**3GPP TSG-RAN WG2 Meeting #125 R2-2401772**

**Athens, Greece, Feb 26 – Mar 1, 2024**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **38.321** | **CR** | **1779** | **rev** | **1** | **Current version:** | **18.0.0** |  |
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| *For* [***HELP***](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:***  | Miscellaneous MAC corrections for CE |
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| ***Source to WG:*** | ZTE Corporation |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | NR\_cov\_enh2-Core |  | ***Date:*** | 2024-03-07 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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)* |
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| ***Reason for change:*** | 1. In current spec, if the CFRA with Msg1 repetition is triggered for RedCap UEs, upon RACH initialization, the UE will select the set of RACH resources which associated with only RedCap indication and Msg1 repetition with the same indicated repetition number. However, for Rel-18 eRedCap UE, similar handling is missing in MAC spec.

In RAN2#125, companies discussed and made below agreement: **=> No fallback from eRedCap to RedCap with Msg1 repetition for CFRA, once RRC indicates that eRedCap is applicable. TP in Annex A (R2-2401774) is be used as a baseline.**1. Current spec is unclear whether Msg1 repetition can be applicable to NTN network, if applicable, then when to start RAR window in this case is not captured in MAC spec.

In RAN2#125, companies discussed and made below agreements:* Msg1 repetition in NTN is supported
* For the Msg1 repetition specification for NTN in MAC, use the TP in R2-2400181 as a baseline.
1. Capture the below RAN2#125 agreement:
* If dpc-Reporting-FR1 is configured and any one of the DPC field is set to a value other than 0, DPCBC field indicates the ΔPPowerClass, CA/ΔPPowerClass, EN-DC/ΔPPowerClass, NR-DC
1. Merge the changes from R2-2400916:
2. For eCovEnh, dynamic waveform switching enhancement in R18 is only applicable to PUSCH channel. So, PCMAX,f,c for assumed PUSCH is supposed to be reported only along with Type 1 PH for a serving cell. However, in the current MAC spec, there is no such kind of limitation. It is not clear whether the UE can report Type 3 PH for a serving cell along with PCMAX,f,c for assumed PUSCH.
3. For Multiple Entry PHR with Assumed PUSCH MAC CE, the relationship between the Ci and Ei is not clear (e.g. it is not clear whether E1 can be set to 1 even if C1 is set to 0).
4. For RO selection in 5.1.2, the wording “the consecutive PRACH occasions” is not applicable to Msg1 repetition, which should be updated.
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| ***Summary of change:*** | 1. In case CFRA with Msg1 repetition is configured for eRedCap, to capture in section 5.1.1b that UE should select the RACH resource set if the RACH resource set is associated with only eRedCap and same Msg1 repetition number is available.
2. Confirm Msg1 repetition can be applicable to NTN network. According to TS 38.213, in section 5.1.4, to clarify the start of RAR window when Msg1 is transmitted with repetitions in NTN network.
3. To clarify in 6.1.3.9 that DPCBC field is applicable only if dpc-Reporting-FR1 is configured and at least one DPC field is present and set to a value other than 0.
4. Clarify in 6.1.3.79 that if Type 3 PH field is reported for the Serving Cell, PCMAX,f,c for assumed PUSCH of that Serving Cell is not present, and add descriptions for the octet bitmap for Ei and clarify the value setting for Ei.
5. Change “amongst the consecutive PRACH occasion” to “amongst sets of PRACH occasions” in 5.1.2.
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| ***Consequences if not approved:*** | 1. CFRA with Msg1 repetition is not supported for eRedCap UEs, more specifically, when eRedCap UE fallbacks from CFRA to CBRA, the UE cannot perform Msg1 repetition.
2. It is unclear whether Msg1 repetition can be supported in NTN network.
3. It is unclear how to set the DPCBC field if the DPC reporting criteria is not fulfilled for all serving cells.
4. It is unclear whether UE can report PCMAX,f,c for assumed PUSCH together with Type 3 PH, and the relationship between Ci and Ei is unclear.
5. RO selection is wrongly captured in MAC.
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| ***Clauses affected:*** | 5.1.1b, 5.1.2, 5.1.4, 6.1.3.9, 6.1.3.79 |
|  |  |
|  | **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:*** | Revision of R2-2401438 to capture RAN2#125 conclusions. |

*START OF CHANGES*

### 5.1.1b Selection of the set of Random Access resources for the Random Access procedure

The MAC entity shall:

1> if the BWP selected for Random Access procedure is configured with both set(s) of Random Access resources with *msg3-Repetitions* set to *true* and set(s) of Random Access resources without *msg3-Repetitions* set to *true* and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg3*; or

1> if the BWP selected for Random Access procedure is only configured with the set(s) of Random Access resources with *msg3-Repetitions* set to *true*:

2> assume Msg3 repetition is applicable for the current Random Access procedure.

