3GPP TSG-RAN2 Meeting #110-e R2-200xxxx

Elbonia, 1st – 12th June, 2020

**Agenda Item: 6.10.3**

**Source: Apple**

**Title: Email Report of [Post109bis-e][926][DCCA] Uplink power control for NR-NR Dual-Connectivity (Apple)**

**Document for: Discussion and Decision**

# Introduction

In RAN2#109bis-e meeting, RAN2 agreed to introduce the inter-node signaling enhancement to support the RAN1 working assumption of uplink dynamic power sharing in NR-DC, which is for MN to identify the T\_offset used by UE which is aligned with SCG configuration.

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| **RAN2 agreement*** Progress by email to next meeting on introduction of/modification of inter-node signalling for this case.
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This is the email discussion report on below email discussion:

* [Post109bis-e][926][DCCA] Uplink power control for NR-NR Dual-Connectivity (Apple)

 Scope : introduction of/modification of inter-node signalling to support what is decribed in R2-2002517
Outcome : Report
Deadline : Next meeting

# Discussion

## Background

Following is the NR-DC dynamic power sharing scheme agreed in RAN1.

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| Update the previous agreement as follows (changes in red):Agreements:·         For NR-DC dynamic power sharing, to compute the transmit power for SCG UL transmission starting at time T0,* UE checks for PDCCH(s) received before time T0-T\_offset that trigger an overlapping MCG UL transmission, and
	+ If such PDCCH(s) are detected, UE sets it’s transmit power in SCG (pwr\_SCG) such that pwr\_SCG <= min{PSCG, Ptotal – MCG tx power} where ‘MCG tx power’ is the actual transmission power of MCG
	+ Otherwise, pwr\_SCG <= Ptotal;
* UE does not expect to be scheduled by PDCCH(s) received on MCG after T0-[T\_offset] that trigger(s) MCG UL transmission(s) that overlaps with the SCG transmission.
	+ (working assumption) No new RRC signaling is introduced for T\_offset:
		- Alt.1: T\_offset =~~<= T\_proc,2~~ $max⁡\{T\_{proc,MCG}^{max},T\_{proc,SCG}^{max},\}$**,** where:
			* $T\_{proc,MCG}^{max}$ is the maximum UE processing time among any of the possible values from $T\_{proc,2}$**,** $T\_{proc,CSI}$**,** $T\_{proc,release}^{mux}$**,** $T\_{proc,2}^{mux}$**,** and/or$T\_{proc,CSI}^{mux}$as specified in TS38.213 and TS38.214 based on the configurations for the MCG.
			* $T\_{proc,SCG}^{max} $is the maximum UE processing time among any of the possible values from $T\_{proc,2}$**,** $T\_{proc,CSI}$**,** $T\_{proc,release}^{mux}$**,** $T\_{proc,2}^{mux}$**,** and/or$T\_{proc,CSI}^{mux}$as specified in TS38.213 and TS38.214 based on the configurations for the SCG.
			* This is the “DPS without look-ahead”.
		- Alt.2: T\_offset =~~<= 2\*T\_proc,2~~$max⁡\{T\_{proc,MCG}^{max},T\_{proc,SCG}^{max},\}$**,** where:
			* $T\_{proc,MCG}^{max}$ is the maximum UE processing time among any of the possible values from $T\_{proc,2}$**,** $T\_{proc,CSI}$**,** $T\_{proc,release}^{mux}$**,** and/or$T\_{proc,2}^{mux}$**,** as specified in TS38.213 and TS38.214 based on the configurations for the MCG.
			* $T\_{proc,SCG}^{max} $is the maximum UE processing time among any of the possible values from $T\_{proc,2}$**,** $T\_{proc,CSI}$**,** $T\_{proc,release}^{mux} $and/or$T\_{proc,2}^{mux}$**,** as specified in TS38.213 and TS38.214 based on the configurations for the SCG.
			* This is the “DPS with look-ahead”.
		- ~~Alt.3: T\_offset reasonbly larger than Alt 1. & Alt 2 but <=4ms~~
		- ~~To be addressed in the CR stage~~
	+ A UE reports the UE capability of Alt.1 and/or Alt.2.
		- Details up to UE feature list discussion
 |

Since T\_offset impacts the scheduling offset in MN, the RAN1 working assumption is that MN can identify the T\_offset used by the UE based on the SCG configuration (i.e., RRC parameters impacting $T\_{proc,2}$**,** $T\_{proc,CSI}$**,** $T\_{proc,release}^{mux}$**,** $T\_{proc,2}^{mux}$**,** and/or$T\_{proc,CSI}^{mux}$as specified in TS38.213 and TS38.214). Otherwise the MN needs to assume the possible largest value of T\_offset.

**Observation 1: MN needs to have the T\_offset information which is aligned with SCG configuration.**

According to RAN2#109bis-e discussion, it is the common understanding that MN and SN are not required to comprehend each other’s UE configuration for MR-DC. And RAN2 agreed to introduce the inter-gNB signaling for the necessary information sharing between MN and SN to help MN to acquire the T\_offset.

**Observation 2: Inter-node signaling is to be introduced to help MN acquire the T\_offset information.**

## Solutions

There are two kinds of solutions indicated in the contributions [1][4].

* **Solution 1:** Follow the semi-static power sharing coordination framework which is implemented for the different MR-DC options, as indicated in [4];

MN signals a *maxToffset* restriction to SN, and SN shall respect the restriction when deciding the SCG configuration, such that $T\_{proc,SCG}^{max}$ < *maxToffset*. By setting *maxToffset*, the MN knows the scheduling offset it can apply when scheduling UE on MCG. In addition, SN may request the change in the *maxToffset* restrictions imposed by the MN, and it is up to the MN to decide whether to change.

There are two directions for the inter-gNB signaling enhancement as follows.

* Direction 1 (MN -> SN): MN provides the *maxToffset* restriction to SN in *CG-ConfigInfo;*
* Direction 2 (SN - >MN): SN may request, in *CG-Config*, a change in the *maxToffset* restrictions imposed by the MN.
* **Solution 2:** Following the basic idea indicated in [1],

- when SN reconfigures SCG configuration via SRB1 or SRB3, SN provides the *maxToffsetSCG (i.e.* $T\_{proc,SCG}^{max}$) in *CG-Config* to MN, which is based on the SCG configuration. MN decides the T\_offset based on *maxToffsetSCG*.

- MN can also request SN to provides the *maxToffsetSCG (i.e.* $T\_{proc,SCG}^{max}$) in *CG-Config* to MN

#### **Question 1: Which solution do you prefer?**

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| **Company** | **Preference** | **Comments** |
| Ericsson | Solution 1 | Our preference is for Solution 1 (we are the proponent company for it). This solution guarantees a fair coordination between the MN and SN as we already to for other fields in the INMs (i.e., power sharing or band coordination).The main drawback if we go with Solution 2 is that the SN will “enforce” how the MN should perform the scheduling and this is something we want to avoid. We want the MN to have still a sort of control over the SN. |
| vivo | Solution2 | In our understanding, solution1 has the following issues:1. T\_offset is anyway the value of *maxToffset* from MN point of view*,* even if the values of $T\_{proc,MCG}^{max}$ $and T\_{proc,SCG}^{max}$ are smaller than *maxToffset*, and thus, RAN1 agreement needs to be changed to avoid the misalignment of the T\_offset value calculated by MN and UE.

