**3GPP TSG-RAN2 Meeting #105 *R2-190xxxx***

**Athens, Greece, 25th Feb 2019 - 1st Mar 2019**

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| *CR-Form-v11.4* |
| **CHANGE REQUEST** |
|  |
|  | **38.331** | **CR** | **0799** | **rev** | **2** | **Current version:** | **15.4.0** |  |
|  |
| *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:***  | Describing mandatory/optional information in inter-node RRC messages |
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| ***Source to WG:*** | NTT DOCOMO, INC., ZTE Corporation,Sanechips |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2019-02-14 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-15 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | In LTE, there is a general principle of inter-node RRC messages such that a sender node provides all the information configured for a UE to a receiver node. For some fields, exceptional handling is defined for the sender to omit the field, e.g. due to the fact that delta signaling is not supported. Such the general principle and exception are described in sub-clause 10.5 in TS 36.331, whereas they have yet to be described in 38.331. At least for the handover case, i.e. HandoverCommand and HandoverPreparationInformation, the same principle as in LTE can be applied for NR.In contrast, what makes it complicated for NR inter-node message is that the SetupRelease structure is used for measGapConfig in CG-ConfigInfo, as agreed at RAN2 #101bis in [R2-1806430](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_101bis/Docs/R2-1806430.zip). The background of using the SetupRelease was to support the delta signalling for measGapConfig. On the other hand, the SetupRelease has not been used for any other fields in the inter-node messages, except for the transparent container (e.g. scg-CellGroupConfig). In spite of the original intention of using the SetupRelease, it is not clear what the absence of measGapConfig means in the current specification.For the mobility case, there is no benefit of supporting delta signalling, since the handover between the source and target nodes happens at once, i.e. one shot nature. For the DC case, in contrast, there are several scenarios that CG-ConfigInfo and CG-Config are transferred between the same pair of nodes. The information conveyed via CG-ConfigInfo and CG-Config is classified as follows:a) Transparently forwarded fields, e.g.; - SCG configuration (cell group, radio bearer): delta to current configuration of UE; - Results of SN configured measurement (transferred by MN);b) Inter-node capability coordination i.e. ConfigRestrict(ModReq); - Band combination, feature sets; - Measurement performance (Num. of frequencies, measurements); - Power control;c) Other inter-node configuration; - Measurement gaps; - DRX configuration exchange for alignment; - PHR information exchange; - SCell identity range; - SFTD, reportCGI, IDC configuration suggestions, results;d) Other assistance (i.e. for upon inter-node mobility); - Current configuration; - Cuirrent capability coordination status; - Candidate cell information (to assist target upon node change).Type b) and c) could benefit from supporting delta signalling, although the existing fields cannot be changed and should be untouched at this juncture. On the other hand, when a new field is introduced and classified as type b) and c), it should be case by case whether the delta signalling is supported or not. If the delta signalling is supported, the specification should provide a guidance how it is supported from ASN.1 viewpoints. |
|  |  |
| ***Summary of change:*** | - A new sub-clause is created to describe mandatory information in inter- node RRC messages (11.2.X).- For AS-Config in HandoverPreparationInformation, all the fields configrued for the UE is mandatory present and need codes and conditional presences are not applied for inter-node RRC messages as in LTE.- For the DC case, i.e. CG-ConfigInfo and CG-Config, the general principle is the same as for AS-Config, unless stated otherwise in the field description. In addition, the fields supporting the delta signalling is listed. - A note is added to give a guidance that the SetupRelease is used for the fields supporting delta signalling, when introduced in future.- For the fields where the condition is defined for mandatory presence, it is clarified that the field is absent for the other case.Rev.1:- Editorial update on new clause (11.2.X);- The condition where the field is absent is defiend to some of the existing fields.Rev.2-**Impact analysis:**Impacted 5G architecture options:Standalone and EN-DCImpacted functionality:Inter-node RRC messagesInter-operability:Sin the impacted functionality is inter-node messages, the inter-operability is analysed between a sender node and a receiver node below.If the sender node implents this CR, but the receiver node does not, the receiver has no idea what the absence of measGapConfig means. The receiver may interpret that the sender has released the measGapConfig. The receiver may then change the gap configuration on SCG and reconfigure it for the UE, although the MCG side has not been changed. In the worst case, the RRC reconfiguration is failured due to the misaligned gap configuration between MCG and SCG.If the receiver node implements this CR, but the sender node does not, it is up to the sender implementation what the absence of measGapConfig means. If the sender intends to release it by omitting the fields, the receiver interprets that the sender keeps the current configuration. Upon the inter-node message exchange, if the sender changes the gap configuration to the UE, the RRC reconfiguraiton massge may be failed due to the misaligned gap configuration between MCG and SCG.In light of the above analysis, gNB and eNB capable of EN-DC should implement this CR. |
|  |  |
| ***Consequences if not approved:*** | As analysed for the inter-operability, potential misalignment of MCG and SCG configurations may result in RRC reconfiguraiton failure for the UE. |
|  |  |
| ***Clauses affected:*** | 11.2.2, 11.2.X (new) |
|  |  |
|  | **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:*** |  |