1> else:

2> assume Msg3 repetition is not applicable for the current Random Access procedure.

1> if contention-free Random Access Resources have been provided for this Random Access procedure and a Msg1 repetition number is indicated in *rach-ConfigDedicated*:

2> assume Msg1 repetition is applicable and Msg1 repetition number applicable for the current Random Access procedure is the Msg1 repetition number indicated in *rach-ConfigDedicated*.

1> else if contention free Random Access Resources have not been provided for this Random Access procedure and the BWP selected for the Random Access procedure is configured with set(s) of Random Access resources with *msg1-Repetitions* set to *true* and set(s) of Random Access resources without *msg1-Repetitions* set to *true*:

2> if the BWP selected for the Random Access procedure is configured with set(s) of Random Access resources associated with Msg1 repetition number 8 and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum8*:

3> assume Msg1 repetition is applicable and Msg1 repetition number applicable for the current Random Access procedure includes 8.

2> if the BWP selected for the Random Access procedure is configured with set(s) of Random Access resources associated with Msg1 repetition number 4 and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum4*:

3> assume Msg1 repetition is applicable and Msg1 repetition number applicable for the current Random Access procedure includes 4.

2> if the BWP selected for the Random Access procedure is configured with set(s) of Random Access resources associated with Msg1 repetition number 2 and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum2*:

3> assume Msg1 repetition is applicable and Msg1 repetition number applicable for the current Random Access procedure includes 2.

2> else if the RSRP of the downlink pathloss reference is not less than any configured *rsrp-ThresholdMsg1-RepetitionNumX*:

3> assume Msg1 repetition is not applicable for the current Random Access procedure.

1> else ifthe BWP selected for Random Access procedure is configured only with Random Access resources with *msg1-Repetitions* set to *true*:

2> assume Msg1 repetition is applicable for the current Random Access procedure;

2> if at least one of *rsrp-ThresholdMsg1-RepetitionNumX* is configured:

3> if *rsrp-ThresholdMsg1-RepetitionNum8* is configured and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum8*;

4> assume Msg1 repetition number applicable for the current Random Access procedure includes 8.

3> if *rsrp-ThresholdMsg1-RepetitionNum4* is configured and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum4*:

4> assume Msg1 repetition number applicable for the current Random Access procedure includes 4.

3> if *rsrp-ThresholdMsg1-RepetitionNum2* is configured and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg1-RepetitionNum2*:

4> assume Msg1 repetition number applicable for the current Random Access procedure includes 2.

3> else if the RSRP of the downlink pathloss reference is not less than any configured *rsrp-ThresholdMsg1-RepetitionNumX*:

4> assume Msg1 repetition number applicable for the current Random Access procedure is the lowest Msg1 repetition number configured for this BWP.

2> else (none of *rsrp-ThresholdMsg1-RepetitionNumX* is configured):

3> assume Msg1 repetition number applicable for the current Random Access procedure is the Msg1 repetition number that configured for this BWP.

NOTE 1: Void.

1> if neither contention-free Random Access Resources nor Random Access Resources for SI request have been provided for this Random Access procedure and one or more of the features including (e)RedCap and/or Slicing and/or SDT and/or MSG3 repetition and/or MSG1 repetition is applicable for this Random Access procedure:

NOTE 2: The applicability of SDT is determined by MAC entity according to clause 5.27. The applicability of *NSAG-ID* is determined by upper layers when the Random Access procedure is initiated. The applicability of (e)RedCap is also determined by upper layers when Random Access procedure is initiated and it is applicable to the Random Access procedures initiated by PDCCH orders and any Random Access procedure initiated by the MAC entity.

