from the UE (when SRB3 is not used)**

This procedure is supported for all the MR-DC options.

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**Figure 10.3.2-4: Transfer of an NR RRC message to/from the UE**

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is not used.

1. The SN initiates the procedure by sending the *SN Modification Required* to the MN including the SN RRC reconfiguration message.

2. The MN forwards the SN RRC reconfiguration message to the UE including it in the *RRC reconfiguration* message.

3. The UE applies the new configuration and replies with the *RRC reconfiguration complete* message by including the SN RRC reconfiguration complete message.

4. The MN forwards the SN RRC response message, if received from the UE, to the SN by including it in the *SN Modification Confirm* message.

5. 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.

**SN initiated Conditional SN Modification (CPC) without MN involvement (SRB3 is not used)**

This procedure is supported for the MR-DC options except for NE-DC.



**Figure 10.3.2-5: SN Modification – SN-initated without MN involvement when CPC is configured and SRB3 is not used**

The SN initiates the procedure when it needs to transfer an NR RRC message to the UE and SRB3 is not used, while CPC is configured.

1. The SN initiates the procedure by sending the *SN Modification Required* to the MN including the SN RRC reconfiguration message with CPC configuration.

2. The MN forwards the SN RRC reconfiguration message to the UE including it in the *RRC reconfiguration* message.

3. The UE replies with the *RRCReconfigurationComplete* message by including the SN RRC reconfiguration complete message. The UE maintains connection with source PSCell after receiving CPC configuration, and starts evaluating the CPC execution conditions for the candidate PSCell(s).

4. The MN forwards the SN RRC response message, if received from the UE, to the SN by including it in the *SN Modification Confirm* message.

5. If at least one CPC candidate PSCell satisfies the corresponding CPC execution condition, the UE completes the CPC execution procedure by an *ULInformationTransferMRDC* message to the MN which includes an embedded *RRCReconfigurationComplete* message to the selected target PSCell.

6. The *RRCReconfigurationComplete* is forwarded to the SN embedded in RRC Transfer.

7. The UE detaches from the source PSCell, applies the stored corresponding configuration and synchronises to the selected candidate PSCell.

Next change

10.12 Activity Notification

10.12.1 EN-DC

The Activity Notification function is used to report user plane activity within SN resources. It can either report inactivity or resumption of activity after inactivity was reported. In EN-DC the Activity Reporting is provided from the SN only. The MN may take further actions.

**EN-DC with Activity Notification**

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**Figure 10.12.1-1: Support of Activity Notification in EN-DC**

Support of Activity Notification in EN-DC is used to keep the MN informed about user traffic activity in resources owned by the SN. The MN may take appropriate action upon receiving such notification.

1. The SN informs the MN about user data inactivity of resources owned by the SN.

2. The MN decides to keep SN resources.

3. After a while the SN reports resumption of user plane activity.

**EN-DC with deactivated SCG**

The Activity Notification function may be used to enable EN-DC with deactivated SCG operation. The MN node may decide, after inactivity is reported from the SN, to deactivate the SCG. Activation of the SCG may take place after activity is reported from the SN for SN terminated bearers.



**Figure 10.12.1-x: Support of activity notification in EN-DC with deactivated SCG**

Figure 10.12.1-x shows how Activity Notification function interacts with SN Modification procedures.

1. The SN notifies the MN about user data inactivity.

2. The MN decides to deactivate the NR SCG.

3/4. The MN triggers the MN initiated SN Modification procedure, requesting the SN to deactivate the SCG.

5/6. If the SN accepts the SCG deactivation request, the RRC Connection Reconfiguration procedure commences, informs the UE to deactivate the SCG. If the SCG configuration is to be updated, the new configuration is provided in the RRC reconfiguration message

*Editor’s note: FFS whether other lower layer signalling can be used to inform the UE about SCG deactivation [pending to RAN2].*

7. The MN informs the SN that the UE has completed the reconfiguration procedure successfully via *SgNB Reconfiguration Complete* message, including the SN RRC response message, if received from the UE.

8~11. After a period of SCG deactivation, the MN decides to reactivate the SCG, it MN triggers the SN modification procedure, and requests the SN to reactivate the SCG. The MN may also trigger this procedure upon receiving the Activity Notification from the SN.

