**3GPP TSG-RAN WG2 Meeting #112e *R2-200xxxx***

**, Nov 2-13, 2020**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  |  | **CR** | **2149** | **rev** | **1** | **Current version:** |  |  |
|  |
| *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:***  | Corrections to 2-Step RA |
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| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_2step\_RACH-Core |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | 1) For the field msgA-DeltaPreamble, the values of the field have not been explained. It is not clear what does the values -1~6 represent and a clarification is needed.2) For the field frequencyStartMsgA-PUSCH, an reference is added to clarify conditions when a single symbol is configured for DMRS by the field *msgA-MaxLength*. 3) Incorrect parameter naming may result in inconsistent setting of *numberofRA-PreamblesGroupA*. 4) Editorial correction to parameter name |
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| **Summary of change:** | 1) Add in the field description of msgA-DeltaPreamble what the values of the field indicates2) Update the field descritpion of msgA-PUSCH-NrOfPort with a reference to L1 specification such that a configuration is aligned with the msgA-DMRS-AdditionalPosition.3) msgA-CB-PreamblesPerSSB parameter name in field description for numberofRA-PreamblesGroupA related to GroupB-ConfiguredTwoStepRA is corrected to msgA-CB-PreamblesPerSSB-PerSharedRO**Impact Analysis**Impacted 5G architecture options: NR SA, (NG)EN-DC, NE-DC, NR-DC Impacted functionality:2-Step Random AccessInter-operability:1,2,4) no inter-operability issues.3) If the network is implemented according to the CR and the UE is not (or vice versa), the UE may perform Random Access procedure using a preamble not used by the network. This could delay completion of the Random Access procedure and possibly access to the network. |
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| ***Consequences if not approved:*** | 1,2) The network may lack guidance to give a usable configuration.3) The number of CB preambles per SSB in group A for idle/inactive or connected mode may not be consistent with *msgA-CB-PreamblesPerSSB-PerSharedRO* if configured. |
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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:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | Merge of agreed corrections from *R2-2010403(CR 2213), R2-2009968(CR 2149) and R2-2010404(CR 2214)* |
|  |  |
| ***This CR's revision history:*** |  |

*START OF CHANGE*

#### – *MsgA-PUSCH-Config*

The IE *MsgA-PUSCH-Config* is used to specify the PUSCH allocation for MsgA in 2-step random access type procedure.

*MsgA-PUSCH-Config* information element

-- ASN1START

-- TAG-MSGA-PUSCH-CONFIG-START

MsgA-PUSCH-Config-r16 ::= SEQUENCE {

 msgA-PUSCH-ResourceGroupA-r16 MsgA-PUSCH-Resource-r16 OPTIONAL, -- Cond InitialBWPConfig

 msgA-PUSCH-ResourceGroupB-r16 MsgA-PUSCH-Resource-r16 OPTIONAL, -- Cond GroupBConfigured

 msgA-TransformPrecoder-r16 ENUMERATED {enabled, disabled} OPTIONAL, -- Need R

 msgA-DataScramblingIndex-r16 INTEGER (0..1023) OPTIONAL, -- Need S

 msgA-DeltaPreamble-r16 INTEGER (-1..6) OPTIONAL -- Need R

}

MsgA-PUSCH-Resource-r16 ::= SEQUENCE {

 msgA-MCS-r16 INTEGER (0..15),

 nrofSlotsMsgA-PUSCH-r16 INTEGER (1..4),

 nrofMsgA-PO-PerSlot-r16 ENUMERATED {one, two, three, six},

 msgA-PUSCH-TimeDomainOffset-r16 INTEGER (1..32),

 msgA-PUSCH-TimeDomainAllocation-r16 INTEGER (1..maxNrofUL-Allocations) OPTIONAL, -- Need S

