**3GPP TSG-RAN WG2 Meeting #122 *R2-230xxxx***

**Incheon, Korea, 22 – 26 May 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **38.331** | **CR** | **4138** | **rev** | **1** | **Current version:** | **17.4.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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| ***Title:***  | RRC configuration for Rel-18 UL Tx switching enhancements |
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| ***Source to WG:*** | Huawei, HiSilicon, NTT DOCOMO INC. |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** | 2023-05-22 |
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| ***Category:*** | C |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)**Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | In Rel-18, dynamic UL Tx switching has been enhanced and the following agreements related to RRC configuration have been achieved.RAN2 #121 agreements:* configure {switchedUL, dualUL} for combination(s) of serving cells (i.e., for each band pair in the band combination)
* For RRC configuration to clarify ambiguous Tx state, RAN2 should introduce an RRC configuration that associates a band to another band which the unused Tx chain is switched to when the switch is from concurrent transmission on two bands to 1 Tx transmission on another band.

RAN2 #121bis-e agreements:* P2: RAN2 reuse uplinkTxSwitching-DualUL-TxState-r17 to indicate the state of Tx chains for dualUL mode.
* P4: RAN2 introduce an optional list of bands in CellGroupConfig, in which the priority is configured by the order (or similar equivalent change, TBD CR disc).
* P3-1: R2 assumes that the network ensures the UE supports dualUL for a band and its associated band (config restriction)
* we send an LS to RAN1, ask to confirm RAN2 understanding (below)
* Baseline R2 understanding:

When the UE is indicated to switch from two bands to one different band (e.g. A+B => C), follow below logic when determine the switched Tx:- If network indicates 1port transmission on band C,and *uplinkTxSwitching-DualUL-TxState* is set to *oneT*, and the associated band is configured to band C:---- Switch 1Tx chain to band C and switch another Tx chain to associated band;- Else if network indicates 1port transmission on band C, but *uplinkTxSwitching-DualUL-TxState* is not configured or is set to *twoT*, or associated band is not configured to band C:---- Switching 2Tx chains to band C.In RAN4 #107 meeting:RAN4 agrees that option 2 matches RAN4 understanding with the following understanding:* Option 2 means semi-static RRC configurations and gNB configures which switching cases are applied to 2Tx-2Tx switching period.
* Regarding the granularity, RAN4 suggests per band pair granularity, i.e.,
	+ if gNB configures as 2Tx-2Tx switching period applies to a band pair between switching (e.g., band A and band B), 2Tx-2Tx switching period applies to the switching cases between the band pair e.g.,
		- 2P(band A)+0P(band B) <=> 0P(band A)+2P(band B)
		- 1P(band A)+0P(band B) <=> 0P(band A)+2P(band B)
		- 0P(band A)+1P(band B) <=> 2P(band A)+0P(band B)
		- 1P(band A)+0P(band B) <=> P(band A)+1P(band B)
	+ if the gNB does not configure the band pair for 2Tx-2Tx, then the Tx switching period for 1Tx-2Tx should be applied.
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| ***Summary of change:*** | In 6.3.2,* Add a band list in *CellGroupConfig* to configure UL bands as well as the band pair and corresponding per-band pair configurations, including the associated band, band priority.

**Impact analysis**Impacted 5G architecture options:NR SA Impacted functionalityUL Tx switchingInter-operability:No inter-operablity issue. |
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| ***Consequences if not approved:*** | RRC configuration is not supported for the Rel-18 UL Tx switching enhancements. |
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| ***Clauses affected:*** | 6.3.2 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| START OF CHANGES  |

6.3.2 Radio resource control information elements

 – *CellGroupConfig*

The *CellGroupConfig* IE is used to configure a master cell group (MCG) or secondary cell group (SCG). A cell group comprises of one MAC entity, a set of logical channels with associated RLC entities and of a primary cell (SpCell) and one or more secondary cells (SCells).

***CellGroupConfig* information element**

-- ASN1START

-- TAG-CELLGROUPCONFIG-START

-- Configuration of one Cell-Group:

CellGroupConfig ::= SEQUENCE {

 cellGroupId CellGroupId,

 rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLC-ID)) OF RLC-BearerConfig OPTIONAL, -- Need N

 rlc-BearerToReleaseList SEQUENCE (SIZE(1..maxLC-ID)) OF LogicalChannelIdentity OPTIONAL, -- Need N

 mac-CellGroupConfig MAC-CellGroupConfig OPTIONAL, -- Need M

 physicalCellGroupConfig PhysicalCellGroupConfig OPTIONAL, -- Need M

 spCellConfig SpCellConfig OPTIONAL, -- Need M

 sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig OPTIONAL, -- Need N

 sCellToReleaseList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellIndex OPTIONAL, -- Need N