# 11 Radio information related interactions between network nodes

## 11.1 General

This clause specifies RRC messages that are transferred between network nodes. These RRC messages may be transferred to or from the UE via another Radio Access Technology. Consequently, these messages have similar characteristics as the RRC messages that are transferred across the NR radio interface, i.e. the same transfer syntax and protocol extension mechanisms apply.

## 11.2 Inter-node RRC messages

### 11.2.1 General

This clause specifies RRC messages that are sent either across the X2-, Xn- or the NG-interface, either to or from the gNB, i.e. a single 'logical channel' is used for all RRC messages transferred across network nodes. The information could originate from or be destined for another RAT.

-- ASN1START

-- TAG-NR-INTER-NODE-DEFINITIONS-START

NR-InterNodeDefinitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

 ARFCN-ValueNR,

 ARFCN-ValueEUTRA,

 CellIdentity,

 CGI-Info,

 CSI-RS-Index,

 FreqBandIndicatorNR,

 GapConfig,

 maxBandComb,

 maxBands,

 maxFeatureSetsPerBand,

 maxFreqIDC-MRDC,

 maxNrofCombIDC,

 maxNrofSCells,

 maxNrofServingCells,

 maxNrofServingCells-1,

 maxNrofServingCellsEUTRA,

 maxNrofIndexesToReport,

 MeasQuantityResults,

 MeasResultSCG-Failure,

 MeasResultCellListSFTD,

 MeasResultList2NR,

 P-Max,

 PhysCellId,

 RadioBearerConfig,

 RAN-NotificationAreaInfo,

 RRCReconfiguration,

 ServCellIndex,

 SetupRelease,

 SSB-Index,

 SSB-MTC,

 SSB-ToMeasure,

 SS-RSSI-Measurement,

 ShortMAC-I,

 SubcarrierSpacing,

 UE-CapabilityRAT-ContainerList

FROM NR-RRC-Definitions;

-- TAG-NR-INTER-NODE-DEFINITIONS-STOP

-- ASN1STOP

### 11.2.2 Message definitions

#### – *HandoverCommand*

This message is used to transfer the handover command as generated by the target gNB.

Direction: target gNB to source gNB/source RAN.

*HandoverCommand* message

-- ASN1START

-- TAG-HANDOVER-COMMAND-START

HandoverCommand ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 handoverCommand HandoverCommand-IEs,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

HandoverCommand-IEs ::= SEQUENCE {

 handoverCommandMessage OCTET STRING (CONTAINING RRCReconfiguration),

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-HANDOVER-COMMAND-STOP

-- ASN1STOP

|  |
| --- |
| *HandoverCommand* field descriptions |
| ***handoverCommandMessage***Contains the *RRCReconfiguration* message used to perform handover within NR or handover to NR, as generated (entirely) by the target gNB. |

#### – *HandoverPreparationInformation*

This message is used to transfer the NR RRC information used by the target gNB during handover preparation, including UE capability information.

Direction: source gNB/source RAN to target gNB.

*HandoverPreparationInformation* message

-- ASN1START

-- TAG-HANDOVER-PREPARATION-INFORMATION-START

HandoverPreparationInformation ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 handoverPreparationInformation HandoverPreparationInformation-IEs,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

HandoverPreparationInformation-IEs ::= SEQUENCE {

 ue-CapabilityRAT-List UE-CapabilityRAT-ContainerList,

 sourceConfig AS-Config OPTIONAL, -- Cond HO

 rrm-Config RRM-Config OPTIONAL,

 as-Context AS-Context OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

AS-Config ::= SEQUENCE {

 rrcReconfiguration OCTET STRING (CONTAINING RRCReconfiguration),

 ...