For example, MN gives *maxToffset* =50ms to SN, SN configures *maxToffset* =30ms to the UE. There still is misalignment between MN and UE.Solution 2 can work well. Even MN gives the max restriction to SN, SN shall send the real T\_offset to the MN to align the understanding between MN and UE.  |
| Qualcomm | Solution 2 (with vivo correction)orSolution 1 is acceptable with clarification | For solution 1, we think at least following issues need clarifications:* If SN can’t use *maxToffset* restrictionfrom MN(e.g. MN requested 20us but SN can only use Toffset >50us), then SN will not perform dynamic power control, and wait whether its change request can be accepted by MN, right?
* If MN can’t accept SN’s change request, what is the followed procedure?

Furthermore, we can see below issues (maybe we have misunderstanding):* It may be difficulty for MN to estimate and set a reasonable initial *maxToffset* of SCG. Then it may cause multiple rounds of coordination between MN and SN on *maxToffset.* In our understanding, it is little different from EN-DC power sharing, where SCG power is limited by power class defined by RAN4.

For solution 2, we echo its drawback mentioned by Ericsson, i.e. SN will take some control over MN, which seems to be kind of conflicted with intention of dynamic power sharing. However, we also think solution 2 with vivo’s correction may be fine. In our understanding, the solution is:* MN can include 1-bit query in CG-ConfigInfo to request *maxToffsetSCG* from SN
* SN can also directly include *maxToffsetSCG* upon reconfiguration of SCG via SRB3 (where MN is not aware)

Among them, we slightly prefer corrected solution 2. However, we can follow majority (if majority prefers Option 1), as long as we introduce inter-node signaling to coordinate T\_offset. |
| Nokia | Solution 1 | We fully agree with Ericsson: Only solution 1 follows the Rel-15 MR-DC design principle that MN decides on its configuration and indicates the configuration restrictions to SN, and SN then applies those to determine its own configuration. Solution 2 would force MN to adapt to the SN configuration, which is not acceptable as it (yet again) breaks the Rel-15 principles. If SN cannot comply with the MN restrictions, it can reject the NR-DC. That is typical way with MR-DC design and will then be solved in the field: MN may use static power sharing with such SNs that cannot comply with the MN requirement. that also has zero impact on the UE and is fully within network control. On Vivo’s point about exact T\_offset not being known by MN, that’s not a real problem: If it’s desired that MN knows the exact T\_offset, then SN can input that back to the MN when it accepts the NR-DC. That would be a very simply solution.We cannot accept solution 2 because it (again!) breaks the Rel-15 principles. |
| Vodafone  | Solution 1 | Solution 1 is more aligned, as it has been pointe out by Ericsson and Nokia, to Rel15 approach where the Master Node is more in control of the Secondary node  |
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#### **Question 2: Do you agree the TP as indicated in section 5.1 if solution 1 is your preference?**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes |  |
| Qualcomm |  | Overall is fine, but some clarification is needed |
| Nokia | Yes |  |
| Vodafone  | Yes  |  |
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#### **Question 3: Do you agree the TP as indicated in section 5.2 if solution 2 is your preference?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | Yes | Maybe further improvement.  |
| Qualcomm |  | 1-bit request can be added in CG-ConfigInfo if can be agreed |
| Nokia | No | See above comments |
| Vodafone | No |  |
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Companies are invited to provide your open issue list for issues not covered.

#### **Question 4: Any other open issues?**

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| **Company** | **Open issue lists** |
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# Conclusion

The followings are proposed:

TBD

The corresponding TP is provided in section 5.

# Reference

1. R2-2002893 T\_offset determination for NR-DC dynamic power sharing vivo discussion
2. R2-2002894 Draft CR on T\_offset determination for NR-DC dynamic power sharing vivo draftCR Rel-16 38.331 16.0.0 LTE\_NR\_DC\_CA\_enh-Core
3. R2-2002895 Draft LS on T\_offset determination for NR-DC dynamic power sharing vivo LS out To:RAN1
4. R2-2003198 Discussion on Toffset for NR-DC power control Ericsson discussion Rel-16 LTE\_NR\_DC\_CA\_enh-Core
5. R2-2002979 NR DC power control Nokia, Nokia Shanghai Bell discussion Rel-16 LTE\_NR\_DC\_CA\_enh-Core
6. R2-2002980 Reply LS on uplink power control for NR-NR Dual-Connectivity Nokia, Nokia Shanghai Bell LS out Rel-16 LTE\_NR\_DC\_CA\_enh-Core To:RAN WG1
7. R2-2003655 Discussion on RAN2 impact for NR-DC Dynamic Power Sharing Huawei, HiSilicon discussion Rel-16 LTE\_NR\_DC\_CA\_enh-Core

# Text Proposal to 38.331

## TP for Solution 1 [4]

*START OF CHANGES*

11.2.2 Message definitions

– *CG-Config*

This message is used to transfer the SCG radio configuration as generated by the SgNB or SeNB. It can also be used by a CU to request a DU to perform certain actions, e.g. to request the DU to perform a new lower layer configuration.

Direction: Secondary gNB or eNB to master gNB or eNB, alternatively CU to DU.

***CG-Config* message**

-- ASN1START

-- TAG-CG-CONFIG-START

CG-Config ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 cg-Config CG-Config-IEs,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

CG-Config-IEs ::= SEQUENCE {

 scg-CellGroupConfig OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,

 scg-RB-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,

 configRestrictModReq ConfigRestrictModReqSCG OPTIONAL,

 drx-InfoSCG DRX-Info OPTIONAL,

 candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

 measConfigSN MeasConfigSN OPTIONAL,

 selectedBandCombination BandCombinationInfoSN OPTIONAL,

 fr-InfoListSCG FR-InfoList OPTIONAL,

 candidateServingFreqListNR CandidateServingFreqListNR OPTIONAL,

 nonCriticalExtension CG-Config-v1540-IEs OPTIONAL

}

CG-Config-v1540-IEs ::= SEQUENCE {

 pSCellFrequency ARFCN-ValueNR OPTIONAL,

 reportCGI-RequestNR SEQUENCE {

 requestedCellInfo SEQUENCE {

 ssbFrequency ARFCN-ValueNR,

 cellForWhichToReportCGI PhysCellId

 } OPTIONAL

 } OPTIONAL,

 ph-InfoSCG PH-TypeListSCG OPTIONAL,

 nonCriticalExtension CG-Config-v1560-IEs OPTIONAL

}

CG-Config-v1560-IEs ::= SEQUENCE {

 pSCellFrequencyEUTRA ARFCN-ValueEUTRA OPTIONAL,

 scg-CellGroupConfigEUTRA OCTET STRING OPTIONAL,

 candidateCellInfoListSN-EUTRA OCTET STRING OPTIONAL,

 candidateServingFreqListEUTRA CandidateServingFreqListEUTRA OPTIONAL,

 needForGaps ENUMERATED {true} OPTIONAL,

 drx-ConfigSCG DRX-Config OPTIONAL,

 reportCGI-RequestEUTRA SEQUENCE {

 requestedCellInfoEUTRA SEQUENCE {

 eutraFrequency ARFCN-ValueEUTRA,

 cellForWhichToReportCGI-EUTRA EUTRA-PhysCellId

 } OPTIONAL

 } OPTIONAL,

 nonCriticalExtension CG-Config-v1590-IEs OPTIONAL

}

CG-Config-v1590-IEs ::= SEQUENCE {

 scellFrequenciesSN-NR SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueNR OPTIONAL,

 scellFrequenciesSN-EUTRA SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueEUTRA OPTIONAL,

 nonCriticalExtension CG-Config-v16xx-IEs OPTIONAL

}

CG-Config-v16xx-IEs ::= SEQUENCE {

 drx-InfoSCG2 DRX-Info2 OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

PH-TypeListSCG ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF PH-InfoSCG

PH-InfoSCG ::= SEQUENCE {

 servCellIndex ServCellIndex,

 ph-Uplink PH-UplinkCarrierSCG,

 ph-SupplementaryUplink PH-UplinkCarrierSCG OPTIONAL,

 ...