 ...,

 [[

 reportUplinkTxDirectCurrent ENUMERATED {true} OPTIONAL -- Cond BWP-Reconfig

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 [[

 bap-Address-r16 BIT STRING (SIZE (10)) OPTIONAL, -- Need M

 bh-RLC-ChannelToAddModList-r16 SEQUENCE (SIZE(1..maxBH-RLC-ChannelID-r16)) OF BH-RLC-ChannelConfig-r16 OPTIONAL, -- Need N

 bh-RLC-ChannelToReleaseList-r16 SEQUENCE (SIZE(1..maxBH-RLC-ChannelID-r16)) OF BH-RLC-ChannelID-r16 OPTIONAL, -- Need N

 f1c-TransferPath-r16 ENUMERATED {lte, nr, both} OPTIONAL, -- Need M

 simultaneousTCI-UpdateList1-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousTCI-UpdateList2-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousSpatial-UpdatedList1-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousSpatial-UpdatedList2-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 uplinkTxSwitchingOption-r16 ENUMERATED {switchedUL, dualUL} OPTIONAL, -- Need R

 uplinkTxSwitchingPowerBoosting-r16 ENUMERATED {enabled} OPTIONAL -- Need R

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 [[

 reportUplinkTxDirectCurrentTwoCarrier-r16 ENUMERATED {true} OPTIONAL -- Need N

 ]],

 [[

 f1c-TransferPathNRDC-r17 ENUMERATED {mcg, scg, both} OPTIONAL, -- Need M

 uplinkTxSwitching-2T-Mode-r17 ENUMERATED {enabled} OPTIONAL, -- Cond 2Tx

 uplinkTxSwitching-DualUL-TxState-r17 ENUMERATED {oneT, twoT} OPTIONAL, -- Cond 2Tx

 uu-RelayRLC-ChannelToAddModList-r17 SEQUENCE (SIZE(1..maxUu-RelayRLC-ChannelID-r17)) OF Uu-RelayRLC-ChannelConfig-r17

 OPTIONAL, -- Need N

 uu-RelayRLC-ChannelToReleaseList-r17 SEQUENCE (SIZE(1..maxUu-RelayRLC-ChannelID-r17)) OF Uu-RelayRLC-ChannelID-r17

 OPTIONAL, -- Need N

 simultaneousU-TCI-UpdateList1-r17 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousU-TCI-UpdateList2-r17 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousU-TCI-UpdateList3-r17 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousU-TCI-UpdateList4-r17 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 rlc-BearerToReleaseListExt-r17 SEQUENCE (SIZE(1..maxLC-ID)) OF LogicalChannelIdentityExt-r17 OPTIONAL, -- Need N

 iab-ResourceConfigToAddModList-r17 SEQUENCE (SIZE(1..maxNrofIABResourceConfig-r17)) OF IAB-ResourceConfig-r17 OPTIONAL, -- Need N

 iab-ResourceConfigToReleaseList-r17 SEQUENCE (SIZE(1..maxNrofIABResourceConfig-r17)) OF IAB-ResourceConfigID-r17 OPTIONAL -- Need N

 ]],

 [[

 reportUplinkTxDirectCurrentMoreCarrier-r17 ReportUplinkTxDirectCurrentMoreCarrier-r17 OPTIONAL -- Need N

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 [[

 uplinkTxSwitchingMoreBands-r18 SetupRelease { UplinkTxSwitchingMoreBands-r18 } OPTIONAL -- Need M

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}

-- Serving cell specific MAC and PHY parameters for a SpCell:

SpCellConfig ::= SEQUENCE {

 servCellIndex ServCellIndex OPTIONAL, -- Cond SCG

 reconfigurationWithSync ReconfigurationWithSync OPTIONAL, -- Cond ReconfWithSync

 rlf-TimersAndConstants SetupRelease { RLF-TimersAndConstants } OPTIONAL, -- Need M

 rlmInSyncOutOfSyncThreshold ENUMERATED {n1} OPTIONAL, -- Need S

 spCellConfigDedicated ServingCellConfig OPTIONAL, -- Need M

 ...,

 [[

 lowMobilityEvaluationConnected-r17 SEQUENCE {

 s-SearchDeltaP-Connected-r17 ENUMERATED {dB3, dB6, dB9, dB12, dB15, spare3, spare2, spare1},

 t-SearchDeltaP-Connected-r17 ENUMERATED {s5, s10, s20, s30, s60, s120, s180, s240, s300, spare7, spare6, spare5,

 spare4, spare3, spare2, spare1}

 } OPTIONAL, -- Need R

 goodServingCellEvaluationRLM-r17 GoodServingCellEvaluation-r17 OPTIONAL, -- Need R

 goodServingCellEvaluationBFD-r17 GoodServingCellEvaluation-r17 OPTIONAL, -- Need R

 deactivatedSCG-Config-r17 SetupRelease { DeactivatedSCG-Config-r17 } OPTIONAL -- Cond SCG-Opt