NOTE 3: SDT is not applicable for the Random Access procedure initiated by upper layers for MT-SDT.

2> if none of the sets of Random Access resources are available for any feature applicable to the current Random Access procedure (as specified in clause 5.1.1c):

3> select the set(s) of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if there is one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure:

3> select this set of Random Access resources for this Random Access procedure.

2> else if there are more than one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure and Msg1 repetition is applicable for this Random Access procedure:

3> select the set of Random Access resources that associated with highest repetition number among the sets of Random Access resources.

2> else (i.e. there are one or more sets of Random Access resources available that are configured with indication(s) for a subset of all features triggering this Random Access procedure):

3> select a set of Random Access resources from the available set(s) of Random Access resources based on the priority order indicated by upper layers as specified in clause 5.1.1d for this Random Access Procedure.

1> else if contention-free Random Access Resources with Msg1 repetition have been provided for this Random Access procedure and Msg1 repetition number is indicated in *rach-ConfigDedicated*, and RedCap is applicable for the current Random Access procedure:

2> select the set of Random Access resources that is only configured with RedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

1> else if contention-free Random Access Resources with Msg1 repetition have been provided for this Random Access procedure and Msg1 repetition number is indicated in *rach-ConfigDedicated*, and eRedCap is applicable for the current Random Access procedure:

2> select the set of Random Access resources that is only configured with eRedCap indication and Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and RedCap is applicable for the current Random Access procedure and there is one set of Random Access resources available that is only configured with RedCap indication; or

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and eRedCap is applicable for the current Random Access procedure and there is one set of Random Access resources available that is only configured with eRedCap indication; or

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and eRedCap is applicable for the current Random Access procedure and there is no set of Random Access resources available that is only configured with eRedCap indication and there is one set of Random Access resources available that is only configured with RedCap indication:

2> select this set of Random Access resources for this Random Access procedure.

1> else:

2> if the Random Access procedure is initiated by PDCCH order with DCI *PRACH association indicator* field set to 1 and *SSB-MTC-AdditionalPCI* is configured by upper layers, as specified in clause 7.3.1.2.1 of TS 38.212 [9]:

3> select the set of Random Access resources corresponding to the active *additionalPCI*.

2> else if contention-free Random Access Resources with Msg1 repetition have been provided for this Random Access procedure, and Msg1 repetition number is indicated in *rach-ConfigDedicated*:

3> select the set of Random Access resources that is only configured with Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

2> else if the Random Access procedure was initiated for SI request and Random Access Resources associated with Msg1 repetition for SI request and Msg1 repetition number have been provided for this Random Access procedure:

3> select the set of Random Access resources that is only configured with Msg1 repetition indication and associated with the indicated Msg1 repetition number for this Random Access procedure.

2> else:

3> select the set of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for the current Random Access procedure.

### 5.1.2 Random Access Resource selection

If the selected *RA\_TYPE* is set to *4-stepRA*, the MAC entity shall:

1> if the Random Access procedure was initiated for SpCell beam failure recovery (as specified in clause 5.17); and

1> if the *beamFailureRecoveryTimer* (in clause 5.17) is either running or not configured; and

1> if the contention-free Random Access Resources for beam failure recovery request associated with any of the SSBs and/or CSI-RSs have been explicitly provided by RRC; and

1> if at least one of the SSBs with SS-RSRP above *rsrp-ThresholdSSB* amongst the SSBs in *candidateBeamRSList* or the CSI-RSs with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the CSI-RSs in *candidateBeamRSList* is available:

2> select an SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the SSBs in *candidateBeamRSList* or a CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the CSI-RSs in *candidateBeamRSList*;

2> if CSI-RS is selected, and there is no *ra-PreambleIndex* associated with the selected CSI-RS:

3> set the *PREAMBLE\_INDEX* to a *ra-PreambleIndex* corresponding to the SSB in *candidateBeamRSList* which is quasi-colocated with the selected CSI-RS as specified in TS 38.214 [7].

2> else:

3> set the *PREAMBLE\_INDEX* to a *ra-PreambleIndex* corresponding to the selected SSB or CSI-RS from the set of Random Access Preambles for beam failure recovery request.