}

PH-UplinkCarrierSCG ::= SEQUENCE{

 ph-Type1or3 ENUMERATED {type1, type3},

 ...

}

MeasConfigSN ::= SEQUENCE {

 measuredFrequenciesSN SEQUENCE (SIZE (1..maxMeasFreqsSN)) OF NR-FreqInfo OPTIONAL,

 ...

}

NR-FreqInfo ::= SEQUENCE {

 measuredFrequency ARFCN-ValueNR OPTIONAL,

 ...

}

ConfigRestrictModReqSCG ::= SEQUENCE {

 requestedBC-MRDC BandCombinationInfoSN OPTIONAL,

 requestedP-MaxFR1 P-Max OPTIONAL,

 ...,

 [[

 requestedPDCCH-BlindDetectionSCG INTEGER (1..15) OPTIONAL,

 requestedP-MaxEUTRA P-Max OPTIONAL

 ]],

 [[

 requestedP-MaxFR2-r16 P-Max OPTIONAL

 ]] ,

 [[

 requestedToffset-r16 ENUMERATED {ffsValue} OPTIONAL

 ]]

}

BandCombinationIndex ::= INTEGER (1..maxBandComb)

BandCombinationInfoSN ::= SEQUENCE {

 bandCombinationIndex BandCombinationIndex,

 requestedFeatureSets FeatureSetEntryIndex

}

FR-InfoList ::= SEQUENCE (SIZE (1..maxNrofServingCells-1)) OF FR-Info

FR-Info ::= SEQUENCE {

 servCellIndex ServCellIndex,

 fr-Type ENUMERATED {fr1, fr2}

}

CandidateServingFreqListNR ::= SEQUENCE (SIZE (1.. maxFreqIDC-MRDC)) OF ARFCN-ValueNR

CandidateServingFreqListEUTRA ::= SEQUENCE (SIZE (1.. maxFreqIDC-MRDC)) OF ARFCN-ValueEUTRA

-- TAG-CG-CONFIG-STOP

-- ASN1STOP

|  |
| --- |
| ***CG-Config* field descriptions** |
| ***candidateCellInfoListSN***Contains information regarding cells that the source secondary node suggests the target secondary gNB to consider configuring. |
| ***candidateCellInfoListSN-EUTRA***Includes the *MeasResultList3EUTRA* as specified in TS 36.331 [10]. Contains information regarding cells that the source secondary node suggests the target secondary eNB to consider configuring. This field is only used in NE-DC. |
| ***candidateServingFreqListNR, candidateServingFreqListEUTRA***Indicates frequencies of candidate serving cells for In-Device Co-existence Indication (see TS 36.331 [10]). |
| ***configRestrictModReq***Used by SN to request changes to SCG configuration restrictions previously set by MN to ensure UE capabilities are respected. E.g. can be used to request configuring an NR band combination whose use MN has previously forbidden. |
| ***drx-ConfigSCG***This field contains the complete DRX configuration of the SCG. This field is only used in NR-DC. |
| ***drx-InfoSCG***This field contains the DRX long and short cycle configuration of the SCG. This field is used in (NG)EN-DC and NE-DC. |
| ***drx-InfoSCG2***This field contains the *drx-onDurationTimer* configuration of the SCG. This field is only used in (NG)EN-DC. |
| ***fr-InfoListSCG***Contains information of FR information of serving cells that include PScell and SCells configured in SCG. |
| ***measuredFrequenciesSN***Used by SN to indicate a list of frequencies measured by the UE. |
| ***needForGaps***In NE-DC, indicates wheter the SN requests gNB to configure measurements gaps. |
| ***ph-InfoSCG***Power headroom information in SCG that is needed in the reception of PHR MAC CE of MCG |
| ***ph-SupplementaryUplink***Power headroom information for supplementary uplink. In the case of (NG)EN-DC and NR-DC, this field is only present when two UL carriers are configued for a serving cell and one UL carrier reports type1 PH while the other reports type 3 PH.  |
| ***ph-Type1or3***Type of power headroom for a certain serving cell in SCG (PSCell and activated SCells). Value *type1* refers to type 1 power headroom, value *type3* refers to type 3 power headroom. (See TS 38.321 [3]). |
| ***ph-Uplink***Power headroom information for uplink. |
| ***pSCellFrequency, pSCellFrequencyEUTRA***Indicates the frequency of PSCell in NR (i.e., *pSCellFrequency*) or E-UTRA (i.e., *pSCellFrequencyEUTRA*). In this version of the specification, *pSCellFrequency* is not used in NE-DC whereas *pSCellFrequencyEUTRA* is only used in NE-DC. |
| ***reportCGI-RequestNR, reportCGI-RequestEUTRA***Used by SN to indicate to MN about configuring *reportCGI* procedure. The request may optionally contain information about the cell for which SN intends to configure *reportCGI* procedure. In this version of the specification, the *reportCGI-RequestNR* is used in (NG)EN-DC and NR-DC whereas *reportCGI-RequestEUTRA* is used only for NE-DC. |
| ***requestedBC-MRDC***Used to request configuring a band combination and corresponding feature sets which are forbidden to use by MN (i.e. outside of the *allowedBC-ListMRDC*) to allow re-negotiation of the UE capabilities for SCG configuration. |
| ***requestedPDCCH-BlindDetectionSCG***Requested value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG. |
| ***requestedP-MaxEUTRA***Requested value for the maximum power for the serving cells the UE can use in E-UTRA SCG. This field is only used in NE-DC. |
| ***requestedP-MaxFR1***Requested value for the maximum power for the serving cells on frequency range 1 (FR1) in this secondary cell group (see TS 38.104 [12]) the UE can use in NR SCG. |
| ***requestedP-MaxFR2***Requested value for the maximum power for the serving cells on frequency range 2 (FR2) in this secondary cell group the UE can use in NR SCG. This field is only used in NR-DC. |
| ***requestedToffset***Requested value for the time offset. This field is used in NR-DC only when the fields *nrdc-PC-mode-FR1-r16* or *nrdc-PC-mode-FR2-r16* are set to dynamic. |
| ***scellFrequenciesSN-EUTRA, scellFrequenciesSN-NR***Indicates the frequency of all SCells configured in SCG. The field *scellFrequenciesSN-EUTRA* is used in NE-DC; the field *scellFrequenciesSN-NR* is used in (NG)EN-DC and NR-DC. In (NG)EN-DC, the field is optionally provided to the MN. |
| ***scg-CellGroupConfig***Contains the *RRCReconfiguration* message (containing only *secondaryCellGroup* and/or *measConfig*):- to be sent to the UE, used upon SCG establishment or modification, as generated (entirely) by the (target) SgNB. In this case, the SN sets the *RRCReconfiguration* message in accordance with clause 6 e.g. regarding the "Need" or "Cond" statements. or- including the current SCG configuration of the UE, when provided in response to a query from MN, or in SN triggered SN change in order to enable delta signaling by the target SN. In this case, the SN sets the *RRCReconfiguration* message in accordance with clause 11.2.3.The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG (re)configuration towards the UE. This field is not applicable in NE-DC. |
| ***scg-CellGroupConfigEUTRA***Includes the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field *scg-Configuration*. Used to (re-)configure the SCG configuration upon SCG establishment or modification, as generated (entirely) by the (target) SeNB. This field is only used in NE-DC. |
| ***scg-RB-Config***Contains the IE *RadioBearerConfig*:- to be sent to the UE, used to (re-)configure the SCG RB configuration upon SCG establishment or modification, as generated (entirely) by the (target) SgNB or SeNB. In this case, the SN sets the *RadioBearerConfig* in accordance with clause 6, e.g. regarding the "Need" or "Cond" statements. or- including the current SCG RB configuration of the UE, when provided in response to a query from MN or in SN triggered SN change or bearer type change between SN terminated bearer to MN terminated bearer in order to enable delta signaling by the MN or target SN. In this case, the SN sets the *RadioBearerConfig* in accordance with clause 11.2.3.The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG RB (re)configuration. |
| ***selectedBandCombination***Indicates the band combination selected by SN in (NG)EN-DC, NE-DC, and NR-DC. The SN should inform the MN with this field whenever the band combination and/or feature set it selected for the SCG changes (i.e. even if the new selection concerns a band combination and/or feature set that is allowed by the *allowedBC-ListMRDC*) |