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}

ReconfigurationWithSync ::= SEQUENCE {

 spCellConfigCommon ServingCellConfigCommon OPTIONAL, -- Need M

 newUE-Identity RNTI-Value,

 t304 ENUMERATED {ms50, ms100, ms150, ms200, ms500, ms1000, ms2000, ms10000},

 rach-ConfigDedicated CHOICE {

 uplink RACH-ConfigDedicated,

 supplementaryUplink RACH-ConfigDedicated

 } OPTIONAL, -- Need N

 ...,

 [[

 smtc SSB-MTC OPTIONAL -- Need S

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 [[

 daps-UplinkPowerConfig-r16 DAPS-UplinkPowerConfig-r16 OPTIONAL -- Need N

 ]],

 [[

 sl-PathSwitchConfig-r17 SL-PathSwitchConfig-r17 OPTIONAL -- Cond DirectToIndirect-PathSwitch

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}

DAPS-UplinkPowerConfig-r16 ::= SEQUENCE {

 p-DAPS-Source-r16 P-Max,

 p-DAPS-Target-r16 P-Max,

 uplinkPowerSharingDAPS-Mode-r16 ENUMERATED {semi-static-mode1, semi-static-mode2, dynamic }

}

SCellConfig ::= SEQUENCE {

 sCellIndex SCellIndex,

 sCellConfigCommon ServingCellConfigCommon OPTIONAL, -- Cond SCellAdd

 sCellConfigDedicated ServingCellConfig OPTIONAL, -- Cond SCellAddMod

 ...,

 [[

 smtc SSB-MTC OPTIONAL -- Need S

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 sCellState-r16 ENUMERATED {activated} OPTIONAL, -- Cond SCellAddSync

 secondaryDRX-GroupConfig-r16 ENUMERATED {true} OPTIONAL -- Cond DRX-Config2

 ]],

 [[

 preConfGapStatus-r17 BIT STRING (SIZE (maxNrofGapId-r17)) OPTIONAL, -- Cond PreConfigMG

 goodServingCellEvaluationBFD-r17 GoodServingCellEvaluation-r17 OPTIONAL, -- Need R

 sCellSIB20-r17 SetupRelease { SCellSIB20-r17 } OPTIONAL -- Need M

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}

SCellSIB20-r17 ::= OCTET STRING (CONTAINING SystemInformation)

DeactivatedSCG-Config-r17 ::= SEQUENCE {

 bfd-and-RLM-r17 BOOLEAN,

 ...

}

GoodServingCellEvaluation-r17 ::= SEQUENCE {

 offset-r17 ENUMERATED {db2, db4, db6, db8} OPTIONAL -- Need S

}

SL-PathSwitchConfig-r17 ::= SEQUENCE {

 targetRelayUE-Identity-r17 SL-SourceIdentity-r17,

 t420-r17 ENUMERATED {ms50, ms100, ms150, ms200, ms500, ms1000, ms2000, ms10000},

 ...

}

IAB-ResourceConfig-r17 ::= SEQUENCE {

 iab-ResourceConfigID-r17 IAB-ResourceConfigID-r17,

 slotList-r17 SEQUENCE (SIZE (1..5120)) OF INTEGER (0..5119) OPTIONAL, -- Need M

 periodicitySlotList-r17 ENUMERATED {ms0p5, ms0p625, ms1, ms1p25, ms2, ms2p5, ms5, ms10, ms20, ms40, ms80, ms160} OPTIONAL, -- Need M

 slotListSubcarrierSpacing-r17 SubcarrierSpacing OPTIONAL, -- Need M

 ...

}

IAB-ResourceConfigID-r17 ::= INTEGER(0..maxNrofIABResourceConfig-1-r17)

ReportUplinkTxDirectCurrentMoreCarrier-r17 ::= SEQUENCE (SIZE(1.. maxSimultaneousBands)) OF IntraBandCC-CombinationReqList-r17

IntraBandCC-CombinationReqList-r17::= SEQUENCE {

 servCellIndexList-r17 SEQUENCE (SIZE(1.. maxNrofServingCells)) OF ServCellIndex,

 cc-CombinationList-r17 SEQUENCE (SIZE(1.. maxNrofReqComDC-Location-r17)) OF IntraBandCC-Combination-r17