1> else if the *ra-PreambleIndex* has been explicitly provided by PDCCH; and

1> if the *ra-PreambleIndex* is not 0b000000:

2> set the *PREAMBLE\_INDEX* to the signalled *ra-PreambleIndex*;

2> select the SSB signalled by PDCCH.

1> else if the *ra-PreambleIndex* has been explicitly provided by an LTM Cell Switch Command MAC CE:

2> set the *PREAMBLE\_INDEX* to the indicated *ra-PreambleIndex*;

2> select the SSB signalled by the LTM Cell Switch Command MAC CE.

1> else if the contention-free Random Access Resources associated with SSBs have been explicitly provided in *rach-ConfigDedicated* and at least one SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs is available:

2> select an SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs;

2> set the *PREAMBLE\_INDEX* to a *ra-PreambleIndex* corresponding to the selected SSB.

1> else if the contention-free Random Access Resources associated with CSI-RSs have been explicitly provided in *rach-ConfigDedicated* and at least one CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs is available:

2> select a CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs;

2> set the *PREAMBLE\_INDEX* to a *ra-PreambleIndex* corresponding to the selected CSI-RS.

1> else if the Random Access procedure was initiated for SI request (as specified in TS 38.331 [5]); and

1> if the Random Access Resources for SI request have been explicitly provided by RRC:

2> if at least one of the SSBs with SS-RSRP above *rsrp-ThresholdSSB* is available:

3> select an SSB with SS-RSRP above *rsrp-ThresholdSSB*.

2> else:

3> select any SSB.

2> select a Random Access Preamble corresponding to the selected SSB, from the Random Access Preamble(s) determined according to *ra-PreambleStartIndex* as specified in TS 38.331 [5];

2> set the *PREAMBLE\_INDEX* to selected Random Access Preamble.

1> else (i.e. for the contention-based Random Access preamble selection):

2> if at least one of the SSBs with SS-RSRP above *rsrp-ThresholdSSB* is available:

3> select an SSB with SS-RSRP above *rsrp-ThresholdSSB*.

2> else:

3> select any SSB.

2> if the *RA\_TYPE* is switched from *2-stepRA* to *4-stepRA*:

3> if a Random Access Preambles group was selected during the current Random Access procedure:

4> select the same group of Random Access Preambles as was selected for the 2-step RA type.

3> else:

4> if Random Access Preambles group B is configured; and

4> if the transport block size of the MSGA payload configured in the *rach-ConfigDedicated* corresponds to the transport block size of the MSGA payload associated with Random Access Preambles group B:

5> select the Random Access Preambles group B.

4> else:

5> select the Random Access Preambles group A.

2> else if Msg3 buffer is empty:

3> if Random Access Preambles group B is configured:

4> if the potential Msg3 size (UL data available for transmission plus MAC subheader(s) and, where required, MAC CEs) is greater than *ra-Msg3SizeGroupA* and the pathloss is less than *PCMAX* (of the Serving Cell performing the Random Access Procedure) – *preambleReceivedTargetPower* – *msg3-DeltaPreamble* – *messagePowerOffsetGroupB*; or

4> if the Random Access procedure was initiated for the CCCH logical channel and the CCCH SDU size plus MAC subheader is greater than *ra-Msg3SizeGroupA*:

5> select the Random Access Preambles group B.

4> else:

5> select the Random Access Preambles group A.

3> else:

4> select the Random Access Preambles group A.

2> else (i.e. Msg3 is being retransmitted):

3> select the same group of Random Access Preambles as was used for the Random Access Preamble transmission attempt corresponding to the first transmission of Msg3.

2> select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB and the selected Random Access Preambles group;

2> set the *PREAMBLE\_INDEX* to the selected Random Access Preamble.

1> if the Random Access procedure was initiated for SI request (as specified in TS 38.331 [5]); and

1> if *ra-AssociationPeriodIndex* and *si-RequestPeriod* are configured:

2> determine the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB in the association period given by *ra-AssociationPeriodIndex* in the *si-RequestPeriod* permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured (the MAC entity shall select a PRACH occasion randomly with equal probability amongst the consecutive PRACH occasions according to clause 8.1 of TS 38.213 [6] corresponding to the selected SSB).