12. The SN responds with *SgNB Modification Request Acknowledge* message, informs the MN the result of SCG activation.

13/14. If the SN accepts the SCG activation request, the RRC Connection Reconfiguration procedure commences, informs the UE to reactivate the SCG. If the SCG configuration is to be updated, the new configuration is provided in the RRC reconfiguration message

*Editor’s note: FFS whether other lower layer signalling can be used to inform the UE about SCG activation [pending to RAN2].*

15. The MN informs the SN that the UE has completed the reconfiguration procedure successfully via *SgNB Reconfiguration Complete* message, including the SN RRC response message, if received from the UE.

*Editor’s note: FFS whether the UE must perform synchronisation towards the PSCell of the SN upon SCG activation [pending to RAN2].*

10.12.2 MR-DC with 5GC

The Activity Notification function is used to report user plane activity within SN resources or to report a RAN Paging Failure event to the SN. It can either report inactivity or resumption of activity after inactivity was reported. In MR-DC with 5GC the Activity Reporting is provided from the SN only. The MN may take further actions. RAN Paging Failure Reporting is provided from the MN only.

**MR-DC with 5GC Activity Notification**

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**Figure 10.12.2-1: Support of Activity Notification in MR-DC with 5GC**

1. The SN notifies the MN about user data inactivity.

2. The MN decides further actions that impact SN resources (e.g. send UE to RRC\_INACTIVE, bearer reconfiguration). In the case shown, MN takes no action.

3. The SN notifies the MN that the (UE or PDU Session or QoS flow) is no longer inactive.

**MR-DC with 5GC with RRC\_INACTIVE – SCG configuration released in SN**

The Activity Notification function may be used to enable MR-DC with 5GC with RRC\_INACTIVE operation. The MN node may decide, after inactivity is reported from the SN and also MN resources show no activity, to send the UE to RRC\_INACTIVE. Resumption to RRC\_CONNECTED may take place after activity is reported from the SN for SN terminated bearers.

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**Figure 10.12.2-2: Support of Activity Notification in MR-DC with 5GC with RRC\_Inactive – SCG configuration released in SN**

Figure 10.12.2-2 shows how Activity Notification function interacts with NG-RAN functions for RRC\_INACTIVE and SN Modification procedures in order to keep the higher layer MR-DC NG-RAN resources established for UEs in RRC\_INACTIVE, including NG and Xn interface C-plane, U-plane and bearer contexts established while lower layer MCG and SCG resources are released. NG-RAN memorises the cell group configuration for MCG in order to apply delta signalling at resume, as specified in TS 38.331 [4]. After the UE has transited successfully back to RRC\_CONNECTED, lower layer SCG resources are established afterwards by means of RRC Connection Reconfiguration.

1. The SN notifies the MN about user data inactivity for SN terminated bearers.

2. The MN decides to send the UE to RRC\_INACTIVE.

3/4. The MN triggers the MN initiated SN Modification procedure, requesting the SN to release lower layers.

5. The UE is sent to RRC\_INACTIVE.

6-8. After a period of inactivity, upon activity notification from the SN, the UE returns to RRC\_CONNECTED.

8bis. MN decides whether to reactivate the SN terminated bearers. If (e.g. due to UE mobility), MN decides not to reactivate the SN terminated bearers, it initiates the MN initiated SN release procedure and the procedure ends.

9/10. The MN triggers the MN initiated SN Modification procedure to re-establish lower layers. The SN provides configuration data within an *SN RRC configuration* message.

11-14. The RRCConnectionReconfiguration procedure commences.

**MR-DC with 5GC with RRC\_INACTIVE - SCG configuration suspended in SN**

The Activity Notification function may be used to enable MR-DC with 5GC with RRC\_INACTIVE operation. The MN node may decide, after inactivity is reported from the SN and also MN resources show no activity, to send the UE to RRC\_INACTIVE, while keeping the SCG configuration. Resumption to RRC\_CONNECTED may take place after activity is reported from the SN for SN terminated bearers.

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**Figure 10.12.2-3: Support of Activity Notification in MR-DC with 5GC with RRC\_Inactive - SCG configuration suspended in SN**

Figure 10.12.2-3 shows how Activity Notification function interacts with NG-RAN functions for RRC\_INACTIVE and SN Modification procedures in order to keep the full MR-DC NG-RAN resources established for UEs in RRC\_INACTIVE. When the UE transits successfully back to RRC\_CONNECTED, lower layer MCG and SCG configurations are restored or reconfigured by means of RRC (Connection) Resume.