}

IntraBandCC-Combination-r17::= SEQUENCE (SIZE(1.. maxNrofServingCells)) OF CC-State-r17

CC-State-r17::= SEQUENCE {

 dlCarrier-r17 CarrierState-r17 OPTIONAL, -- Need N

 ulCarrier-r17 CarrierState-r17 OPTIONAL -- Need N

}

CarrierState-r17::= CHOICE {

 deActivated-r17 NULL,

 activeBWP-r17 INTEGER (0..maxNrofBWPs)

}

UplinkTxSwitchingMoreBands-r18::= SEQUENCE {

 uplinkTxSwitchingBandList-r18 SEQUENCE (SIZE (1.. maxSimultaneousBands)) OF FreqBandIndicatorNR,

 uplinkTxSwitchingBandPairList-r18 UplinkTxSwitchingBandPairList-r18 OPTIONAL, -- Need M

 uplinkTxSwitchingAssociatedBandDualULList-r18 UplinkTxSwitchingAssociatedBandDualUL-r18 OPTIONAL, -- Need M

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}

UplinkTxSwitchingBandPairList-r18 ::= SEQUENCE (SIZE (1.. maxULTxSwitchingBandPairs)) OF UplinkTxSwitchingBandPairConfig-r18

UplinkTxSwitchingBandPairConfig-r18 ::= SEQUENCE {

 bandInfoUL1-r18 UplinkTxSwitchingBandIndex-r18,

 bandInfoUL2-r18 UplinkTxSwitchingBandIndex-r18,

 switchingOptionConfigForBandPair-r18 ENUMERATED {switchedUL, dualUL},

 switching2T-DualUL-r18 ENUMERATED {enabled} OPTIONAL, -- Need R

 ...

}

UplinkTxSwitchingAssociatedBandDualULList-r18::= SEQUENCE (SIZE (1.. maxSimultaneousBands)) OF UplinkTxSwitchingAssociatedBandDualUL-r18

UplinkTxSwitchingAssociatedBandDualUL-r18::= SEQUENCE {

 transmitBand-r18 UplinkTxSwitchingBandIndex-r18,

 associatedBand-r18 UplinkTxSwitchingBandIndex-r18

}

UplinkTxSwitchingBandIndex-r18::= INTEGER (1..maxSimultaneousBands)

-- TAG-CELLGROUPCONFIG-STOP

-- ASN1STOP

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| ***CC-State* field descriptions** |
| ***dlCarrier***Indicates DL carrier activation state for this carrier and the related active BWP Index, if activated. |
| ***ulCarrier***Indicates UL carrier activation state for this carrier and the related active BWP Index, if activated. |