1> else if an SSB is selected above:

2> if the set of Random Access resources associated with Msg1 repetition is selected for this Random Access procedure:

3> determine the next available set of PRACH occasions (as specified in TS 38.213 [6]) for the Msg1 repetition number applicable for this Random Access procedure corresponding to the selected SSB, permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or *ssb-SharedRO-MaskIndex* if configured (the MAC entity shall select a set of PRACH occasions randomly with equal probability amongst sets of PRACH occasions according to clause 8.1 of TS 38.213 [6] regardless the FR2 UL gap, corresponding to the selected SSB and selected Msg1 repetition number for this Random Access procedure; the MAC entity may take into account the possible occurrence of measurement gaps and MUSIM gaps when determining the next available set of PRACH occasions corresponding to the selected SSB).

2> else:

3> determine the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or *ssb-SharedRO-MaskIndex* if configured, or indicated by PDCCH, or indicated by the LTM Cell Switch Command MAC CE (the MAC entity shall select a PRACH occasion randomly with equal probability amongst the consecutive PRACH occasions according to clause 8.1 of TS 38.213 [6] regardless the FR2 UL gap, corresponding to the selected SSB; the MAC entity may take into account the possible occurrence of measurement gaps and MUSIM gaps when determining the next available PRACH occasion corresponding to the selected SSB).

1> else if a CSI-RS is selected above:

2> if there is no contention-free Random Access Resource associated with the selected CSI-RS:

3> determine the next available PRACH occasion from the PRACH occasions, permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, corresponding to the SSB in *candidateBeamRSList* which is quasi-colocated with the selected CSI-RS as specified in TS 38.214 [7] (the MAC entity shall select a PRACH occasion randomly with equal probability amongst the consecutive PRACH occasions according to clause 8.1 of TS 38.213 [6] regardless the FR2 UL gap, corresponding to the SSB which is quasi-colocated with the selected CSI-RS; the MAC entity may take into account the possible occurrence of measurement gaps and MUSIM gaps when determining the next available PRACH occasion corresponding to the SSB which is quasi-colocated with the selected CSI-RS).

2> else:

3> determine the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS (the MAC entity shall select a PRACH occasion randomly with equal probability amongst the PRACH occasions occurring simultaneously but on different subcarriers regardless the FR2 UL gap, corresponding to the selected CSI-RS; the MAC entity may take into account the possible occurrence of measurement gaps and MUSIM gaps when determining the next available PRACH occasion corresponding to the selected CSI-RS).

1> perform the Random Access Preamble transmission procedure (see clause 5.1.3).

NOTE 1: When the UE determines if there is an SSB with SS-RSRP above *rsrp-ThresholdSSB* or a CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS*, the UE uses the latest unfiltered L1-RSRP measurement.

NOTE 2: Void.

NOTE 3: If an (e)RedCap UE in RRC\_IDLE or RRC\_INACTIVE mode is configured with a BWP indicated by *initialDownlinkBWP-RedCap* which is not associated with any SSB, SS-RSRP measurement is performed based on the SSB associated with the BWP indicated by *initialDownlinkBWP*. If a RedCap UE in RRC\_INACTIVE mode is configured with SDT and with a BWP indicated by *initialDownlinkBWP-RedCap* which is associated with NCD-SSB, SS-RSRP measurement can also be performed based on this NCD-SSB during SDT.

NOTE 4: If an (e)RedCap UE in RRC\_IDLE or RRC\_INACTIVE mode is configured with a BWP indicated by *initialDownlinkBWP-RedCap* which is not associated with any SSB for RACH, it is up to the UE implementation to perform a new RSRP measurements before Msg1/MsgA retransmission.

*NEXT CHANGE*

### 5.1.4 Random Access Response reception

Once the Random Access Preamble is transmitted and regardless of the possible occurrence of a measurement gap, the MAC entity shall:

1> if the contention-free Random Access Preamble for beam failure recovery request was transmitted by the MAC entity:

2> if the contention-free Random Access Preamble for beam failure recovery request was transmitted on a non-terrestrial network:

3> start the *ra-ResponseWindow* configured in *BeamFailureRecoveryConfig* at the PDCCH occasion as specified in TS 38.213 [6].

2> else:

3> start the *ra-ResponseWindow* configured in *BeamFailureRecoveryConfig* at the first PDCCH occasion as specified in TS 38.213 [6] from the end of the Random Access Preamble transmission.