}

AS-Context ::= SEQUENCE {

 reestablishmentInfo ReestablishmentInfo OPTIONAL,

 configRestrictInfo ConfigRestrictInfoSCG OPTIONAL,

 ...,

 [[ ran-NotificationAreaInfo RAN-NotificationAreaInfo OPTIONAL

 ]]

}

ReestablishmentInfo ::= SEQUENCE {

 sourcePhysCellId PhysCellId,

 targetCellShortMAC-I ShortMAC-I,

 additionalReestabInfoList ReestabNCellInfoList OPTIONAL

}

ReestabNCellInfoList ::= SEQUENCE ( SIZE (1..maxCellPrep) ) OF ReestabNCellInfo

ReestabNCellInfo::= SEQUENCE{

 cellIdentity CellIdentity,

 key-gNodeB-Star BIT STRING (SIZE (256)),

 shortMAC-I ShortMAC-I

}

RRM-Config ::= SEQUENCE {

 ue-InactiveTime ENUMERATED {

 s1, s2, s3, s5, s7, s10, s15, s20,

 s25, s30, s40, s50, min1, min1s20, min1s40,

 min2, min2s30, min3, min3s30, min4, min5, min6,

 min7, min8, min9, min10, min12, min14, min17, min20,

 min24, min28, min33, min38, min44, min50, hr1,

 hr1min30, hr2, hr2min30, hr3, hr3min30, hr4, hr5, hr6,

 hr8, hr10, hr13, hr16, hr20, day1, day1hr12, day2,

 day2hr12, day3, day4, day5, day7, day10, day14, day19,

 day24, day30, dayMoreThan30} OPTIONAL,

 candidateCellInfoList MeasResultList2NR OPTIONAL,

 ...

}

-- TAG-HANDOVER-PREPARATION-INFORMATION-STOP

-- ASN1STOP

|  |
| --- |
| *HandoverPreparationInformation* field descriptions |
| ***as-Context***Local RAN context required by the target gNB. |
| ***sourceConfig***The radio resource configuration as used in the source cell. |
| ***rrm-Config***Local RAN context used mainly for RRM purposes. |
| ***ue-CapabilityRAT-List***The UE radio access related capabilities concerning RATs supported by the UE. FFS whether certain capabilities are mandatory to provide by source e.g. of target and/or source RAT. |

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| --- | --- |
| Conditional Presence | Explanation |
| *HO* | The field is mandatory present in case of handover within NR; The field is optionally present in case of handover from E-UTRA connected to 5GC; otherwise the field is not present. |

NOTE 1: The following table indicates per source RAT whether RAT capabilities are included or not.

|  |  |  |  |
| --- | --- | --- | --- |
| Source RAT | NR capabilites | E-UTRA capabilities | MR-DC capabilities |
| NR | Included | May be included | May be included |
| E-UTRAN | Included | May be included | May be included |

NOTE 2: The following table indicates, in case of inter-RAT handover from E-UTRA, which additional IEs are included or not:

|  |  |  |  |
| --- | --- | --- | --- |
| Source system | sourceConfig | rrm-Config | as-Context |
| E-UTRA/EPC | Not included | May be included | Not included |
| E-UTRA/5GC | May be included, but only *radioBearerConfig* is included in the *RRCReconfiguration*. | May be included | Not included |

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| *RRM-Config field descriptions* |
| ***candidateCellInfoList***A list of the best cells on each frequency for which measurement information was available |

#### – *CG-Config*

This message is used to transfer the SCG radio configuration as generated by the SgNB.

Direction: Secondary gNB to master gNB or eNB.

*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,

 selectedBandCombinationNR 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-Request SEQUENCE {

 requestedCellInfo SEQUENCE {

 ssbFrequency ARFCN-ValueNR,

 cellForWhichToReportCGI PhysCellId

 } OPTIONAL

 } OPTIONAL,

 ph-InfoSCG PH-TypeListSCG 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,

 ...