 startSymbolAndLengthMsgA-PO-r16 INTEGER (0..127) OPTIONAL, -- Need S

 mappingTypeMsgA-PUSCH-r16 ENUMERATED {typeA, typeB} OPTIONAL, -- Need S

 guardPeriodMsgA-PUSCH-r16 INTEGER (0..3) OPTIONAL, -- Need R

 guardBandMsgA-PUSCH-r16 INTEGER (0..1),

 frequencyStartMsgA-PUSCH-r16 INTEGER (0..maxNrofPhysicalResourceBlocks-1),

 nrofPRBs-PerMsgA-PO-r16 INTEGER (1..32),

 nrofMsgA-PO-FDM-r16 ENUMERATED {one, two, four, eight},

 msgA-IntraSlotFrequencyHopping-r16 ENUMERATED {enabled} OPTIONAL, -- Need R

 msgA-HoppingBits-r16 BIT STRING (SIZE(2)) OPTIONAL, -- Need R

 msgA-DMRS-Config-r16 MsgA-DMRS-Config-r16,

 nrofDMRS-Sequences-r16 INTEGER (1..2),

 msgA-Alpha-r16 ENUMERATED {alpha0, alpha04, alpha05, alpha06,

 alpha07, alpha08, alpha09, alpha1} OPTIONAL, -- Need S

 interlaceIndexFirstPO-MsgA-PUSCH-r16 INTEGER (1..10) OPTIONAL, -- Need R

 nrofInterlacesPerMsgA-PO-r16 INTEGER (1..10) OPTIONAL, -- Need R

 ...

}

MsgA-DMRS-Config-r16 ::= SEQUENCE {

 msgA-DMRS-AdditionalPosition-r16 ENUMERATED {pos0, pos1, pos3} OPTIONAL, -- Need S

 msgA-MaxLength-r16 ENUMERATED {len2} OPTIONAL, -- Need S

 msgA-PUSCH-DMRS-CDM-Group-r16 INTEGER (0..1) OPTIONAL, -- Need S

 msgA-PUSCH-NrofPorts-r16 INTEGER (0..1) OPTIONAL, -- Need S

 msgA-ScramblingID0-r16 INTEGER (0..65535) OPTIONAL, -- Need S

 msgA-ScramblingID1-r16 INTEGER (0..65535) OPTIONAL -- Need S

}

-- TAG-MSGA-PUSCH-CONFIG-STOP

-- ASN1STOP

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| *MsgA-PUSCH-Config* field descriptions |
| ***msgA-DataScramblingIndex***Identifier used to initiate data scrambling (c\_init) for msgA PUSCH. If the field is absent the UE applies the value Physical cell ID (*physCellID*). |
| ***msgA-DeltaPreamble***Power offset of msgA PUSCH relative to the preamble received target power. Actual value = field value \* 2 [dB] (see TS 38.213 [13], clause 7.1). |
| ***msgA-PUSCH-ResourceGroupA***MsgA PUSCH resources that the UE shall use when performing MsgA transmission using preambles group A. If field is not configured for the selected UL BWP, the UE shall use the MsgA PUSCH configuration for group A of initial UL BWP. |
| ***msgA-PUSCH-ResourceGroupB***MsgA PUSCH resources that the UE shall use when performing MsgA transmission using preambles group B. |
| ***msgA-TransformPrecoder***Enables or disables the transform precoder for MsgA transmission (see clause 6.1.3 of TS 38.214 [19]). |