1. The SN notifies the MN about user data inactivity for SN terminated bearers.

2. The MN decides to send the UE to RRC\_INACTIVE.

3/4. The MN triggers the MN initiated SN Modification procedure, requesting the SN to suspend lower layers.

5. The UE is sent to RRC\_INACTIVE.

6-7. After a period of inactivity, the MN receives activity notification from the SN.

8. The MN decides whether to reactivate the SN terminated bearers. If (e.g. due to UE mobility), the MN decides not to reactivate the SN terminated bearers, it initiates the MN initiated SN release procedure, rather than the MN initiated SN modification procedure in steps 9/10. If the MN decides to return the UE to RRC\_CONNECTED, the network triggered state transition from RRC\_INACTIVE to RRC\_CONNECTED commences as described in clause 9.2.2.4.2 in TS 38.300 [3].

9/10. The MN triggers the MN initiated SN Modification procedure to resume the SCG lower layers. If the SCG configuration needs to be updated, the SN provides the configuration data within an *SN RRC configuration* message.

11/12. The UE is instructed to resume both the MCG and the SCG. If the SCG configuration is to be updated, the new configuration is provided in the *RRC(Connection)Resume* message.

13. The MN informs the SN that the UE has completed the reconfiguration procedure successfully, via the *SN Reconfiguration Complete* message, including the SN RRC response message, if received from the UE.

14. The UE performs synchronisation towards the PSCell of the SN.

**MR-DC with deactivated SCG**

The Activity Notification function may be used to enable MR-DC with deactivated SCG operation. The MN node may decide, after inactivity is reported from the SN, to deactivate the SCG. Activation of the SCG may take place after activity is reported from the SN for SN terminated bearers.



**Figure 10.12.2-x: Support of activity notification in MR-DC with 5GC with deactivated SCG**

Figure 10.12.2-x shows how Activity Notification function interacts with SN Modification procedures.

1. The SN notifies the MN about user data inactivity.

2. The MN decides to deactivate the NR SCG.

3/4. The MN triggers the MN initiated SN Modification procedure, requesting the SN to deactivate the SCG.

5/6. If the SN accepts the SCG deactivation request, the RRC reconfiguration procedure commences, informs the UE to deactivate the SCG. If the SCG configuration is to be updated, the new configuration is provided in the RRC reconfiguration message

*Editor’s note: FFS whether other lower layer signalling can be used to inform the UE about SCG deactivation [pending to RAN2].*

7. The MN informs the SN that the UE has completed the reconfiguration procedure successfully via *SgNB Reconfiguration Complete* message, including the SN RRC response message, if received from the UE.

8~11. After a period of SCG deactivation, the MN decides to reactivate the SCG, it MN triggers the SN modification procedure, and requests the SN to reactivate the SCG. The MN may trigger this procedure upon receiving the Activity Notification from the SN.

12. The SN responds with *SgNB Modification Request Acknowledge* message, informs the MN the result of SCG activation.

13/14. If the SN accepts the SCG activation request, the RRC reconfiguration procedure commences, informs the UE to reactivate the SCG. If the SCG configuration is to be updated, the new configuration is provided in the RRC reconfiguration message

*Editor’s note: FFS whether other lower layer signalling can be used to inform the UE about SCG activation [pending to RAN2].*

15. The MN informs the SN that the UE has completed the reconfiguration procedure successfully via *SgNB Reconfiguration Complete* message, including the SN RRC response message, if received from the UE.

*Editor’s note: FFS whether the UE must perform synchronisation towards the PSCell of the SN upon SCG activation [pending to RAN2].*

# Reference

RAN2#113e—Agreements

Agreements

1a SCG activation can be requested by MN/SN/UE. FFS on how to accept/reject the procedure. FFS which signalling is used.

1b SCG deactivation can be requested by MN/SN. FFS whether UE can request deactivation. FFS on how to accept/reject the procedure. FFS which signalling is used.

3 RRC signalling is defined for the interaction between UE/MN and MN/SN in SCG activation/deactivation. FFS if lower-layer signalling is needed.