}

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

-- TAG-CG-CONFIG-STOP

-- ASN1STOP

|  |
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| *CG-Config* field descriptions |
| ***candidateCellInfoListSN***Contains information regarding cells that the source secondary node suggests the target secondary gNB to consider configuring. |
| ***candidateServingFreqListNR***Indicates frequencies of candidate serving cells for In-Device Co-existence Indication (see TS 36.331 [10]). |
| ***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. |
| ***ph-InfoSCG***Power headroom information in SCG that is needed in the reception of PHR MAC CE of MCG |
| ***ph-SupplimentaryUplink***Power headroom information for supplementary uplink. In the case of EN-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***Indicates the frequency of PSCell. |
| ***reportCGI-Request***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. |
| ***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. |
| ***requestedBC-MRDC***Used to request configuring an NR band combination and corresponding feature sets which are forbidden to use by MN.  |
| ***scg-CellGroupConfig***Contains the *RRCReconfiguration* message to be sent to the UE, used upon SCG establishment or modification, as generated (entirely) by the (target) SgNB. The SN sets the *RRCReconfiguration* message in accordance with section 6 e.g.regarding the "need" or "cond" statements. The field is absent if SCG (re)configuration is not performed, e.g. at inter-node capability/configuration coordination which does not result in SCG (re)configuration towards the UE. |
| ***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. The SN sets the *RRCReconfiguration* message in accordance with section 6 e.g.regarding the "need" or "cond" statements. The field is absent if SCG (re)configuration is not performed, e.g. at inter-node capability/configuration coordination which does not result in SCG RB (re)configuration. |
| ***selectedBandCombinationNR***Indicates the band combination selected by SN for the EN-DC. |
| ***configRestrictModReq***Used by SN to request changes to SCG configuration restrictions previously set by MN to ensure UE capabilities are respected. E.g. can used to request configuring an NR band combination whose use MN has previously forbidden. |

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| *BandCombinationInfoSN field descriptions* |
| ***bandCombinationIndex***The position of a band combination in the 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 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 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, modify or release an MCG or SCG.

Direction: Master eNB or gNB to secondary gNB, 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-Addition

 candidateCellInfoListMN MeasResultList2NR OPTIONAL,

 candidateCellInfoListSN OCTET STRING (CONTAINING MeasResultList2NR) OPTIONAL,

 measResultCellListSFTD MeasResultCellListSFTD 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-Info

 } OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

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-NR INTEGER(1..maxMeasFreqsMN) OPTIONAL,

 maxMeasIdentitiesSCG-NR INTEGER(1..maxMeasIdentitiesMN) OPTIONAL,

 ...

}

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

}

MeasConfigMN ::= SEQUENCE {

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

 measGapConfig SetupRelease { GapConfig } OPTIONAL,

 gapPurpose ENUMERATED {perUE, perFR1} 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 |
| ***allowedBC-ListMRDC***A list of indices referring to band combinations in MR-DC capabilities from which SN is allowed to select an NR band combination. Each entry refers to a band combination numbered according to supportedBandCombinationList in the UE-MRDC-Capability and the Feature Sets allowed for each band entry. All MR-DC band combinations indicated by this field comprise the LTE band combination, which is a superset of the LTE band(s) selected by MN. |
| ***candidateCellInfoListMN***, ***candidateCellInfoListSN***Contains information regarding cells that the master node or the source node suggests the target gNB to consider configuring.Including CSI-RS measurement results in candidateCellInfoListMN is not supported in this version of the specification. |
| ***configRestrictInfo***Includes fields for which SgNB is explictly indicated to observe a configuration restriction. |
| ***maxMeasFreqsSCG-NR***Indicates the maximum number of NR inter-frequency carriers the SN is allowed to configure with PSCell for measurements. |
| ***maxMeasIdentitiesSCG-NR***Indicates the maximum number of allowed measurement identities that the SCG is allowed to configure. |
| ***measuredFrequenciesMN***Used by MN to indicate a list of frequencies measured by the UE. |
| ***measGapConfig***Indicates the measurement gap configuration configured by MN. |
| ***measResultReportCGI***Used by MN to provide SN with CGI-Info for the cell as per SN′s request. |
| ***mcg-RB-Config***Contains the full IE RadioBearerConfig of the MN, used by the SN to support delta configuration to UE, for bearer type change between MN terminated to SN terminated bearer and SN change. It is also used to indicate the PDCP duplication related information (whether duplication is configured and if so, whether it is initially activated) in SN Addition/Modification procedure. The field is signalled upon addition or change of SN. Otherwise, this field is absent. |
| ***mrdc-AssistanceInfo***Contains the IDC assistance information for MR-DC reported by the UE (see TS 36.331 [10]). |
| ***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]). |
| ***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 UE can use in NR SCG. |
| ***p-maxUE-FR1***Indicates the maximum total transmit power to be used by the UE across all serving cells in frequency range 1 (FR1). |
| ***ph-InfoMCG***Power headroom information in MCG that is needed in the reception of PHR MAC CE in SCG. |
| ***ph-SupplimentaryUplink***Power headroom information for supplementary uplink. For 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. |
| ***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 *measResultsPerMOList*. |
| ***scg-RB-Config***Contains the full IE RadioBearerConfig of the SN, used to allow the target SN to use delta configuration to the UE e.g. during SN change. The field is signalled upon addition or change of SN, unless MN uses full configuration option. Otherwise, the field is absent. This field is also absent when master eNB uses full configuration option. |
| ***servCellIndexRangeSCG***Range of serving cell indices that SN is allowed to configure for SCG serving cells. |
| ***sourceConfigSCG***Includes the current full SCG configuration 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. not only CellGroupConfig but also e.g. measConfig. The field is signalled upon addition or change of SN, unless MN uses full configuration option. Otherwise, the field is absent. |
| ***ue-CapabilityInfo***Contains the IE *UE-CapabilityRAT-ContainerList* supported by the UE (see NOTE 3). The field is signalled upon addition or change of SN. |