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| *MsgA-PUSCH-Resource* field descriptions |
| ***guardBandMsgA-PUSCH***PRB-level guard band between FDMed PUSCH occasions (see TS 38.213 [13], clause 8.1A). If interlaced PUSCH is configured, value 0 is applied. |
| ***guardPeriodMsgA-PUSCH***Guard period between PUSCH occasions in the unit of symbols (see TS 38.213 [13], clause 8.1A). |
| ***frequencyStartMsgA-PUSCH***Offset of lowest PUSCH occasion in frequency domain with respect to PRB 0 (see TS 38.213 [13], clause 8.1A).  |
| ***interlaceIndexFirstPO-MsgA-PUSCH***Interlace index of the first PUSCH occasion in frequency domain if interlaced PUSCH is configured. For 30kHz SCS only the integers 1, 2, 3, 4, 5 are applicable (see TS 38.213 [13], clause 8.1A). |
| ***mappingTypeMsgA-PUSCH***PUSCH mapping type A or B. If the field is absent, the UE shall use the parameter *msgA-PUSCH-TimeDomainAllocation* (see TS 38.213 [13], clause 8.1A). |
| ***msgA-Alpha***Dedicated alpha value for MsgA PUSCH. If value is absent, the UE shall use the value of *msg3-Alpha* if configured, else UE applies value 1 (see TS 38.213 [13], clause 7.1.1). |
| ***msgA-DMRS-Config***DMRS configuration for msgA PUSCH (see TS 38.213 [13], clause 8.1A and TS 38.214 [19] clause 6.2.2). |
| ***msgA-HoppingBits***Value of hopping bits to indicate which frequency offset to be used for second hop. See Table 8.3-1 in 38.213 [13]. This field is mandatory present when the field *msgA-IntraSlotFrequencyHopping* is configured. Otherwise, the field is absent. |
| ***msgA-IntraSlotFrequencyHopping***Intra-slot frequency hopping per PUSCH occasion (see TS 38.213 [13], clause 8.1A). |
| ***msgA-MCS***Indicates the MCS index for msgA PUSCH from the Table 6.1.4.1-1 for DFT-s-OFDM and Table 5.1.3.1-1 for CP-OFDM in 38.214 [19]. |
| ***msgA-PUSCH-TimeDomainAllocation***Indicates a combination of start symbol and length and PUSCH mapping type from the TDRA table (*PUSCH-TimeDomainResourceAllocationList* if provided in *PUSCH-ConfigCommon*, or else the default Table 6.1.2.1.1-2 in 38.214 [19] is used if *pusch-TimeDomainAllocationList* is not provided in PUSCH-ConfigCommon). The parameter K2 in the table is not used for msgA PUSCH. The network configures one of *msgA-PUSCH-TimeDomainAllocation* and *startSymbolAndLengthMsgA-PO,* but not both. If the field is absent, the UE shall use the value of startSymbolAndLenghtMsgA-PO. |
| ***msgA-PUSCH-TimeDomainOffset***A single time offset with respect to the start of each PRACH slot (with at least one valid RO), counted as the number of slots (based on the numerology of active UL BWP). See 38.213 [13], clause 8.1A. |
| ***nrofDMRS-Sequences***Number of DMRS sequences for MsgA PUSCH for CP-OFDM. In case of single PUSCH configuration or if the DMRS symbols of multiple configurations are not overlapped, if the DMRS resources configured in one PUSCH occasion is no larger than 8 (for *len2*) or 4 (for *len1*), then only DMRS port is configured. |
| ***nrofInterlacesPerMsgA-PO***Number of consecutive interlaces per PUSCH occasion if interlaced PUSCH is configured. For 30kHz SCS only the integers 1, 2, 3, 4, 5 are applicable (see TS 38.213 [13], clause 8.1A). |
| ***nrofMsgA-PO-FDM***The number of msgA PUSCH occasions FDMed in one time instance (see TS 38.213 [13], clause 8.1A). |
| ***nrofMsgA-PO-PerSlot***Number of time domain PUSCH occasions in each slot. PUSCH occasions including guard period are contiguous in time domain within a slot (see TS 38.213 [13], clause 8.1A). |
| ***nrofPRBs-PerMsgA-PO***Number of PRBs per PUSCH occasion (see TS 38.213 [13], clause 8.1A). |
| ***nrofSlotsMsgA-PUSCH***Number of slots (in active UL BWP numerology) containing one or multiple PUSCH occasions, each slot has the same time domain resource allocation (see TS 38.213 [13], clause 8.1A). |
| ***startSymbolAndLengthMsgA-PO***An index giving valid combinations of start symbol, length and mapping type as start and length indicator (SLIV) for the first msgA PUSCH occasion, for RRC\_CONNECTED UEs in non-initial BWP as described in TS 38.214 [19] clause 6.1.2. The network configures the field so that the allocation does not cross the slot boundary. The number of occupied symbols excludes the guard period. If the field is absent, the UE shall use the value in *msgA-PUSCH-TimeDomainAllocation* (see TS 38.213 [13], clause 8.1A). The network configures one of *msgA-PUSCH-TimeDomainAllocation* and *startSymbolAndLengthMsgA-PO,* but not both. If the field is absent, the UE shall use the value of *msgA-PUSCH-TimeDomainAllocation****.*** |