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| ***CellGroupConfig* field descriptions** |
| ***bap-Address***BAP address of the parent node in cell group. |
| ***bh-RLC-ChannelToAddModList***Configuration of the backhaul RLC entities and the corresponding MAC Logical Channels to be added and modified. |
| ***bh-RLC-ChannelToReleaseList***List of the backhaul RLC entities and the corresponding MAC Logical Channels to be released. |
| ***f1c-TransferPath***The F1-C transfer path that an EN-DC IAB-MT should use for transferring F1-C packets to the IAB-donor-CU. If IAB-MT is configured with *lte*, IAB-MT can only use LTE leg for F1-C transfer. If IAB-MT is configured with *nr*, IAB-MT can only use NR leg for F1-C transfer. If IAB-MT is configured with *both*, it is up to IAB-MT to select an LTE leg or a NR leg for F1-C transfer. If the field is not configured, the IAB node uses the NR leg as the default one. |
| ***f1c-TransferPathNRDC***The F1-C transfer path that an NR-DC IAB-MT should use for transferring F1-C packets to the IAB-donor-CU. If IAB-MT is configured with *mcg*, IAB-MT can only use the MCG for F1-C transfer. If IAB-MT is configured with *scg*, IAB-MT can only use the SCG for F1-C transfer. If IAB-MT is configured with *both*, it is up to IAB-MT to select the MCG or the SCG for F1-C transfer. |
| ***mac-CellGroupConfig***MAC parameters applicable for the entire cell group. |
| ***rlc-BearerToAddModList***Configuration of the MAC Logical Channel, the corresponding RLC entities and association with radio bearers. |
| ***reportUplinkTxDirectCurrent***Enables reporting of uplink and supplementary uplink Direct Current location information upon BWP configuration and reconfiguration. This field is only present when the BWP configuration is modified or any serving cell is added or removed. This field is absent in the IE *CellGroupConfig* when provided as part of *RRCSetup* message. If UE is configured with SUL carrier, UE reports both UL and SUL Direct Current locations. |
| ***reportUplinkTxDirectCurrentMoreCarrier***Enables reporting of uplink Direct Current location information when the UE is configured with intra-band CA. This field is absent in the IE *CellGroupConfig* when provided as part of *RRCSetup* message. The UE only reports the uplink Direct Current location information that are related to the indicated *cc-CombinationList*. The network does not include carriers which locate in DL only spectrum described in TS 38.101-2 [39], clause 5.3A.4 and defined by Fsd according to Table 5.3A.4-3 in FR2 in the *IntraBandCC-CombinationReqList*. I.e. DL-only carrier in FR2 frequency spectrum is not used to calculate the default DC location. |
| ***reportUplinkTxDirectCurrentTwoCarrier***Enables reporting of uplink Direct Current location information when the UE is configured with uplink intra-band CA with two carriers. This field is absent in the IE *CellGroupConfig* when provided as part of *RRCSetup* message. |
| ***rlc-BearerToReleaseListExt***List of the RLC entities and the corresponding MAC Logical Channels to be released for multicast MRBs. |
| ***rlmInSyncOutOfSyncThreshold***BLER threshold pair index for IS/OOS indication generation, see TS 38.133 [14], table 8.1.1-1. *n1* corresponds to the value 1. When the field is absent, the UE applies the value 0. Whenever this is reconfigured, UE resets N310 and N311, and stops T310, if running. Network does not include this field. |
| ***sCellSIB20***This field is used to transfer *SIB20* of the SCell in order to allow the UE for MBS broadcast reception on SCell. The network configures this field only for a single SCell at a time. |
| ***sCellState***Indicates whether the SCell shall be considered to be in activated state upon SCell configuration. If the field is included for an SCell configured with TRS for fast activation of the SCell, such TRS is not used for the corresponding SCell. |
| ***sCellToAddModList***List of secondary serving cells (SCells) to be added or modified. |
| ***sCellToReleaseList***List of secondary serving cells (SCells) to be released. |
| ***secondaryDRX-GroupConfig***The field is used to indicate whether the SCell belongs to the secondary DRX group. All serving cells in the secondary DRX group shall belong to one Frequency Range and all serving cells in the legacy DRX group shall belong to another Frequency Range. |
| ***simultaneousSpatial-UpdatedList1, simultaneousSpatial-UpdatedList2***List of serving cells which can be updated simultaneously for spatial relation with a MAC CE. The *simultaneousSpatial-UpdatedList1* and *simultaneousSpatial-UpdatedList2* shall not contain same serving cells. Network should not configure serving cells that are configured with a BWP with two different values for the *coresetPoolIndex* in these lists. |
| ***simultaneousTCI-UpdateList1, simultaneousTCI-UpdateList2***List of serving cells which can be updated simultaneously for TCI relation with a MAC CE. The *simultaneousTCI-UpdateList1* and *simultaneousTCI-UpdateList2* shall not contain same serving cells. Network should not configure serving cells that are configured with a BWP with two different values for the *coresetPoolIndex* in these lists. |
| ***simultaneousU-TCI-UpdateList1, simultaneousU-TCI-UpdateList2, simultaneousU-TCI-UpdateList3, simultaneousU-TCI-UpdateList4***List of serving cells for which the Unified TCI States Activation/Deactivation MAC CE applies simultaneously, as specified in TS 38.321 [3] clause 6.1.3.47. The different lists shall not contain same serving cells. Network only configures in these lists serving cells that are configured with *unifiedTCI-StateType*. |
| ***spCellConfig***Parameters for the SpCell of this cell group (PCell of MCG or PSCell of SCG).  |
| ***uplinkTxSwitchingOption***Indicates which option is configured for dynamic UL Tx switching for inter-band UL CA or (NG)EN-DC. The field is set to *switchedUL* if network configures option 1 as specified in TS 38.214 [19], or *dualUL* if network configures option 2 as specified in TS 38.214 [19]. Network always configures UE with a value for this field in inter-band UL CA case and (NG)EN-DC case where UE supports dynamic UL Tx switching. |
| ***uplinkTxSwitchingPowerBoosting***Indicates whether the UE is allowed to enable 3dB boosting on the maximum output power for transmission on carrier2 under the operation state in which 2-port transmission can be supported on carrier2 for inter-band UL CA case with dynamic UL Tx switching as defined in TS 38.101-1 [15]. Network can only configure this field for dynamic UL Tx switching in inter-band UL CA case with power Class 3 as defined in TS 38.101-1 [15]. |
| ***uplinkTxSwitching-2T-Mode***Indicates 2Tx-2Tx switching mode is configured for inter-band UL CA or SUL, in which the switching gap duration for a triggered uplink switching (as specified in TS 38.214 [19]) is equal to the switching time capability value reported for the switching mode.If this field is absent and *uplinkTxSwitching* is configured, it is interpreted that 1Tx-2Tx UL Tx switching is configured as specified in TS 38.214 [19]. In this case, there is one uplink (or one uplink band in case of intra-band) configured with *uplinkTxSwitching*, on which the maximum number of antenna ports among all configured P-SRS/A-SRS and activated SP-SRS resources should be 1 and non-codebook based UL MIMO is not configured. |
| ***uplinkTxSwitching-DualUL-TxState***Indicates the state of Tx chains if the state of Tx chains after the UL Tx switching is not unique (as specified in TS 38.214 [19]) in case of 2Tx-2Tx switching is configured and *uplinkTxSwitchingOption* is set to *dualUL*. Value *oneT* indicates 1Tx is assumed to be supported on the carriers on each band, value *twoT* indicates 2Tx is assumed to be supported on that carrier. |
| ***uplinkTxSwitchingMoreBands***Indicates UL band list, band pair list and other configurations for ULTx switching. |
| ***uu-RelayRLC-ChannelToAddModList***List of the Uu RLC entities and the corresponding MAC Logical Channels to be added or modified. |
| ***uu-RelayRLC-ChannelToReleaseList***List of the Uu RLC entities and the corresponding MAC Logical Channels to be released. |