|  |
| --- |
| *BandCombinationInfo field descriptions* |
| ***allowedFeatureSetsList***Defines a subset of the entries in a FeatureSetCombination. Each index identifies one FeatureSetUplink/Downlink for each band entry in the associated band combination. |
| ***bandCombinationIndex***The position of a band combination in the supportedBandCombinationList |

|  |  |
| --- | --- |
| Conditional Presence | Explanation |
| *SN-Addition* | The field is mandatory present upon SN addition and change. Otherwise, the field is absent. |
| *SN-AddMod* | The field is mandatory present upon SN addition and optionally present upon SN modification. 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 |

#### – *MeasurementTimingConfiguration*

The *MeasurementTimingConfiguration* message is used to convey assistance information for measurement timing.

Direction: en-gNB to eNB, eNB to en-gNB, gNB to gNB, gNB DU to gNB CU, and gNB CU to gNB DU.

*MeasurementTimingConfiguration* message

-- ASN1START

-- TAG-MEASUREMENT-TIMING-CONFIGURATION-START

MeasurementTimingConfiguration ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 measTimingConf MeasurementTimingConfiguration-IEs,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

MeasurementTimingConfiguration-IEs ::= SEQUENCE {

 measTiming MeasTimingList OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

MeasTimingList ::= SEQUENCE (SIZE (1..maxMeasFreqsMN)) OF MeasTiming

MeasTiming ::= SEQUENCE {

 frequencyAndTiming SEQUENCE {

 carrierFreq ARFCN-ValueNR,

 ssbSubcarrierSpacing SubcarrierSpacing,

 ssb-MeasurementTimingConfiguration SSB-MTC,

 ss-RSSI-Measurement SS-RSSI-Measurement OPTIONAL

 } OPTIONAL,

...,

 [[

 ssb-ToMeasure-v1540 SSB-ToMeasure OPTIONAL,

 physCellId PhysCellId OPTIONAL

 ]]

}

-- TAG-MEASUREMENT-TIMING-CONFIGURATION-STOP

-- ASN1STOP

|  |
| --- |
| *MeasTiming* field descriptions |
| ***carrierFreq, ssbSubcarrierSpacing***Indicates the frequency and subcarrier spacing of the SS block of the cell for which this message is included, or of other SS blocks within the same carrier. |
| ***ssb-MeasurementTimingConfiguration***Indicates the SMTC which can be used to search for SSB of the cell for which the message is included. When the message is included in "Served Cell Information NR", the timing is based on the cell for which the message is included. When the message is included in "NR Neighbour Information", the timing is based on the cell indicated in the "Served Cell Information NR" with which the "NR Neighbour Information" is provided. See TS 36.423, TS 38.423 and TS 38.473. |
| ***ss-RSSI-Measurement***Provides the configuration which can be used for RSSI measurements of the cell for which the message is included. |

|  |
| --- |
| *MeasurementTimingConfiguration* field descriptions |
| ***measTiming***A list of SMTC information, SSB RSSI measurement information and associated NR frequency exchanged via EN-DC X2 Setup, EN-DC Configuration Update, Xn Setup and NG-RAN Node Configuration Update procedures, or F1 messages between gNB DU and gNB CU. |
| ***physCellId***Physical Cell Identity of the SSB on the ARFCN indicated by *carrierFreq*. |
| ***ssb-ToMeasure***The set of SS blocks to be measured within the SMTC measurement duration (see TS 38.215 [9]). |

#### – *UERadioPagingInformation*

This message is used to transfer radio paging information, covering both upload to and download from the AMF.