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| *MsgA-DMRS-Config* field descriptions |
| ***msgA-DMRS-AdditionalPosition***Indicates the position for additional DM-RS. If the field is absent, the UE applies value *pos2*. |
| ***msgA-MaxLength***indicates single-symbol or double-symbol DMRS. If the field is absent, the UE applies value *len1*. |
| ***msgA-PUSCH-DMRS-CDM-group***1-bit indication of indices of CDM group(s). If the field is absent, then both CDM groups are used. |
| ***msgA-PUSCH-NrofPort***0 indicates 1 port per CDM group, 1 indicates 2 ports per CDM group. If the field is absent then 4 ports per CDM group are used (see TS 38.213 [13], clause 8.1A). |
| ***msgA-ScramblingID0***UL DMRS scrambling initialization for CP-OFDM. If the field is absent the UE applies the value Physical cell ID (*physCellID*). |
| ***msgA-ScramblingID1***UL DMRS scrambling initialization for CP-OFDM. If the field is absent the UE applies the value Physical cell ID (*physCellID*). |

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| Conditional Presence | Explanation |
| *GroupBConfigured* | The field is mandatory present if *groupB-ConfiguredTwoStepRA* is configured in *RACH-ConfigCommonTwoStepRA*, ortherwise the field is absent. |
| *InitialBWPConfig* | The field is mandatory present when *MsgA-ConfigCommon* is configured for the initial uplink BWP, or when *MsgA-ConfigCommon* is configured for a non-initial uplink BWP and *MsgA-ConfigCommon* is not configured for the initial uplink BWP, otherwise the field is Need S. |

 *NEXT CHANGE*

#### – *RACH-ConfigCommonTwoStepRA*

The IE *RACH-ConfigCommonTwoStepRA* is used to specify cell specific 2-step random-access type parameters.

*RACH-ConfigCommonTwoStepRA* information element

-- ASN1START

-- TAG-RACH-CONFIGCOMMONTWOSTEPRA-START

RACH-ConfigCommonTwoStepRA-r16 ::= SEQUENCE {

 rach-ConfigGenericTwoStepRA-r16 RACH-ConfigGenericTwoStepRA-r16,

 msgA-TotalNumberOfRA-Preambles-r16 INTEGER (1..63) OPTIONAL, -- Need S

 msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB-r16 CHOICE {

 oneEighth ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},

 oneFourth ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},

 oneHalf ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},

 one ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32,n36,n40,n44,n48,n52,n56,n60,n64},

 two ENUMERATED {n4,n8,n12,n16,n20,n24,n28,n32},

 four INTEGER (1..16),

 eight INTEGER (1..8),

 sixteen INTEGER (1..4)

 } OPTIONAL, -- Cond 2StepOnly

 msgA-CB-PreamblesPerSSB-PerSharedRO-r16 INTEGER (1..60) OPTIONAL, -- Cond SharedRO

 msgA-SSB-SharedRO-MaskIndex-r16 INTEGER (1..15) OPTIONAL, -- Need S

 groupB-ConfiguredTwoStepRA-r16 GroupB-ConfiguredTwoStepRA-r16 OPTIONAL, -- Need S

 msgA-PRACH-RootSequenceIndex-r16 CHOICE {

 l839 INTEGER (0..837),

 l139 INTEGER (0..137),

 l571 INTEGER (0..569),

 l1151 INTEGER (0..1149)

 } OPTIONAL, -- Cond 2StepOnly

 msgA-TransMax-r16 ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200} OPTIONAL, -- Need R

 msgA-RSRP-Threshold-r16 RSRP-Range OPTIONAL, -- Cond 2Step4Step

 msgA-RSRP-ThresholdSSB-r16 RSRP-Range OPTIONAL, -- Need R

 msgA-SubcarrierSpacing-r16 SubcarrierSpacing OPTIONAL, -- Cond 2StepOnlyL139

 msgA-RestrictedSetConfig-r16 ENUMERATED {unrestrictedSet, restrictedSetTypeA,

 restrictedSetTypeB} OPTIONAL, -- Cond 2StepOnly

 ra-PrioritizationForAccessIdentityTwoStep-r16 SEQUENCE {

 ra-Prioritization-r16 RA-Prioritization,

 ra-PrioritizationForAI-r16 BIT STRING (SIZE (2))

 } OPTIONAL, -- Cond InitialBWP-Only

 ra-ContentionResolutionTimer-r16 ENUMERATED {sf8, sf16, sf24, sf32, sf40, sf48, sf56, sf64} OPTIONAL, -- Cond 2StepOnly

 ...