2> monitor for a PDCCH transmission on the search space indicated by *recoverySearchSpaceId* of the SpCell identified by the C-RNTI while *ra-ResponseWindow* is running.

1> else:

2> if the Random Access Preamble was transmitted on a non-terrestrial network:

3> if the Random Access Preamble is transmitted with repetitions:

4> start the *ra-ResponseWindow* configured in *RACH-ConfigCommon* at the PDCCH occasion from the end of all repetitions of the Random Access Preamble transmission as specified in TS 38.213 [6].

3> else:

4> start the *ra-ResponseWindow* configured in *RACH-ConfigCommon* at the PDCCH occasion as specified in TS 38.213 [6].

2> else if the Random Access Preamble is transmitted with repetitions:

3> start the *ra-ResponseWindow* configured in *RACH-ConfigCommon* at the first PDCCH occasion from the end of all repetitions of the Random Access Preamble transmission as specified in TS 38.213 [6].

2> else:

3> start the *ra-ResponseWindow* configured in *RACH-ConfigCommon* at the first PDCCH occasion as specified in TS 38.213 [6] from the end of the Random Access Preamble transmission.

2> monitor the PDCCH of the SpCell for Random Access Response(s) identified by the RA-RNTI while the *ra-ResponseWindow* is running.

1> if notification of a reception of a PDCCH transmission on the search space indicated by *recoverySearchSpaceId* is received from lower layers on the Serving Cell where the preamble was transmitted; and

1> if PDCCH transmission is addressed to the C-RNTI; and

1> if the contention-free Random Access Preamble for beam failure recovery request was transmitted by the MAC entity:

2> consider the Random Access procedure successfully completed.

1> else if a valid (as specified in TS 38.213 [6]) downlink assignment has been received on the PDCCH for the RA-RNTI and the received TB is successfully decoded:

2> if the Random Access Response contains a MAC subPDU with Backoff Indicator:

3> set the *PREAMBLE\_BACKOFF* to value of the BI field of the MAC subPDU using Table 7.2-1, multiplied with *SCALING\_FACTOR\_BI*.

2> else:

3> set the *PREAMBLE\_BACKOFF* to 0 ms.

2> if the Random Access Response contains a MAC subPDU with Random Access Preamble identifier corresponding to the transmitted *PREAMBLE\_INDEX* (see clause 5.1.3):

3> consider this Random Access Response reception successful.

2> if the Random Access Response reception is considered successful:

3> if the Random Access Response includes a MAC subPDU with RAPID only:

4> consider this Random Access procedure successfully completed;

4> indicate the reception of an acknowledgement for SI request to upper layers.

3> else:

4> apply the following actions for the Serving Cell where the Random Access Preamble was transmitted:

5> process the received Timing Advance Command (see clause 5.2);

5> indicate the *preambleReceivedTargetPower* and the amount of power ramping applied to the latest Random Access Preamble transmission to lower layers (i.e. (*PREAMBLE\_POWER\_RAMPING\_COUNTER* – 1) × *PREAMBLE\_POWER\_RAMPING\_STEP*);

5> if the Random Access procedure for an SCell is performed on uplink carrier where *pusch-Config* is not configured:

6> ignore the received UL grant.

5> else:

6> process the received UL grant value and indicate it to the lower layers.

4> if the Random Access Preamble was not selected by the MAC entity among the contention-based Random Access Preamble(s):

5> consider the Random Access procedure successfully completed.

4> else:

5> set the *TEMPORARY\_C-RNTI* to the value received in the Random Access Response;

5> if this is the first successfully received Random Access Response within this Random Access procedure:

6> if the transmission is not being made for the CCCH logical channel:

7> indicate to the Multiplexing and assembly entity to include a C-RNTI MAC CE in the subsequent uplink transmission.

6> if the Random Access procedure was initiated for SpCell beam failure recovery and *spCell-BFR-CBRA* with value *true* is configured:

7> if there is at least one Serving Cell of this MAC entity configured with two BFD-RS sets:

8> indicate to the Multiplexing and assembly entity to include an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE in the subsequent uplink transmission.