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| ***DeactivatedSCG-Config* field descriptions** |
| ***bfd-and-RLM***If the field is set to *true*, the UE shall perform RLM and BFD on the PSCell when the SCG is deactivated and the network ensures that *beamFailure* is not configured in the *radioLinkMonitoringConfig* of the DL BWP of the PSCell in which the UE performs BFD. If set to *false*, the UE is not required to perform RLM and BFD on the PSCell when the SCG is deactivated. |

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| ***DAPS-UplinkPowerConfig* field descriptions** |
| ***p-DAPS-Source***The maximum total transmit power to be used by the UE in the source cell group during DAPS handover. |
| ***p-DAPS-Target***The maximum total transmit power to be used by the UE in the target cell group during DAPS handover. |
| ***uplinkPowerSharingDAPS-Mode***Indicates the uplink power sharing mode that the UE uses in DAPS handover (see TS 38.213 [13]). |

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| ***GoodServingCellEvaluation* field descriptions** |
| ***offset***The parameter "X" (dB) for the good serving cell quality criterion in RRC\_CONNECTED, for a cell operating in FR1 and FR2, respectively. If this field is absent, the UE applies the (default) value of 0 dB for "X". |

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| ***IAB-ResourceConfig* field descriptions** |
| ***iab-ResourceConfigID***This ID is used to indicate the specific resource configuration addressed by the MAC CEs specified in TS 38.321 [3]. |
| ***periodicitySlotList***Indicates the periodicity in ms of the list of slot indexes indicated in *slotList*. |
| ***slotList***Indicates the list of slot indexes to which the information indicated in the specific MAC CE applies to, as specified in TS 38.321 [3]. The values of the entries in the *slotList* are strictly less than the value of the *periodicitySlotList*. |
| ***slotListSubcarrierSpacing***Subcarrier spacing used as reference for the *slotList* configuration.Only the following values are applicable depending on the used frequency:FR1: 15 or 30 kHzFR2-1: 60 or 120 kHzFR2-2: 120 or 480 kHz |

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| ***ReconfigurationWithSync* field descriptions** |
| ***rach-ConfigDedicated***Random access configuration to be used for the reconfiguration with sync (e.g. handover). The UE performs the RA according to these parameters in the *firstActiveUplinkBWP* (see *UplinkConfig*). |
| ***smtc***The SSB periodicity/offset/duration configuration of target cell for NR PSCell change and NR PCell change. The network sets the *periodicityAndOffset* to indicate the same periodicity as *ssb-periodicityServingCell* in *spCellConfigCommon* or sets to the same periodicity as *ssb-Periodicity-r17* in *nonCellDefiningSSB-r17* if the first active DL BWP included in this RRC message is configured with *nonCellDefiningSSB-r17* for RedCap.For case of NR PCell change, the *smtc* is based on the timing reference of (source) PCell. For case of NR PSCell change, it is based on the timing reference of source PSCell.If both this field and *targetCellSMTC-SCG* are absent, the UE uses the SMTC in the *measObjectNR* having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message. For a RedCap UE, if the first active DL BWP included in this RRC message is configured with *nonCellDefiningSSB-r17*, this field corresponds to the NCD-SSB indicated by *nonCellDefiningSSB-r17*, otherwise, this field corresponds to the CD-SSB indicated by *absoluteFrequencySSB* in *frequencyInfoDL*. |