Agreements

1 Confirm that there is no PUSCH transmission on deactivated SCG. FFS if any other UL is allowed towards SCG.

2 Confirm that there is no PDCCH monitoring on PSCell of the deactivated SCG.

3 Confirm that there is no support of SCell dormancy for SCG SCells within a deactivated SCG.

**Agreements**

**1 NW-triggered SCG activation is indicated to the UE via the MCG.**

**9 NW-triggered SCG deactivation can be indicated to the UE via the MCG. FFS via SCG.**

**Agreements**

**2 The UE behaviour when the SCG activation is indicated to the UE via the MCG is one or more of the following options:**

**option 1) similar to reconfiguration with sync, i.e. the UE always initiates random access to the PSCell.**

**option 2) in certain cases:**

**- the UE does not initiate random access and monitors PDCCH on the PSCell (at the latest after the specified processing time).**

**- the SCG can schedule data transmission on the PDCCH**

**The UE decides not to perform random access (one option to be selected):**

**option 2a) if the TA timer is still running and possibly other conditions (FFS how TAT starts)**

**option 2b) based on the contents of the SCG activation indication**

**FFS for option 2a): in the SCG deactivated state, the UE monitors some DL beams (FFS if the same as BFD or RLM) and, if the UE sees that the beams are not good enough (details FFS), the UE either (one of the options to be selected):**

**- will perform random access upon reception of the next SCG activation indication from the MCG**

**- reports measurement results (details FFS) via the MCG and wait for reconfiguration.**

**7 Further discuss the format and content of the SCG activation indication from the MCG to the UE after there is more progress on solution 2.**

**5 Continue to discuss whether some kind of beam monitoring (similar to RLM/BFD) should be supported when the SCG is deactivated. FFS if this only applies to when TAT is running.**

**6 Clarify the meaning of "the UE maintains DL sync while the SCG is deactivated" (e.g. whether that is a consequence of doing RRM measurements of the PSCell or something more is needed).**

**8 Further discuss the comparison between**

**- define a mechanism for SCG activation upon UL data arrival on SCG bearers**

**- use split bearer with primary path on MCG (network sees UL data and can initiate activation)**

**11 It is FFS whether the UE can provide some assistance information for deactivation of the SCG (but there is no proposal so far).**

**FFS if in absence of PDCCH monitoring and UL transmission, and it is possible to assume that TA is valid when the TA timer has not expired.**

RAN2#112e—Agreements

**Agreements**

* The work will focus on a single deactivated SCG.
* FFS if SCG RRC reconfiguration can select the SCG activation state (activated/deactivated) at PSCell addition/change, RRC resume or HO.
* Continue RAN2 work with the assumption that when the SCG is deactivated, the UE does not monitor PDCCH on the PSCell. This assumption can be reconsidered if issues are found.
* As a baseline, MN-configured RRM measurement/reporting procedures do not depend on the SCG activation state (deactivated or activated). Further optimisations are not precluded.
* While the SCG is deactivated, PSCell mobility is supported. MN- and SN-configured measurements are supported for deactivated SCG.
* FFS1: Details on the performed measurements (e.g. all SN configured measurements or subset based on certain criteria, restrictions on inter-frequency/RAT)
* FFS2: Support for SCell addition/mobility
* FFS3: Reporting procedure
* FF4: PSCell mobility procedure
* RAN2 assumes that UE will not perform SRS transmission while the SCG is deactivated. This assumption can be reconsidered if issues are found.
* FFS if RACH is needed for SCG reactivation

**Agreements**

**1 SCG RRC reconfiguration can select the SCG activation state (activated/deactivated) at PSCell addition/change, RRC resume or HO.**

**Agreements**

**5: When the SCG is in deactivated state, the UE sends MeasurementReport messages for measurement results of SN-configured measurements embedded in the E-UTRA (if the MCG is EUTRA) or in the NR (if the MCG is NR) ULInformationTransferMRDC message via SRB1**

**6a: When the SCG is in deactivated state, the UE can receive an SCG RRCReconfiguration message embedded in an MCG RRC(Connection)Reconfiguration message on SRB1, like when the SCG is activated, and then the UE**

**- processes the SCG RRCReconfiguration message according to Rel-15/16 procedures (FFS if any restriction/difference)**

**- sends an SCG RRCReconfigurationComplete message in the MCG RRC(Connection)ReconfigurationComplete message according to Rel-15/16 procedures**

**6b: The SCG RRCReconfiguration can change the PSCell. FFS if the UE does RACH towards the target PSCell, in that case.**

**7a: While the SCG is deactivated:**

**- there can be SCG SCells in deactivated state**

**- there cannot be SCG SCells in activated state**

**- it is FFS whether there can be SCells in SCG dormant state.**

**7b: FFS whether SCell can be added/reconfigured/released while the SCG is deactivated or this can be done only at SCG activation or after SCG activation.**

**8a: It is FFS whether the network can configure the UE stop certain configured RRM measurements while the SCG is deactivated, or can release certain RRM measurements at SCG deactivation.**

**8b: Relaxation of RRM measurement requirements (as compared with non-DRX activated cell requirements) while the SCG is deactivated is FFS.**

RAN3#111e—Agreements

**Xn interface: MN initiated SN addition procedure:**

**Add a new IE in the SN addition request message to indicate at least the de-activation, while the detail code of this new IE is FFS.**

E.g., if the IE is set to 1 or not existed, the SCG is requested to activate. If the IE is set to 0, the SCG is requested to de-activate.