7> else:

8> indicate to the Multiplexing and assembly entity to include a BFR MAC CE or a Truncated BFR MAC CE in the subsequent uplink transmission.

6> else if the Random Access procedure was initiated for beam failure recovery of both BFD-RS sets of SpCell:

7> indicate to the Multiplexing and assembly entity to include an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE in the subsequent uplink transmission.

6> obtain the MAC PDU to transmit from the Multiplexing and assembly entity and store it in the Msg3 buffer.

NOTE 1: If within a Random Access procedure, an uplink grant provided in the Random Access Response for the same group of contention-based Random Access Preambles has a different size than the first uplink grant allocated during that Random Access procedure, the UE behavior is not defined.

1> if *ra-ResponseWindow* configured in *BeamFailureRecoveryConfig* expires and if a PDCCH transmission on the search space indicated by *recoverySearchSpaceId* addressed to the C-RNTI has not been received on the Serving Cell where the preamble was transmitted; or

1> if *ra-ResponseWindow* configured in *RACH-ConfigCommon* expires, and if the Random Access Response containing Random Access Preamble identifiers that matches the transmitted *PREAMBLE\_INDEX* has not been received:

2> consider the Random Access Response reception not successful;

2> increment *PREAMBLE\_TRANSMISSION\_COUNTER* by 1;

2> if *PREAMBLE\_TRANSMISSION\_COUNTER* = *preambleTransMax* + 1:

3> if the Random Access Preamble is transmitted on the SpCell:

4> indicate a Random Access problem to upper layers;

4> if this Random Access procedure was triggered for SI request:

5> consider the Random Access procedure unsuccessfully completed.

3> else if the Random Access Preamble is transmitted on an SCell:

4> consider the Random Access procedure unsuccessfully completed.

2> if the Random Access procedure is not completed:

3> if the Random Access Preamble is transmitted with repetitions and neither contention-free Random Access Resources nor Random Access resources for SI request have been provided for this Random Access procedure:

4> if *PREAMBLE\_TRANSMISSION\_COUNTER* = [*preambleTransMax-Msg1-Repetition*] + 1; or

4> if *PREAMBLE\_TRANSMISSION\_COUNTER* = 2 × [*preambleTransMax-Msg1-Repetition*] + 1:

5> if set of Random Access resources configured with the same *prach-ConfigurationIndex* and associated with a higher Msg1 repetition number with the same feature or feature combination as the current set of Random Access resources is available:

6> select the set of Random Access resources associated with the next higher Msg1 repetition number with the same feature or feature combination for this Random Access procedure;

6> initialize *startPreambleForThisPartition*, *numberOfPreamblesPerSSB-ForThisPartition*, *ssb-SharedRO-MaskIndex* and *numberOfRA-PreamblesGroupA* parameters for the Random Access procedure according to the values configured by RRC for the selected set of Random Access resources.

3> select a random backoff time according to a uniform distribution between 0 and the *PREAMBLE\_BACKOFF*;

3> if the criteria (as defined in clause 5.1.2) to select contention-free Random Access Resources is met during the backoff time:

4> perform the Random Access Resource selection procedure (see clause 5.1.2).

3> else if the Random Access procedure for an SCell is performed on uplink carrier where *pusch-Config* is not configured:

4> delay the subsequent Random Access transmission until the Random Access Procedure is triggered by a PDCCH order with the same *ra-PreambleIndex*, *ra-ssb-OccasionMaskIndex*, and UL/SUL indicator TS 38.212 [9].

3> else:

4> perform the Random Access Resource selection procedure (see clause 5.1.2) after the backoff time.

The MAC entity may stop *ra-ResponseWindow* (and hence monitoring for Random Access Response(s)) after successful reception of a Random Access Response containing Random Access Preamble identifiers that matches the transmitted *PREAMBLE\_INDEX*.

HARQ operation is not applicable to the Random Access Response reception.

NOTE 2: For the case that RAR PDSCH bandwidth is larger than the bandwidth the eRedCap UE can receive or process per slot, and the UL grant in RAR indicates that the time is not enough for Msg3 transmission, as specified in TS 38.213 [6], it is up to UE implementation, e.g. either to consider the Random Access Response reception not successful, or transmit Msg3.