}

GroupB-ConfiguredTwoStepRA-r16 ::= SEQUENCE {

 ra-MsgA-SizeGroupA ENUMERATED {b56, b144, b208, b256, b282, b480, b640, b800,

 b1000, b72, spare6, spare5, spare4, spare3, spare2, spare1},

 messagePowerOffsetGroupB ENUMERATED {minusinfinity, dB0, dB5, dB8, dB10, dB12, dB15, dB18},

 numberofRA-PreamblesGroupA INTEGER (1..64)

}

-- TAG-RACH-CONFIGCOMMONTWOSTEPRA-STOP

-- ASN1STOP

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| *RACH-ConfigCommonTwoStepRA* field descriptions |
| ***groupB-ConfiguredTwoStepRA***Preamble grouping for 2-step random access type. If the field is absent then there is only one preamble group configured and only one msgA PUSCH configuration. |
| ***msgA-CB-PreamblesPerSSB-PerSharedRO***Number of contention-based preambles used for 2-step RA type from the non-CBRA 4-step type preambles associated with each SSB for RO shared with 4-step type RA. The number of preambles for 2-step RA type shall not exceed the number of preambles per SSB minus the number of contention-based preambles per SSB for 4-step type RA. The possible value range for this parameter needs to be aligned with value range for the configured SSBs per RACH occasion in *SSB-perRACH-OccasionAndCB-PreamblesPerSSB* in *RACH-ConfigCommon*. The field is only applicable for the case of shared ROs with 4-step type random access. |
| ***msgA-PRACH-RootSequenceIndex***PRACH root sequence index. If the field is not configured, the UE applies the value in field *prach-RootSequenceIndex* in *RACH-ConfigCommon* in the configured BWP. When both 2-step and 4-step type random access is configured, this field is only configured for the case of separate ROs between 2-step and 4-step type random access. |
| ***msgA-RestrictedSetConfig***Configuration of an unrestricted set or one of two types of restricted sets for 2-step random access type preamble. If the field is not configured, the UE applies the value in field *restrictedSetConfig* in *RACH-ConfigCommon* in the configured BWP. When both 2-step and 4-step type random access is configured, this field is only configured for the case of separate ROs between 2-step and 4-step type random access. |
| ***msgA-RSRP-Threshold***The UE selects 2-step random access type to perform random access based on this threshold (see TS 38.321 [3], clause 5.1.1). This field is only present if both 2-step and 4-step RA type are configured for the BWP. |
| ***msgA-RSRP-ThresholdSSB***UE may select the SS block and corresponding PRACH resource for path-loss estimation and (re)transmission based on SS blocks that satisfy the threshold (see TS 38.213 [13]). |
| ***msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB***The meaning of this field is twofold: the CHOICE conveys the information about the number of SSBs per RACH occasion. Value *oneEight* corresponds to one SSB associated with 8 RACH occasions, value *oneFourth* corresponds to one SSB associated with 4 RACH occasions, and so on. The ENUMERATED part indicates the number of Contention Based preambles per SSB. Value *n4* corresponds to 4 Contention Based preambles per SSB, value *n8* corresponds to 8 Contention Based preambles per SSB, and so on. The total number of CB preambles in a RACH occasion is given by *CB-preambles-per-SSB* \* max(1, *SSB-per-rach-occasion*). If the field is not configured and both 2-step and 4-step are configured for the BWP, the UE applies the value in the field *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* in *RACH-ConfigCommon*. The field is not present when RACH occasions are shared between 2-step and 4-step type random access in the BWP. |
| ***msgA-SSB-SharedRO-MaskIndex***Indicates the subset of 4-step type ROs shared with 2-step random access type for each SSB. This field is configured when there is more than one RO per SSB. If the field is absent, and 4-step and 2-step has shared ROs, then all ROs are shared. |
| ***msgA-SubcarrierSpacing***Subcarrier spacing of PRACH (see TS 38.211 [16], clause 5.3.2). Only the values 15 or 30 kHz (FR1), and 60 or 120 kHz (FR2) are applicable. The field is only present in case of 2-step only BWP, otherwise the UE applies the SCS as derived from the *msg1-SubcarrierSpacing* in *RACH-ConfigCommon*. The value also applies to contention free 2-step random access type (*RACH-ConfigDedicated*). |
| ***msgA-TotalNumberOfRA-Preambles***Indicates the total number of preambles used for contention-based and contention-free 2-step random access type when ROs for 2-step are not shared with 4-step. If the field is absent, and 2-step and 4-step does not have shared ROs, all 64 preambles are available for 2-step random access type. |
| ***msgA-TransMax***Max number of MsgA preamble transmissions performed before switching to 4-step random access (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when 2-step and 4-step RA type are configured and switching to 4-step type RA is supported. If the field is absent, switching from 2-step RA type to 4-step RA type is not allowed. |
| ***ra-PrioritizationForAI***Indicates whether the field ra-Prioritization-r16 applies for Access Identities. The first/leftmost bit corresponds to Access Identity 1, the next bit corresponds to Access Identity 2. Value 1 indicates that the field ra-Prioritization-r16 applies, otherwise the field does not apply. |
| ***ra-ContentionResolutionTimer***The initial value for the contention resolution timer for fallback RAR in case no 4-step random access type is configured (see TS 38.321 [3], clause 5.1.5). Value *sf8* corresponds to 8 subframes, value *sf16* corresponds to 16 subframes, and so on. If both 2-step and 4-step random access type resources are configured on the BWP, then this field is absent. |
| ***ra-Prioritization***Parameters which apply for prioritized random access procedure on any UL BWP of SpCell for specific Access Identities (see TS 38.321 [3], clause 5.1.1a). |
| ***rach-ConfigGenericTwoStepRA***2-step random access type parameters for both regular random access and beam failure recovery. |