**Add a new IE in the SN addition response message to indicate at least the de-activation result, while the detail code of this new IE is FFS.**

E.g., if the IE is set to 0, the SCG is de-activated. If the IE is set to 1, the SCG is activated.

Open issue 1: During SN addition procedure, if the request of SCG (de)activation is rejected:

1) SN uses the response message including “SCG deactivation” result is sufficient;

2) or SN allows to use the reject message including new Cause value;

3) or SN allows to uses the reject message as legacy (without new Cause)

**MN initiated SN modification procedure**

**Add a new IE, e.g., “SCG activation requested” with two codepoints in the SN modification request message in order to indicate the SCG is requested to activate or de-activate.**

**Add a new IE, e.g., “SCG activation result” with two codepoints in the SN modification response message in order to indicate the SCG is activated or de-activated.**

Open issue 2: During SN modification procedure, if the request of SCG (de)activation is rejected:

1) SN uses the response message including “SCG (de)activation” is sufficient;

2) or SN allows to use the reject message including new Cause value;

3) or SN allows to use the reject message as legacy (without new Cause).

FFS: Whether X2/Xn Handover procedure needs to be enhanced to support of SCG (de)activation.

**F1 interface: UE context setup procedure**

**Add a new IE in the UE context setup request message to indicate at least the de-activation, while the detail code of this new IE is FFS.**

E.g., if the IE is set to 1 or not existed, the SCG is requested to activate. If the IE is set to 0, the SCG is requested to de-activate.

**Add a new IE in the UE context setup response message to indicate at least the de-activation result, while the detail code of this new IE is FFS.**

E.g., if the IE is set to 0, the SCG is de-activated. If the IE is set to 1, the SCG is activated.

Open issue 3: During UE context setup procedure, if the request of SCG (de)activation is rejected:

1) gNB-DU uses the response message including “SCG (de)activation” is sufficient;

2) or gNB-DU allows to use the reject message including new Cause value;

3) or gNB-DU allows to use the reject message as legacy (without new Cause).

F1 interface: UE Context Modification

**Add a new IE, e.g., “SCG activation requested” with two codepoints in the UE Context Modification request message in order to indicate the SCG is requested to activate or de-activate.**

**Add a new IE, e.g., “SCG activation result” with two codepoints in the UE Context Modification response message in order to indicate the SCG is activated or de-activated.**

Open issue 4: During UE Context Modification procedure, if the request of SCG (de)activation is rejected:

1) gNB-DU uses the response message including “SCG (de)activation” is sufficient;

2) or gNB-DU allows to use the reject message including new Cause value;

3) or gNB-DU allows to use the reject message as legacy (without new Cause).

Open issue 5: Whether E1AP shall be enhanced to support of SCG (de)activation, if included, the Bearer Context Setup procedure enhancement shall be aligned with X2/Xn/F1AP.

Open issue 6: Whether E1AP shall be enhanced to support of SCG (de)activation, if included, the Bearer Context Modification enhancement shall be aligned with X2/Xn/F1AP.

Open issue 7: Introduce a new Cause value for class1 procedure failure case, e.g., “Requested SCG state not available” is defined as “The action failed because the requested SCG state is not accepted.”

RAN3#110e—Agreements

**Agreements:**

**MN initiated SN modification procedure can be used for support of SCG (de)activation, and SN can decide whether to accept or reject SCG (de)activation request after receiving SN modification request message.**

**Activity Notification message sent from SN to MN, can be used for the MN to make final decision on SCG (de)activation. It is FFS whether no spec impacts or the Activity Notification message shall be enhanced, e.g., add a new SCG (de)activation suggestion IE.**

**MN can initiate SCG (de)activation during SN addition procedure, SN can decide whether to accept or reject SCG (de)activation request after receiving SN addition request message, FFS on how to reject it.**