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| ***BandCombinationInfoSN* field descriptions** |
| ***bandCombinationIndex***In case of (NG)EN-DC and NR-DC, this field indicates the position of a band combination in the *supportedBandCombinationList.* In case of NE-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationListNEDC-Only*. Band combination entries in *supportedBandCombinationList* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationListNEDC-Only* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationListNEDC-Only* increased by the number of entries in *supportedBandCombinationList*. |
| ***requestedFeatureSets***The position in the *FeatureSetCombination* which identifies one *FeatureSetUplink*/*Downlink* for each band entry in the associated band combination |

*– CG-ConfigInfo*

This message is used by master eNB or gNB to request the SgNB or SeNB to perform certain actions e.g. to establish, modify or release an SCG. The message may include additional information e.g. to assist the SgNB or SeNB to set the SCG configuration. It can also be used by a CU to request a DU to perform certain actions, e.g. to establish, or modify an MCG or SCG.

Direction: Master eNB or gNB to secondary gNB or eNB, alternatively CU to DU.

***CG-ConfigInfo* message**

-- ASN1START

-- TAG-CG-CONFIG-INFO-START

CG-ConfigInfo ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 cg-ConfigInfo CG-ConfigInfo-IEs,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

CG-ConfigInfo-IEs ::= SEQUENCE {

 ue-CapabilityInfo OCTET STRING (CONTAINING UE-CapabilityRAT-ContainerList) OPTIONAL,-- Cond SN-AddMod

 candidateCellInfoListMN MeasResultList2NR OPTIONAL,

 candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

 measResultCellListSFTD-NR MeasResultCellListSFTD-NR OPTIONAL,

 scgFailureInfo SEQUENCE {

 failureType ENUMERATED { t310-Expiry, randomAccessProblem,

 rlc-MaxNumRetx, synchReconfigFailure-SCG,

 scg-reconfigFailure,

 srb3-IntegrityFailure},

 measResultSCG OCTET STRING (CONTAINING MeasResultSCG-Failure)

 } OPTIONAL,

 configRestrictInfo ConfigRestrictInfoSCG OPTIONAL,

 drx-InfoMCG DRX-Info OPTIONAL,

 measConfigMN MeasConfigMN OPTIONAL,

 sourceConfigSCG OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,

 scg-RB-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,

 mcg-RB-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,

 mrdc-AssistanceInfo MRDC-AssistanceInfo OPTIONAL,

 nonCriticalExtension CG-ConfigInfo-v1540-IEs OPTIONAL

}

CG-ConfigInfo-v1540-IEs ::= SEQUENCE {

 ph-InfoMCG PH-TypeListMCG OPTIONAL,

 measResultReportCGI SEQUENCE {

 ssbFrequency ARFCN-ValueNR,

 cellForWhichToReportCGI PhysCellId,

 cgi-Info CGI-InfoNR

 } OPTIONAL,

 nonCriticalExtension CG-ConfigInfo-v1560-IEs OPTIONAL

}

CG-ConfigInfo-v1560-IEs ::= SEQUENCE {

 candidateCellInfoListMN-EUTRA OCTET STRING OPTIONAL,

 candidateCellInfoListSN-EUTRA OCTET STRING OPTIONAL,

 sourceConfigSCG-EUTRA OCTET STRING OPTIONAL,

 scgFailureInfoEUTRA SEQUENCE {

 failureTypeEUTRA ENUMERATED { t313-Expiry, randomAccessProblem,

 rlc-MaxNumRetx, scg-ChangeFailure},

 measResultSCG-EUTRA OCTET STRING

 } OPTIONAL,

 drx-ConfigMCG DRX-Config OPTIONAL,

 measResultReportCGI-EUTRA SEQUENCE {

 eutraFrequency ARFCN-ValueEUTRA,

 cellForWhichToReportCGI-EUTRA EUTRA-PhysCellId,

 cgi-InfoEUTRA CGI-InfoEUTRA

 } OPTIONAL,

 measResultCellListSFTD-EUTRA MeasResultCellListSFTD-EUTRA OPTIONAL,

 fr-InfoListMCG FR-InfoList OPTIONAL,

 nonCriticalExtension CG-ConfigInfo-v1570-IEs OPTIONAL

}

CG-ConfigInfo-v1570-IEs ::= SEQUENCE {

 sftdFrequencyList-NR SFTD-FrequencyList-NR OPTIONAL,

 sftdFrequencyList-EUTRA SFTD-FrequencyList-EUTRA OPTIONAL,

 nonCriticalExtension CG-ConfigInfo-v1590-IEs OPTIONAL

}

CG-ConfigInfo-v1590-IEs ::= SEQUENCE {

 servFrequenciesMN-NR SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueNR OPTIONAL,

 nonCriticalExtension CG-ConfigInfo-v16xx-IEs OPTIONAL

}

CG-ConfigInfo-v16xx-IEs ::= SEQUENCE {

 drx-InfoMCG2 DRX-Info2 OPTIONAL,

 alignedDRX-Indication ENUMERATED {true} OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

SFTD-FrequencyList-NR ::= SEQUENCE (SIZE (1..maxCellSFTD)) OF ARFCN-ValueNR

SFTD-FrequencyList-EUTRA ::= SEQUENCE (SIZE (1..maxCellSFTD)) OF ARFCN-ValueEUTRA

ConfigRestrictInfoSCG ::= SEQUENCE {

 allowedBC-ListMRDC BandCombinationInfoList OPTIONAL,

 powerCoordination-FR1 SEQUENCE {

 p-maxNR-FR1 P-Max OPTIONAL,

 p-maxEUTRA P-Max OPTIONAL,

 p-maxUE-FR1 P-Max OPTIONAL

 } OPTIONAL,

 servCellIndexRangeSCG SEQUENCE {

 lowBound ServCellIndex,

 upBound ServCellIndex

 } OPTIONAL, -- Cond SN-AddMod

 maxMeasFreqsSCG INTEGER(1..maxMeasFreqsMN) OPTIONAL,

 dummy INTEGER(1..maxMeasIdentitiesMN) OPTIONAL,

 ...,

 [[

 selectedBandEntriesMNList SEQUENCE (SIZE (1..maxBandComb)) OF SelectedBandEntriesMN OPTIONAL,

 pdcch-BlindDetectionSCG INTEGER (1..15) OPTIONAL,

 maxNumberROHC-ContextSessionsSN INTEGER(0.. 16384) OPTIONAL

 ]],

 [[

 maxIntraFreqMeasIdentitiesSCG INTEGER(1..maxMeasIdentitiesMN) OPTIONAL,

 maxInterFreqMeasIdentitiesSCG INTEGER(1..maxMeasIdentitiesMN) OPTIONAL

 ]],

 [[

 maxMeasSRS-ResourceSCG-r16 INTEGER(0..maxNrofSRS-Resources-r16) OPTIONAL,

 maxMeasCLI-ResourceSCG-r16 INTEGER(0..maxNrofCLI-RSSI-Resources-r16) OPTIONAL,

 p-maxNR-FR1-MCG-r16 P-Max OPTIONAL,

 powerCoordination-FR2-r16 SEQUENCE {

 p-maxNR-FR2-MCG-r16 P-Max OPTIONAL,

 p-maxNR-FR2-SCG-r16 P-Max OPTIONAL,

 p-maxUE-FR2-r16 P-Max OPTIONAL

 } OPTIONAL,

 nrdc-PC-mode-FR1-r16 ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic} OPTIONAL,

 nrdc-PC-mode-FR2-r16 ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic} OPTIONAL