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| *GroupB-ConfiguredTwoStepRA* field descriptions |
| ***messagePowerOffsetGroupB***Threshold for preamble selection. Value is in dB. Value *minusinfinity* corresponds to –infinity. Value *dB0* corresponds to 0 dB, *dB5* corresponds to 5 dB and so on. (see TS 38.321 [3], clause 5.1.1). |
| ***numberofRA-PreamblesGroupA***The number of CB preambles per SSB in group A for idle/inactive or connected mode. The setting of the number of preambles for each group should be consistent with *ssb-perRACH-OccasionAndCB-PreamblesPerSSB-TwoStepRA* or *msgA-CB-PreamblesPerSSB-PerSharedRO* if configured. |
| ***ra-MsgA-SizeGroupA***Transport block size threshold in bits below which the UE shall use a contention-based RA preamble of group A. (see TS 38.321 [3], clause 5.1.1). |

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| Conditional Presence | Explanation |
| *2StepOnlyL139* | The field is mandatory present if *prach-RootSequenceIndex* L=139 and no 4-step random access type is configured, otherwise the field is absent, Need S. |
| *2StepOnly* | The field is mandatory present if there are no 4-step random access configurations configured in the BWP, i.e only 2-step random access type configured in the BWP, otherwise the field is Need S. |
| *SharedRO* | The field is mandatory present if the 2-step random access type occasions are shared with 4-step random access type, otherwise the field is not present. |
| *2Step4Step* | The field is mandatory present if both 2-step random access type and 4-step random access type are configured in the BWP, otherwise the field is not present.  |
| *InitialBWP-Only* | This field is optionally present, Need R, if this BWP is the initial BWP of SpCell. Otherwise the field is absent. |

#### – *RACH-ConfigDedicated*

The IE *RACH-ConfigDedicated* is used to specify the dedicated random access parameters.