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| ***ReportUplinkTxDirectCurrentMoreCarrier* field descriptions** |
| ***IntraBandCC-Combination***Indicates the state of the carriers and BWPs indexes of the carriers in a CC combination, each carrier in this combination corresponds to an entry in *servCellIndexList* with same order. This IE shall have the same size as *servCellIndexList*. |
| ***IntraBandCC-CombinationReqList***Indicates the list of the requested carriers/BWPs combinations for an intra-band CA component. |
| ***servCellIndexList***indicates the list of cell index for an intra-band CA component. |

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| ***SCellConfig* field descriptions** |
| ***goodServingCellEvaluationBFD***Indicates the criterion for a UE to detect the good serving cell quality for BFD relaxation in an SCell in RRC\_CONNECTED. This field is always configured when the network enables BFD relaxation for the UE in this SCell. This field is absent if *failureDetectionSetN* is present for the SCell. |
| ***preConfGapStatus***Indicates whether the pre-configured measurement gaps (i.e. the gaps configured with *preConfigInd*) are activated or deactivated while this SCell is deactivated. If this field is configured, the UE shall apply network-controlled mechanism for activation and deactivation of the pre-configured measurement gaps, otherwise the UE shall apply the autonomous activation/deactivation mechanism, as specified in TS 38.133 [14]. The first/leftmost bit corresponds to the measurement gap with gap ID 1, the second bit corresponds to measurement gap with gap ID 2, and so on. Value 0 indicates that the corresponding pre-configured measurement gap is deactivated while value 1 indicates that the corresponding pre-configured measurement gap is activated. The UE shall ignore the bit if the corresponding measurement gap is not a pre-configured measurement gap. |
| ***smtc***The SSB periodicity/offset/duration configuration of target cell for NR SCell addition. The network sets the *periodicityAndOffset* to indicate the same periodicity as *ssb-periodicityServingCell* in *sCellConfigCommon*. The *smtc* is based on the timing of the SpCell of associated cell group. In case of inter-RAT handover to NR, the timing reference is the NR PCell. In case of intra-NR PCell change (standalone NR) or NR PSCell change (EN-DC), the timing reference is the target SpCell. If the field is absent, the UE uses the SMTC in the *measObjectNR* having the same SSB frequency and subcarrier spacing, as configured before the reception of the RRC message. |

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| ***SpCellConfig* field descriptions** |
| ***deactivatedSCG-Config***Configuration applicable when the SCG is deactivated. The network always configures this field before or when indicating that the SCG is deactivated in an *RRCReconfiguration*, *RRCResume*, E-UTRA *RRCConnectionReconfiguration* or E-UTRA *RRCConnectionResume* message. |
| ***goodServingCellEvaluationBFD***Indicates the criterion for a UE to detect the good serving cell quality for BFD relaxation in the SpCell in RRC\_CONNECTED. The field is always configured when the network enables BFD relaxation for the UE in this SpCell. This field is absent if *failureDetectionSetN* is present for the SpCell. |
| ***goodServingCellEvaluationRLM***Indicates the criterion for a UE to detect the good serving cell quality for RLM relaxation in the SpCell in RRC\_CONNECTED. The field is always configured when the network enables RLM relaxation for the UE in this SpCell. |
| ***lowMobilityEvaluationConnected***Indicates the criterion for a UE to detect low mobility in RRC\_CONNECTED in an SpCell. The *s-SearchDeltaP-Connected* is the parameter "SSearchDeltaP-connected". Value *dB*3 corresponds to 3 dB, *dB*6 corresponds to 6 dB and so on. The *t-SearchDeltaP-Connected* is the parameter "TSearchDeltaP-Connected". Value *s5* means 5 seconds, value *s10* means 10 seconds and so on. Low mobility criterion is configured in NR PCell for the case of NR SA/ NR CA/ NE-DC/NR-DC, and in the NR PSCell for the case of EN-DC. |
| ***reconfigurationWithSync***Parameters for the synchronous reconfiguration to the target SpCell. |
| ***rlf-TimersAndConstants***Timers and constants for detecting and triggering cell-level radio link failure. For the SCG, *rlf-TimersAndConstants* can only be set to *setup* and is always included at SCG addition. |
| ***servCellIndex***Serving cell ID of a PSCell. The PCell of the Master Cell Group uses ID = 0. |

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| ***SL-PathSwitchConfig* field descriptions** |
| ***targetRelayUE-Identity***Indicates the L2 source ID of the target L2 U2N Relay UE during path switch. |
| ***T420***Indicates the timer value of T420 to be used during path switch. |