 ]] ,

 [[

 maxToffset-r16 ENUMERATED {ffsValue} OPTIONAL

 ]]

}

SelectedBandEntriesMN ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandEntryIndex

BandEntryIndex ::= INTEGER (0.. maxNrofServingCells)

PH-TypeListMCG ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF PH-InfoMCG

PH-InfoMCG ::= SEQUENCE {

 servCellIndex ServCellIndex,

 ph-Uplink PH-UplinkCarrierMCG,

 ph-SupplementaryUplink PH-UplinkCarrierMCG OPTIONAL,

 ...

}

PH-UplinkCarrierMCG ::= SEQUENCE{

 ph-Type1or3 ENUMERATED {type1, type3},

 ...

}

BandCombinationInfoList ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationInfo

BandCombinationInfo ::= SEQUENCE {

 bandCombinationIndex BandCombinationIndex,

 allowedFeatureSetsList SEQUENCE (SIZE (1..maxFeatureSetsPerBand)) OF FeatureSetEntryIndex

}

FeatureSetEntryIndex ::= INTEGER (1.. maxFeatureSetsPerBand)

DRX-Info ::= SEQUENCE {

 drx-LongCycleStartOffset CHOICE {

 ms10 INTEGER(0..9),

 ms20 INTEGER(0..19),

 ms32 INTEGER(0..31),

 ms40 INTEGER(0..39),

 ms60 INTEGER(0..59),

 ms64 INTEGER(0..63),

 ms70 INTEGER(0..69),

 ms80 INTEGER(0..79),

 ms128 INTEGER(0..127),

 ms160 INTEGER(0..159),

 ms256 INTEGER(0..255),

 ms320 INTEGER(0..319),

 ms512 INTEGER(0..511),

 ms640 INTEGER(0..639),

 ms1024 INTEGER(0..1023),

 ms1280 INTEGER(0..1279),

 ms2048 INTEGER(0..2047),

 ms2560 INTEGER(0..2559),

 ms5120 INTEGER(0..5119),

 ms10240 INTEGER(0..10239)

 },

 shortDRX SEQUENCE {

 drx-ShortCycle ENUMERATED {

 ms2, ms3, ms4, ms5, ms6, ms7, ms8, ms10, ms14, ms16, ms20, ms30, ms32,

 ms35, ms40, ms64, ms80, ms128, ms160, ms256, ms320, ms512, ms640, spare9,

 spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 },

 drx-ShortCycleTimer INTEGER (1..16)

 } OPTIONAL

}

DRX-Info2 ::= SEQUENCE {

 drx-onDurationTimer CHOICE {

 subMilliSeconds INTEGER (1..31),

 milliSeconds ENUMERATED {

 ms1, ms2, ms3, ms4, ms5, ms6, ms8, ms10, ms20, ms30, ms40, ms50, ms60,

 ms80, ms100, ms200, ms300, ms400, ms500, ms600, ms800, ms1000, ms1200,

 ms1600, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 }

 }

}

MeasConfigMN ::= SEQUENCE {

 measuredFrequenciesMN SEQUENCE (SIZE (1..maxMeasFreqsMN)) OF NR-FreqInfo OPTIONAL,

 measGapConfig SetupRelease { GapConfig } OPTIONAL,

 gapPurpose ENUMERATED {perUE, perFR1} OPTIONAL,

 ...,

 [[ measGapConfigFR2 SetupRelease { GapConfig } OPTIONAL

 ]]

}

MRDC-AssistanceInfo ::= SEQUENCE {

 affectedCarrierFreqCombInfoListMRDC SEQUENCE (SIZE (1..maxNrofCombIDC)) OF AffectedCarrierFreqCombInfoMRDC,

 ...

}

AffectedCarrierFreqCombInfoMRDC ::= SEQUENCE {

 victimSystemType VictimSystemType,

 interferenceDirectionMRDC ENUMERATED {eutra-nr, nr, other, utra-nr-other, nr-other, spare3, spare2, spare1},

 affectedCarrierFreqCombMRDC SEQUENCE {

 affectedCarrierFreqCombEUTRA AffectedCarrierFreqCombEUTRA OPTIONAL,

 affectedCarrierFreqCombNR AffectedCarrierFreqCombNR

 } OPTIONAL

}

VictimSystemType ::= SEQUENCE {

 gps ENUMERATED {true} OPTIONAL,

 glonass ENUMERATED {true} OPTIONAL,

 bds ENUMERATED {true} OPTIONAL,

 galileo ENUMERATED {true} OPTIONAL,

 wlan ENUMERATED {true} OPTIONAL,

 bluetooth ENUMERATED {true} OPTIONAL

}

AffectedCarrierFreqCombEUTRA ::= SEQUENCE (SIZE (1..maxNrofServingCellsEUTRA)) OF ARFCN-ValueEUTRA

AffectedCarrierFreqCombNR ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF ARFCN-ValueNR