*RACH-ConfigDedicated* information element

-- ASN1START

-- TAG-RACH-CONFIGDEDICATED-START

RACH-ConfigDedicated ::= SEQUENCE {

 cfra CFRA OPTIONAL, -- Need S

 ra-Prioritization RA-Prioritization OPTIONAL, -- Need N

 ...,

 [[

 ra-PrioritizationTwoStep-r16 RA-Prioritization OPTIONAL, -- Need N

 cfra-TwoStep-r16 CFRA-TwoStep-r16 OPTIONAL -- Need S

 ]]

}

CFRA ::= SEQUENCE {

 occasions SEQUENCE {

 rach-ConfigGeneric RACH-ConfigGeneric,

 ssb-perRACH-Occasion ENUMERATED {oneEighth, oneFourth, oneHalf, one, two, four, eight, sixteen}

 OPTIONAL -- Cond Mandatory

 } OPTIONAL, -- Need S

 resources CHOICE {

 ssb SEQUENCE {

 ssb-ResourceList SEQUENCE (SIZE(1..maxRA-SSB-Resources)) OF CFRA-SSB-Resource,

 ra-ssb-OccasionMaskIndex INTEGER (0..15)

 },

 csirs SEQUENCE {

 csirs-ResourceList SEQUENCE (SIZE(1..maxRA-CSIRS-Resources)) OF CFRA-CSIRS-Resource,

 rsrp-ThresholdCSI-RS RSRP-Range

 }

 },

 ...,

 [[

 totalNumberOfRA-Preambles INTEGER (1..63) OPTIONAL -- Cond Occasions

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}

CFRA-TwoStep-r16 ::= SEQUENCE {

 occasionsTwoStepRA-r16 SEQUENCE {

 rach-ConfigGenericTwoStepRA-r16 RACH-ConfigGenericTwoStepRA-r16,

 ssb-PerRACH-OccasionTwoStepRA-r16 ENUMERATED {oneEighth, oneFourth, oneHalf, one,

 two, four, eight, sixteen}

 } OPTIONAL, -- Need S

 msgA-CFRA-PUSCH-r16 MsgA-PUSCH-Resource-r16,

 msgA-TransMax-r16 ENUMERATED {n1, n2, n4, n6, n8, n10, n20, n50, n100, n200} OPTIONAL, -- Need S

 resourcesTwoStep-r16 SEQUENCE {

 ssb-ResourceList SEQUENCE (SIZE(1..maxRA-SSB-Resources)) OF CFRA-SSB-Resource,

 ra-ssb-OccasionMaskIndex INTEGER (0..15)

 },

 ...

}

CFRA-SSB-Resource ::= SEQUENCE {

 ssb SSB-Index,

 ra-PreambleIndex INTEGER (0..63),

 ...,

 [[

 msgA-PUSCH-Resource-Index-r16 INTEGER (0..3071) OPTIONAL -- Cond 2StepCFRA

 ]]

}

CFRA-CSIRS-Resource ::= SEQUENCE {

 csi-RS CSI-RS-Index,

 ra-OccasionList SEQUENCE (SIZE(1..maxRA-OccasionsPerCSIRS)) OF INTEGER (0..maxRA-Occasions-1),

 ra-PreambleIndex INTEGER (0..63),

 ...

}

-- TAG-RACH-CONFIGDEDICATED-STOP

-- ASN1STOP

|  |
| --- |
| *CFRA-CSIRS-Resource* field descriptions |
| ***csi-RS***The ID of a CSI-RS resource defined in the measurement object associated with this serving cell. |
| ***ra-OccasionList***RA occasions that the UE shall use when performing CF-RA upon selecting the candidate beam identified by this CSI-RS. The network ensures that the RA occasion indexes provided herein are also configured by prach-ConfigurationIndex and msg1-FDM. Each RACH occasion is sequentially numbered, first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot and Third, in increasing order of indexes for PRACH slots. |
| ***ra-PreambleIndex***The RA preamble index to use in the RA occasions associated with this CSI-RS. |