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| ***UplinkTxSwitchingMoreBands* field descriptions** |
| ***uplinkTxSwitchingBandList***Indicates the NR frequency band number of the UL bands for UL Tx switching. If the UE needs to determine location of switching period as specified in TS 38.101-1 [15], the UE considers that the bands are listed in decreasing order of priority, i.e. the first/leftmost entry corresponds to the band with the highest priority, the next entry corresponds to the band with the second highest priority, and so on. The last entry corresponds the band with the lowest priority. |
| ***uplinkTxSwitchingBandPairList***Indicates the band pairs involved in UL Tx switching, as well as the per band pair configurations.  |
| ***uplinkTxSwitchingAssociatedBandDualULList***Indicates the associated band for transmtting band(s) as specified in TS 38.214 [19], clause 6.16.  |
| ***UplinkTxSwitchingBandIndex***The value n indicates the band included at the n-th entry of *uplinkTxSwitchingBandList*. |

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| ***UplinkTxSwitchingBandPairConfig* field descriptions** |
| ***bandInfoUL1, bandInfoUL2***Indicates the band index for a band pair. The value n indicates the band included at the n-th entry of *uplinkTxSwitchingBandList*. |
| ***switching2T-ModeForBandPair***Indicates 2Tx-2Tx switching period is considered as the switching gap duration when UL Tx switching is performed between the two bands within the band pair as specified in TS 38.214 [19].  |
| ***switchingOptionConfigForBandPair***Indicates the switching option for the band pair as specified in TS 38.214 [19], clause 6.16.  |

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| **Conditional Presence** | **Explanation** |
| *2Tx* | The field is optionally present, Need R, if *uplinkTxSwitching* is configured; otherwise it is absent, Need R. |
| *BWP-Reconfig* | The field is optionally present, Need N, if the BWPs are reconfigured or if serving cells are added or removed. Otherwise it is absent.  |
| *DirectToIndirect-PathSwitch* | The field is mandatory present for the L2 U2N remote UE at path switch to the target L2 U2N Relay UE. It is absent otherwise. |
| *DRX-Config2* | The field is optionally present, Need N, if *drx-ConfigSecondaryGroup* is configured. It is absent otherwise. |
| *PreConfigMG* | The field is optionally present, Need R, if there is at least one per UE gap configured with *preConfigInd* or there is at least one per FR gap of the same FR which the SCell belongs to and configured with *preConfigInd*. It is absent, Need R, otherwise. |
| *ReconfWithSync* | The field is mandatory present in the *RRCReconfiguration* message:- in each configured *CellGroupConfig* for which the SpCell changes,- in the *masterCellGroup:*- at change of AS security key derived from KgNB,- in an *RRCReconfiguration* message contained in a *DLInformationTransferMRDC* message,- path switch of L2 U2N remote UE to the target PCell,- path switch of L2 U2N remote UE to the target L2 U2N Relay UE,- in the *secondaryCellGroup* at:- PSCell addition,- SCG resume with NR-DC or (NG)EN-DC,- update of required SI for PSCell,- change of AS security key derived from S-KgNB in NR-DC while the UE is configured with at least one radio bearer with *keyToUse* set to *secondary* and that is not released by this *RRCReconfiguration* message,- MN handover in (NG)EN-DC.Otherwise, it is optionally present, need M. The field is absent in the *masterCellGroup* in *RRCResume* and *RRCSetup* messages and is absent in the *masterCellGroup* in *RRCReconfiguration* messages if source configuration is not released during DAPS handover. |
| *SCellAdd* | The field is mandatory present upon SCell addition; otherwise it is absent, Need M. |
| *SCellAddMod* | The field is mandatory present upon SCell addition; otherwise it is optionally present, need M. |
| *SCellAddSync* | The field is optionally present, Need N:- in the *masterCellGroup* at- SCell addition,- reconfiguration with sync,- resume of an RRC connection.- in the *secondaryCellGroup*, when the SCG is not indicated as deactivated at:- SCG activation while the SCG was previously deactivated,- SCell addition,- reconfiguration with sync.It is absent otherwise. |
| *SCG* | The field is mandatory present in an *SpCellConfig* for the PSCell. It is absent otherwise.  |
| *SCG-Opt* | The field is optionally present, Need M, in an SpCellConfig for the PSCell. It is absent otherwise. |

NOTE: In case of change of AS security key derived from S-KgNB/S-KeNB, if *reconfigurationWithSync* is not included in the *masterCellGroup*, the network releases all existing MCG RLC bearers associated with a radio bearer with *keyToUse* set to *secondary*. In case of change of AS security key derived from KgNB/KeNB, if *reconfigurationWithSync* is not included in the *secondaryCellGroup*, the network releases all existing SCG RLC bearers associated with a radio bearer with *keyToUse* set to *primary*.