-- TAG-CG-CONFIG-INFO-STOP

-- ASN1STOP

|  |
| --- |
| ***CG-ConfigInfo* field descriptions** |
| ***alignedDRX-Indication***This field is signalled upon MN triggered CGI reporting by the UE that requires aligned DRX configurations between the MCG and the SCG (i.e. same DRX cycle and on-duration configured by MN completely contains on-duration configured by SN). |
| ***allowedBC-ListMRDC***A list of indices referring to band combinations in MR-DC capabilities from which SN is allowed to select the SCG band combination. Each entry refers to : - a band combination numbered according to *supportedBandCombinationList* in the *UE-MRDC-Capability* (in case of (NG)EN-DC, or according to *supportedBandCombinationList* and *supportedBandCombinationListNEDC-Only* in the *UE-MRDC-Capability* (in case of NE-DC), or according to *supportedBandCombinationList* in the UE-NR-Capability (in case of NR-DC) ;- and the Feature Sets allowed for each band entry. All MR-DC band combinations indicated by this field comprise the MCG band combination, which is a superset of the MCG band(s) selected by MN. |
| ***candidateCellInfoListMN***, ***candidateCellInfoListSN***Contains information regarding cells that the master node or the source node suggests the target gNB or DU to consider configuring.For (NG)EN-DC, including CSI-RS measurement results in *candidateCellInfoListMN* is not supported in this version of the specification. For NR-DC, including SSB and/or CSI-RS measurement results in *candidateCellInfoListMN* is supported. |
| ***candidateCellInfoListMN-EUTRA***, ***candidateCellInfoListSN-EUTRA***Includes the *MeasResultList3EUTRA* as specified in TS 36.331 [10]. Contains information regarding cells that the master node or the source node suggests the target secondary eNB to consider configuring. These fields are only used in NE-DC. |
| ***configRestrictInfo***Includes fields for which SgNB is explictly indicated to observe a configuration restriction. |
| ***drx-ConfigMCG***This field contains the complete DRX configuration of the MCG. This field is only used in NR-DC. |
| ***drx-InfoMCG***This field contains the DRX long and short cycle configuration of the MCG. This field is used in (NG)EN-DC and NE-DC. |
| ***drx-InfoMCG2***This field contains the *drx-onDurationTimer* configuration of the MCG and a DRX alignment indication. This field is only used in (NG)EN-DC. |
| ***fr-InfoListMCG***Contains information of FR information of serving cells that include PCell and SCell(s) configured in MCG. |
| ***maxMeasFreqsSCG***Indicates the maximum number of NR inter-frequency carriers the SN is allowed to configure with PSCell for measurements. |
| ***dummy***Indicates the maximum number of allowed measurement identities that the SCG is allowed to configure. |
| ***maxNumberROHC-ContextSessionsSN***This field is not used in the specification and SN ignores the received value. |
| ***maxInterFreqMeasIdentitiesSCG***Indicates the maximum number of allowed measurement identities that the SCG is allowed to configure for inter-frequency measurement. The maximum value for this field is 10. If the field is absent, the SCG is allowed to configure inter-frequency measurements up to the maximum value. This field is only used in NR-DC. |
| ***maxIntraFreqMeasIdentitiesSCG***Indicates the maximum number of allowed measurement identities that the SCG is allowed to configure for intra-frequency measurement on each serving frequency. The maximum value for this field is 9 (in case of (NG)EN-DC or NR-DC) or 10 (in case of NE-DC). If the field is absent, the SCG is allowed to configure intra-frequency measurements up to the maximum value on each serving frequency. |
| ***maxMeasSRS-ResourceSCG***Indicates the maximum number of SRS resources that the SCG is allowed to configure for CLI measurement. |
| ***maxMeasCLI-ResourceSCG***Indicates the maximum number of CLI RSSI resources that the SCG is allowed to configure. |
| ***maxToffset***Indicates the maximum value used by the MN for scheduling MCG transmissions (see TS 38.213 [13]). This field is used in NR-DC only when the fields *nrdc-PC-mode-FR1-r16* or *nrdc-PC-mode-FR2-r16* are set to dynamic. |
| ***measuredFrequenciesMN***Used by MN to indicate a list of frequencies measured by the UE. |
| ***measGapConfig***Indicates the FR1 and perUE measurement gap configuration configured by MN. |
| ***measGapConfigFR2***Indicates the FR2 measurement gap configuration configured by MN. |
| ***mcg-RB-Config***Contains all of the fields in the IE *RadioBearerConfig* used in MCG, used by the SN to support delta configuration to UE, for bearer type change between MN terminated bearer with NR PDCP to SN terminated bearer. It is also used to indicate the PDCP duplication related information for MN terminated split bearer (whether duplication is configured and if so, whether it is initially activated) in SN Addition/Modification procedure. Otherwise, this field is absent. |
| ***measResultReportCGI, measResultReportCGI-EUTRA***Used by MN to provide SN with CGI-Info for the cell as per SN′s request. In this version of the specification, the *measResultReportCGI* is used for (NG)EN-DC and NR-DC and the *measResultReportCGI-EUTRA* is used only for NE-DC. |
| ***measResultSCG-EUTRA***This field includes the *MeasResultSCG-FailureMRDC* IE as specified in TS 36.331 [10]. This field is only used in NE-DC. |
| ***measResultSFTD-EUTRA***SFTD measurement results between the PCell and the E-UTRA PScell in NE-DC. This field is only used in NE-DC. |
| ***mrdc-AssistanceInfo***Contains the IDC assistance information for MR-DC reported by the UE (see TS 36.331 [10]). |
| ***nrdc-PC-mode-FR1***Indicates the uplink power sharing mode that the UE uses in NR-DC FR1 (see TS 38.213 [13], clause 7.6). |
| ***nrdc-PC-mode-FR2***Indicates the uplink power sharing mode that the UE uses in NR-DC FR2 (see TS 38.213 [13], clause 7.6). |
| ***p-maxEUTRA***Indicates the maximum total transmit power to be used by the UE in the E-UTRA cell group (see TS 36.104 [33]). This field is used in (NG)EN-DC and NE-DC. |
| ***p-maxNR-FR1***Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 1 (FR1) (see TS 38.104 [12]). The field is used in (NG)EN-DC and NE-DC. |
| ***p-maxUE-FR1***Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1). |
| ***p-maxNR-FR1-MCG***Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 1 (FR1) (see TS 38.104 [12]) the UE can use in NR MCG. This field is only used in NR-DC. |
| ***p-maxNR-FR2-SCG***Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 2 (FR2) (see TS 38.104 [12]) the UE can use in NR SCG.  |
| ***p-maxUE-FR2***Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 2 (FR2).  |
| ***p-maxNR-FR2-MCG***Indicates the maximum total transmit power to be used by the UE in the NR cell group across all serving cells in frequency range 2 (FR2) (see TS 38.104 [12]) the UE can use in NR MCG.  |
| ***pdcch-BlindDetectionSCG***Indicates the maximum value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG. |
| ***ph-InfoMCG***Power headroom information in MCG that is needed in the reception of PHR MAC CE in SCG. |
| ***ph-SupplementaryUplink***Power headroom information for supplementary uplink. For UE in (NG)EN-DC, this field is absent. |
| ***ph-Type1or3***Type of power headroom for a serving cell in MCG (PCell and activated SCells). *type1* refers to type 1 power headroom, *type3* refers to type 3 power headroom. (See TS 38.321 [3]).  |
| ***ph-Uplink***Power headroom information for uplink. |
| ***powerCoordination-FR1***Indicates the maximum power that the UE can use in FR1. |
| ***powerCoordination-FR2***Indicates the maximum power that the UE can use in frequency range 2 (FR2). This field is only used in NR-DC. |
| ***scgFailureInfo***Contains SCG failure type and measurement results. In case the sender has no measurement results available, the sender may include one empty entry (i.e. without any optional fields present) in *measResultPerMOList*. This field is used in (NG)EN-DC and NR-DC. |
| ***scgFailureInfoEUTRA***Contains SCG failure type and measurement results of the EUTRA secondary cell group. This field is only used in NE-DC. |
| ***scg-RB-Config***Contains all of the fields in the IE RadioBearerConfig used in SCG, used to allow the target SN to use delta configuration to the UE, e.g. during SN change. The field is signalled upon change of SN. Otherwise, the field is absent. This field is also absent when master eNB uses full configuration option. |
| ***selectedBandEntriesMNList***A list of indices referring to the position of a band entry selected by the MN, in each band combination entry in *allowedBC-ListMRDC* IE. *BandEntryIndex* 0 identifies the first band in the *bandList* of the *BandCombination*, *BandEntryIndex* 1 identifies the second band in the *bandList* of the *BandCombination*, and so on. This *selectedBandEntriesMNList* includes the same number of entries, and listed in the same order as in *allowedBC-ListMRDC*. The SN uses this information to determine which bands out of the NR band combinations in *allowedBC-ListMRDC* it can configure in SCG. This field is only used in NR-DC. |
| ***servCellIndexRangeSCG***Range of serving cell indices that SN is allowed to configure for SCG serving cells. |
| ***servFrequenciesMN-NR***Indicates the frequency of all serving cells that include PCell and SCell(s) configured in MCG. This field is only used in NR-DC. |
| ***sftdFrequencyList-NR***Includes a list of SSB frequencies. Each entry identifies the SSB frequency of a PSCell, which corresponds to one *MeasResultCellSFTD-NR* entry in the *MeasResultCellListSFTD-NR*. |
| ***sftdFrequencyList-EUTRA***Includes a list of E-UTRA frequencies. Each entry identifies the carrier frequency of a PSCell, which corresponds to one *MeasResultSFTD-EUTRA* entry in the *MeasResultCellListSFTD-EUTRA*. |
| ***sourceConfigSCG***Includes all of the current SCG configurations used by the target SN to build delta configuration to be sent to UE, e.g. during SN change. The field contains the *RRCReconfiguration* message, i.e. including *secondaryCellGroup* and *measConfig*. The field is signalled upon change of SN, unless MN uses full configuration option. Otherwise, the field is absent. |
| ***sourceConfigSCG-EUTRA***Includes the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field *scg-Configuration.* In this version of the specification, this field is absent when master gNB uses full configuration option. This field is only used in NE-DC. |
| ***ue-CapabilityInfo***Contains the IE *UE-CapabilityRAT-ContainerList* supported by the UE (see NOTE 3). A gNB that retrieves MRDC related capability containers ensures that the set of included MRDC containers is consistent w.r.t. the feature set related information. |