Direction: gNB to/ from AMF

*UERadioPagingInformation* message

-- ASN1START

-- TAG-UE-RADIO-PAGING-INFORMATION-START

UERadioPagingInformation ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 ueRadioPagingInformation UERadioPagingInformation-IEs,

 spare7 NULL,

 spare6 NULL, spare5 NULL, spare4 NULL,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

UERadioPagingInformation-IEs ::= SEQUENCE {

 supportedBandListNRForPaging SEQUENCE (SIZE (1..maxBands)) OF FreqBandIndicatorNR OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-UE-RADIO-PAGING-INFORMATION-STOP

-- ASN1STOP

| *UERadioPagingInformation field descriptions* |
| --- |
| ***supportedBandListNRForPaging***Indicates the UE supported NR frequency bands which is derived by the gNB from *UE-NR-Capability*. |

#### – *UERadioAccessCapabilityInformation*

This message is used to transfer UE radio access capability information, covering both upload to and download from the 5GC.

Direction: ng-eNB or gNB to/ from 5GC

*UERadioAccessCapabilityInformation* message

-- ASN1START

-- TAG-UE-RADIO-ACCESS-CAPABILITY-INFORMATION-START

UERadioAccessCapabilityInformation ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 ueRadioAccessCapabilityInformation UERadioAccessCapabilityInformation-IEs,

 spare7 NULL,

 spare6 NULL, spare5 NULL, spare4 NULL,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

UERadioAccessCapabilityInformation-IEs ::= SEQUENCE {

 ue-RadioAccessCapabilityInfo OCTET STRING (CONTAINING UE-CapabilityRAT-ContainerList),

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-UE-RADIO-ACCESS-CAPABILITY-INFORMATION-STOP

-- ASN1STOP

|  |
| --- |
| *UERadioAccessCapabilityInformation-IEs field descriptions* |
| ***ue-RadioAccessCapabilityInfo***Including NR, MR-DC, E-UTRA radio access capabilities. |

### 11.2.X Mandatory information in inter-node RRC messages

For the *AS-Config* transferred within the *HandoverPreparationInformation*:

- The source node shall include all fields necessary to reflect the AS configuration of the UE;

- Need codes or conditions specified for subfields according to IEs defined in section 6 do not apply. I.e. some fields shall be included regardless of the "need" or "cond" e.g. discardTimer;

- Based on the received AS configuration, the target node can indicate the delta (difference) to the UE’s AS configuration (as included in *HandoverCommand*).

For a field that conveys the UE configuration in *CG-Config* (SN initiated change of SN) and in *CG-ConfigInfo* upon change of SN (i.e. *mcg-RB-Config*, *scg-RB-Config* and *sourceConfigSCG*), :

- The source node shall include all fields necessary to reflect the AS configuration of the UE, unless stated otherwise in the field description or in this sub-clause;

- Need codes or conditions specified for subfields according to IEs defined in section 6 do not apply;

- Based on the received AS configuration, the target node can indicate the delta (difference) to the UE’s AS configuration (as included in *CG-Config*).

For the other fields in *CG-Config* and *CG-ConfigInfo*, the sender shall always signal the appropriate value even if same as indicated in the previous RRC INM, unless explicitly stated otherwise:

- *measGapConfig* (for which delta signaling applies);

- *ue-CapabilityInfo*.

For the above fields, the absence of field means that the receiver maintains the values informed via the previous message.

NOTE 4: The exception also applies for some one shot fields i.e. fields that the receiver does not need to maintain and that sender only provides to trigger the receiver to take a particular action.

## 11.3 Inter-node RRC information element definitions

-

## 11.4 Inter-node RRC multiplicity and type constraint values

#### – Multiplicity and type constraints definitions

-- ASN1START

-- TAG-NR-MULTIPLICITY-AND-CONSTRAINTS-START

maxMeasFreqsMN INTEGER ::= 32 -- Maximum number of MN-configured measurement frequencies

maxMeasFreqsSN INTEGER ::= 32 -- Maximum number of SN-configured measurement frequencies

maxMeasIdentitiesMN INTEGER ::= 62 -- Maximum number of measurement identities that a UE can be configured with

maxCellPrep INTEGER ::= 32 -- Maximum number of cells prepared for handover

-- TAG-NR-MULTIPLICITY-AND-CONSTRAINTS-STOP

-- ASN1STOP

#### – *End of NR-InterNodeDefinitions*

-- ASN1START

-- TAG-NR-INTER-NODE-DEFINITIONS-END-START

END

-- TAG-NR-INTER-NODE-DEFINITIONS-END-STOP

-- ASN1STOP