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| *CFRA* field descriptions |
| ***occasions***RA occasions for contention free random access. If the field is absent, the UE uses the RA occasions configured in *RACH-ConfigCommon* in the first active UL BWP. |
| ***ra-ssb-OccasionMaskIndex***Explicitly signalled PRACH Mask Index for RA Resource selection in TS 38.321 [3]. The mask is valid for all SSB resources signalled in *ssb-ResourceList*. |
| ***rach-ConfigGeneric***Configuration of contention free random access occasions for CFRA. The UE shall ignore *preambleReceivedTargetPower*, *preambleTransMax*, *powerRampingStep*, *ra-ResponseWindow* signaled within this field and use the corresponding values provided in *RACH-ConfigCommon*. |
| ***ssb-perRACH-Occasion***Number of SSBs per RACH occasion. |
| ***totalNumberOfRA-Preambles***Total number of preambles used for contention free random access in the RACH resources defined in CFRA, excluding preambles used for other purposes (e.g. for SI request). If the field is absent but the field *occasions* is present, the UE may assume all the 64 preambles are for RA. The setting should be consistent with the setting of *ssb-perRACH-Occasion*, if present, i.e. it should be a multiple of the number of SSBs per RACH occasion. |

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| *CFRA-SSB-Resource* field descriptions |
| ***msgA-PUSCH-Resource-Index***Identifies the index of the PUSCH resource used for MSGA CFRA. The PUSCH resource index indicates a valid PUSCH occasion (as specified in TS 38.213 [13], subclause 8.1A) and the associated DMRS resources corresponding to a PRACH slot. The PUSCH resource indexes are sequentially numbered and are mapped to valid PUSCH occasions corresponding to a PRACH slot which are ordered, first, in increasing order of frequency resource indexes for frequency multiplexed PUSCH occasions; second, in increasing order of DMRS resource indexes within a PUSCH occasion, where a DMRS resource index $DMRS\_{id}$ is determined first in an ascending order of a DMRS port index and then in an ascending order of a DMRS sequence index, third in increasing order of time resource indexes for time multiplexed PUSCH occasions within a PUSCH slot and fourth, in increasing order of indexes for PUSCH slots. For the case of contention free 2-step random access type, if this field is absent, the UE shall use the value 0. |
| ***ra-PreambleIndex***The preamble index that the UE shall use when performing CF-RA upon selecting the candidate beams identified by this SSB. |
| ***ssb***The ID of an SSB transmitted by this serving cell. |

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| *CFRA-TwoStep* field descriptions |
| ***msgA-CFRA-PUSCH***PUSCH resource configuration(s) for msgA CFRA. |
| ***msgA-TransMax***Max number of MsgA preamble transmissions performed before switching to 4-step type random access (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when 2-step and 4-step RA type are configured and switching to 4-step type RA is supported. If the field is absent in *RACH-ConfigDedidated*, switching from 2-step RA type to 4-step RA type is not allowed. |
| ***occasionsTwoStepRA***RA occasions for contention free random access. If the field is absent, the UE uses the RA occasions configured in *RACH-ConfigCommonTwoStepRA* in the first active UL BWP. |
| ***ra-SSB-OccasionMaskIndex***Explicitly signalled PRACH Mask Index for RA Resource selection in TS 38.321 [3]. The mask is valid for all SSB resources signalled in *ssb-ResourceList*. |
| ***rach-ConfigGenericTwoStepRA***Configuration of contention free random access occasions for CFRA 2-step random access type. |
| ***ssb-PerRACH-OccasionTwoStep***Number of SSBs per RACH occasion for 2-step random access type. |

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| *RACH-ConfigDedicated* field descriptions |
| ***cfra***Parameters for contention free random access to a given target cell. If this field and *cfra-TwoStep* are absent, the UE performs contention based random access. |
| ***cfra-TwoStep***Parameters for contention free 2-step random access type to a given target cell. Network ensures that *cfra* and *cfra-TwoStep* are not configured at the same time. If this field and *cfra* are absent, the UE performs contention based random access. This field may only be present if *msgA-ConfigCommon* is configured on the BWP. |
| ***ra-prioritization***Parameters which apply for prioritized random access procedure to a given target cell (see TS 38.321 [3], clause 5.1.1). |
| ***ra-PrioritizationTwoStep***Parameters which apply for prioritized 2-step random access type procedure to a given target cell (see TS 38.321 [3], clause 5.1.1). |

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| Conditional Presence | Explanation |
| *Mandatory* | The field is mandatory present. |
| *Occasions* | The field is optionally present, Need S, if the field *occasions* is present, otherwise it is absent. |
| *2StepCFRA* | The field is optionally present for the case of 2-step RA type contention free random access, Need S, otherwise it is absent. |

*END CHANGE*