|  |
| --- |
| ***BandCombinationInfo* field descriptions** |
| ***allowedFeatureSetsList***Defines a subset of the entries in a *FeatureSetCombination*. Each index identifies a position in the *FeatureSetCombination*, which corresponds to one *FeatureSetUplink*/*Downlink* for each band entry in the associated band combination. |
| ***bandCombinationIndex***In case of (NG)EN-DC and NR-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* .In case of NE-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationListNEDC-Only*. Band combination entries in *supportedBandCombinationList* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationListNEDC-Only* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationListNEDC-Only* increased by the number of entries in *supportedBandCombinationList*. |

|  |  |
| --- | --- |
| **Conditional Presence** | **Explanation** |
| *SN-AddMod* | The field is mandatory present upon SN addition and SN change. It is optionally present upon SN modification and inter-MN handover without SN change. Otherwise, the field is absent. |

NOTE 3: The following table indicates per source RAT whether RAT capabilities are included or not in *ue-CapabilityInfo*.

|  |  |  |  |
| --- | --- | --- | --- |
| **Source RAT** | **NR capabilities** | **E-UTRA capabilities** | **MR-DC capabilities** |
| E-UTRA | Included | Not included | Included |

*END OF CHANGES*

## TP for Solution 2

*START OF CHANGES*

11.2.2 Message definitions

– *CG-Config*

This message is used to transfer the SCG radio configuration as generated by the SgNB or SeNB. It can also be used by a CU to request a DU to perform certain actions, e.g. to request the DU to perform a new lower layer configuration.

Direction: Secondary gNB or eNB to master gNB or eNB, alternatively CU to DU.

***CG-Config* message**

-- ASN1START

-- TAG-CG-CONFIG-START

CG-Config ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 cg-Config CG-Config-IEs,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

CG-Config-IEs ::= SEQUENCE {

 scg-CellGroupConfig OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL,

 scg-RB-Config OCTET STRING (CONTAINING RadioBearerConfig) OPTIONAL,

 configRestrictModReq ConfigRestrictModReqSCG OPTIONAL,

 drx-InfoSCG DRX-Info OPTIONAL,

 candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

 measConfigSN MeasConfigSN OPTIONAL,

 selectedBandCombination BandCombinationInfoSN OPTIONAL,

 fr-InfoListSCG FR-InfoList OPTIONAL,

 candidateServingFreqListNR CandidateServingFreqListNR OPTIONAL,

 nonCriticalExtension CG-Config-v1540-IEs OPTIONAL

}

CG-Config-v1540-IEs ::= SEQUENCE {

 pSCellFrequency ARFCN-ValueNR OPTIONAL,

 reportCGI-RequestNR SEQUENCE {

 requestedCellInfo SEQUENCE {

 ssbFrequency ARFCN-ValueNR,

 cellForWhichToReportCGI PhysCellId

 } OPTIONAL

 } OPTIONAL,

 ph-InfoSCG PH-TypeListSCG OPTIONAL,

 nonCriticalExtension CG-Config-v1560-IEs OPTIONAL

}

CG-Config-v1560-IEs ::= SEQUENCE {

 pSCellFrequencyEUTRA ARFCN-ValueEUTRA OPTIONAL,

 scg-CellGroupConfigEUTRA OCTET STRING OPTIONAL,

 candidateCellInfoListSN-EUTRA OCTET STRING OPTIONAL,

 candidateServingFreqListEUTRA CandidateServingFreqListEUTRA OPTIONAL,

 needForGaps ENUMERATED {true} OPTIONAL,

 drx-ConfigSCG DRX-Config OPTIONAL,

 reportCGI-RequestEUTRA SEQUENCE {

 requestedCellInfoEUTRA SEQUENCE {

 eutraFrequency ARFCN-ValueEUTRA,

 cellForWhichToReportCGI-EUTRA EUTRA-PhysCellId

 } OPTIONAL

 } OPTIONAL,

 nonCriticalExtension CG-Config-v1590-IEs OPTIONAL

}

CG-Config-v1590-IEs ::= SEQUENCE {

 scellFrequenciesSN-NR SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueNR OPTIONAL,

 scellFrequenciesSN-EUTRA SEQUENCE (SIZE (1.. maxNrofServingCells-1)) OF ARFCN-ValueEUTRA OPTIONAL,

 nonCriticalExtension CG-Config-v16xx-IEs OPTIONAL

}

CG-Config-v16xx-IEs ::= SEQUENCE {

 drx-InfoSCG2 DRX-Info2 OPTIONAL,

 maxToffsetSCG-r16 ENUMERATED {ffsValue} OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

PH-TypeListSCG ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF PH-InfoSCG

PH-InfoSCG ::= SEQUENCE {

 servCellIndex ServCellIndex,

 ph-Uplink PH-UplinkCarrierSCG,

 ph-SupplementaryUplink PH-UplinkCarrierSCG OPTIONAL,

 ...

}

PH-UplinkCarrierSCG ::= SEQUENCE{

 ph-Type1or3 ENUMERATED {type1, type3},

 ...

}

MeasConfigSN ::= SEQUENCE {

 measuredFrequenciesSN SEQUENCE (SIZE (1..maxMeasFreqsSN)) OF NR-FreqInfo OPTIONAL,

 ...

}

NR-FreqInfo ::= SEQUENCE {

 measuredFrequency ARFCN-ValueNR OPTIONAL,

 ...

}

ConfigRestrictModReqSCG ::= SEQUENCE {

 requestedBC-MRDC BandCombinationInfoSN OPTIONAL,

 requestedP-MaxFR1 P-Max OPTIONAL,

 ...,

 [[

 requestedPDCCH-BlindDetectionSCG INTEGER (1..15) OPTIONAL,

 requestedP-MaxEUTRA P-Max OPTIONAL

 ]],

 [[

 requestedP-MaxFR2-r16 P-Max OPTIONAL

 ]]

}

BandCombinationIndex ::= INTEGER (1..maxBandComb)

BandCombinationInfoSN ::= SEQUENCE {

 bandCombinationIndex BandCombinationIndex,

 requestedFeatureSets FeatureSetEntryIndex

}

FR-InfoList ::= SEQUENCE (SIZE (1..maxNrofServingCells-1)) OF FR-Info

FR-Info ::= SEQUENCE {

 servCellIndex ServCellIndex,

 fr-Type ENUMERATED {fr1, fr2}

}

CandidateServingFreqListNR ::= SEQUENCE (SIZE (1.. maxFreqIDC-MRDC)) OF ARFCN-ValueNR

CandidateServingFreqListEUTRA ::= SEQUENCE (SIZE (1.. maxFreqIDC-MRDC)) OF ARFCN-ValueEUTRA

-- TAG-CG-CONFIG-STOP

-- ASN1STOP

|  |
| --- |
| ***CG-Config* field descriptions** |
| ***candidateCellInfoListSN***Contains information regarding cells that the source secondary node suggests the target secondary gNB to consider configuring. |
| ***candidateCellInfoListSN-EUTRA***Includes the *MeasResultList3EUTRA* as specified in TS 36.331 [10]. Contains information regarding cells that the source secondary node suggests the target secondary eNB to consider configuring. This field is only used in NE-DC. |
| ***candidateServingFreqListNR, candidateServingFreqListEUTRA***Indicates frequencies of candidate serving cells for In-Device Co-existence Indication (see TS 36.331 [10]). |
| ***configRestrictModReq***Used by SN to request changes to SCG configuration restrictions previously set by MN to ensure UE capabilities are respected. E.g. can be used to request configuring an NR band combination whose use MN has previously forbidden. |
| ***drx-ConfigSCG***This field contains the complete DRX configuration of the SCG. This field is only used in NR-DC. |
| ***drx-InfoSCG***This field contains the DRX long and short cycle configuration of the SCG. This field is used in (NG)EN-DC and NE-DC. |
| ***drx-InfoSCG2***This field contains the drx-onDurationTimer configuration of the SCG. This field is only used in (NG)EN-DC. |
| ***fr-InfoListSCG***Contains information of FR information of serving cells that include PScell and SCells configured in SCG. |
| ***measuredFrequenciesSN***Used by SN to indicate a list of frequencies measured by the UE. |
| ***maxToffsetSCG***Indicates the maximum value used by the SCG for scheduling SCG transmissions (i.e. $T\_{proc,SCG}^{max}, $see TS 38.213 [13]). This field is present when SN reconfigures SCG configuration via SRB1 or SRB3. This field is used in NR-DC only when the fields *nrdc-PC-mode-FR1-r16* or *nrdc-PC-mode-FR2-r16* are set to dynamic. |
| ***needForGaps***In NE-DC, indicates wheter the SN requests gNB to configure measurements gaps. |
| ***ph-InfoSCG***Power headroom information in SCG that is needed in the reception of PHR MAC CE of MC |
| ***ph-SupplementaryUplink***Power headroom information for supplementary uplink. In the case of (NG)EN-DC and NR-DC, this field is only present when two UL carriers are configued for a serving cell and one UL carrier reports type1 PH while the other reports type 3 PH.  |
| ***ph-Type1or3***Type of power headroom for a certain serving cell in SCG (PSCell and activated SCells). Value *type1* refers to type 1 power headroom, value *type3* refers to type 3 power headroom. (See TS 38.321 [3]). |
| ***ph-Uplink***Power headroom information for uplink. |
| ***pSCellFrequency, pSCellFrequencyEUTRA***Indicates the frequency of PSCell in NR (i.e., *pSCellFrequency*) or E-UTRA (i.e., *pSCellFrequencyEUTRA*). In this version of the specification, *pSCellFrequency* is not used in NE-DC whereas *pSCellFrequencyEUTRA* is only used in NE-DC. |
| ***reportCGI-RequestNR, reportCGI-RequestEUTRA***Used by SN to indicate to MN about configuring *reportCGI* procedure. The request may optionally contain information about the cell for which SN intends to configure *reportCGI* procedure. In this version of the specification, the *reportCGI-RequestNR* is used in (NG)EN-DC and NR-DC whereas *reportCGI-RequestEUTRA* is used only for NE-DC. |
| ***requestedBC-MRDC***Used to request configuring a band combination and corresponding feature sets which are forbidden to use by MN (i.e. outside of the *allowedBC-ListMRDC*) to allow re-negotiation of the UE capabilities for SCG configuration. |
| ***requestedPDCCH-BlindDetectionSCG***Requested value of the reference number of cells for PDCCH blind detection allowed to be configured for the SCG. |
| ***requestedP-MaxEUTRA***Requested value for the maximum power for the serving cells the UE can use in E-UTRA SCG. This field is only used in NE-DC. |
| ***requestedP-MaxFR1***Requested value for the maximum power for the serving cells on frequency range 1 (FR1) in this secondary cell group (see TS 38.104 [12]) the UE can use in NR SCG. |
| ***requestedP-MaxFR2***Requested value for the maximum power for the serving cells on frequency range 2 (FR2) in this secondary cell group the UE can use in NR SCG. This field is only used in NR-DC. |
| ***scellFrequenciesSN-EUTRA, scellFrequenciesSN-NR***Indicates the frequency of all SCells configured in SCG. The field *scellFrequenciesSN-EUTRA* is used in NE-DC; the field *scellFrequenciesSN-NR* is used in (NG)EN-DC and NR-DC. In (NG)EN-DC, the field is optionally provided to the MN. |
| ***scg-CellGroupConfig***Contains the *RRCReconfiguration* message (containing only *secondaryCellGroup* and/or *measConfig*):- to be sent to the UE, used upon SCG establishment or modification, as generated (entirely) by the (target) SgNB. In this case, the SN sets the *RRCReconfiguration* message in accordance with clause 6 e.g. regarding the "Need" or "Cond" statements. or- including the current SCG configuration of the UE, when provided in response to a query from MN, or in SN triggered SN change in order to enable delta signaling by the target SN. In this case, the SN sets the *RRCReconfiguration* message in accordance with clause 11.2.3.The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG (re)configuration towards the UE. This field is not applicable in NE-DC. |
| ***scg-CellGroupConfigEUTRA***Includes the E-UTRA *RRCConnectionReconfiguration* message as specified in TS 36.331 [10]. In this version of the specification, the E-UTRA RRC message can only include the field *scg-Configuration*. Used to (re-)configure the SCG configuration upon SCG establishment or modification, as generated (entirely) by the (target) SeNB. This field is only used in NE-DC. |
| ***scg-RB-Config***Contains the IE *RadioBearerConfig*:- to be sent to the UE, used to (re-)configure the SCG RB configuration upon SCG establishment or modification, as generated (entirely) by the (target) SgNB or SeNB. In this case, the SN sets the *RadioBearerConfig* in accordance with clause 6, e.g. regarding the "Need" or "Cond" statements. or- including the current SCG RB configuration of the UE, when provided in response to a query from MN or in SN triggered SN change or bearer type change between SN terminated bearer to MN terminated bearer in order to enable delta signaling by the MN or target SN. In this case, the SN sets the *RadioBearerConfig* in accordance with clause 11.2.3.The field is absent if neither SCG (re)configuration nor SCG configuration query nor SN triggered SN change is performed, e.g. at inter-node capability/configuration coordination which does not result in SCG RB (re)configuration. |
| ***selectedBandCombination***Indicates the band combination selected by SN in (NG)EN-DC, NE-DC, and NR-DC. The SN should inform the MN with this field whenever the band combination and/or feature set it selected for the SCG changes (i.e. even if the new selection concerns a band combination and/or feature set that is allowed by the *allowedBC-ListMRDC*) |

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| ***BandCombinationInfoSN* field descriptions** |
| ***bandCombinationIndex***In case of (NG)EN-DC and NR-DC, this field indicates the position of a band combination in the *supportedBandCombinationList*. In case of NE-DC, this field indicates the position of a band combination in the *supportedBandCombinationList* and/or *supportedBandCombinationListNEDC-Only*. Band combination entries in *supportedBandCombinationList* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationList*. Band combination entries in *supportedBandCombinationListNEDC-Only* are referred by an index which corresponds to the position of a band combination in the *supportedBandCombinationListNEDC-Only* increased by the number of entries in *supportedBandCombinationList*. |
| ***requestedFeatureSets***The position in the *FeatureSetCombination* which identifies one *FeatureSetUplink*/*Downlink* for each band entry in the associated band combination |

*END OF CHANGES*