*NEXT CHANGE*

### 6.1.3 MAC Control Elements (CEs)

#### 6.1.3.9 Multiple Entry PHR MAC CE

The Multiple Entry PHR MAC CE is identified by a MAC subheader with LCID as specified in Table 6.2.1-2.

It has a variable size, and includes the bitmap, a Type 2 PH field and an octet containing the associated PCMAX,f,c field (if reported) for SpCell of the other MAC entity, a Type 1 PH field and an octet containing the associated PCMAX,f,c field (if reported) for the PCell. It further includes, in ascending order based on the *ServCellIndex*, one or multiple of Type X PH fields and octets containing the associated PCMAX,f,c fields (if reported) for Serving Cells other than PCell indicated in the bitmap. X is either 1 or 3 according to TS 38.213 [6] and TS 36.213 [17].

The presence of Type 2 PH field for SpCell of the other MAC entity is configured by *phr-Type2OtherCell* with value *true*.

A single octet bitmap is used for indicating the presence of PH per Serving Cell when the highest *ServCellIndex* of Serving Cell with configured uplink is less than 8, otherwise four octets are used.

The MAC entity determines whether PH value for an activated Serving Cell is based on real transmission or a reference format by considering the configured grant(s) and downlink control information which has been received until and including the PDCCH occasion in which the first UL grant for a new transmission that can accommodate the MAC CE for PHR as a result of LCP as defined in clause 5.4.3.1 is received since a PHR has been triggered if the PHR MAC CE is reported on an uplink grant received on the PDCCH or until the first uplink symbol of PUSCH transmission minus PUSCH preparation time as defined in clause 7.7 of TS 38.213 [6] if the PHR MAC CE is reported on a configured grant.

For a band combination in which the UE does not support dynamic power sharing, the UE may omit the octets containing Power Headroom field and PCMAX,f,c field for Serving Cells in the other MAC entity except for the PCell in the other MAC entity and the reported values of Power Headroom and PCMAX,f,c for the PCell are up to UE implementation.

The PHR MAC CEs are defined as follows:

- Ci: This field indicates the presence of a PH field for the Serving Cell with *ServCellIndex* i as specified in TS 38.331 [5]. The Ci field set to 1 indicates that a PH field for the Serving Cell with *ServCellIndex* i is reported. The Ci field set to 0 indicates that a PH field for the Serving Cell with *ServCellIndex* i is not reported;

- R: Reserved bit, set to 0;

- DPCBC: If *dpc-Reporting-FR1* is configured and at least one DPC field is not set to 0, this field indicates the ΔPPowerClass, CA/ΔPPowerClass, EN-DC/ΔPPowerClass, NR-DC, as specified in TS 38.101-1[14] and TS 38.101-3 [16], this field set to 0 indicates the delta power class for band combination is 0 dB, this field set to 1 indicates the delta power class for band combination is same or larger than 3 dB. Otherwise, R bit is present, set to 0;

- V: This field indicates if the PH value is based on a real transmission or a reference format. For Type 1 PH, the V field set to 0 indicates real transmission on PUSCH and the V field set to 1 indicates that a PUSCH reference format is used. For Type 2 PH, the V field set to 0 indicates real transmission on PUCCH and the V field set to 1 indicates that a PUCCH reference format is used. For Type 3 PH, the V field set to 0 indicates real transmission on SRS and the V field set to 1 indicates that an SRS reference format is used. Furthermore, for Type 1, Type 2, and Type 3 PH, the V field set to 0 indicates the presence of the octet containing the associated PCMAX,f,c field and the MPE or DPC field, and the V field set to 1 indicates that the octet containing the associated PCMAX,f,c field and the MPE or DPC field is omitted;

- Power Headroom (PH): This field indicates the power headroom level. The length of the field is 6 bits. The reported PH and the corresponding power headroom levels are shown in Table 6.1.3.8-1 (the corresponding measured values in dB for the NR Serving Cell are specified in TS 38.133 [11] while the corresponding measured values in dB for the E-UTRA Serving Cell are specified in TS 36.133 [12]);

- P: If *mpe-Reporting-FR2* is configured and the Serving Cell operates on FR2, the MAC entity shall set this field to 0 if the applied P-MPR value, to meet MPE requirements, as specified in TS 38.101-2 [15], is less than P-MPR\_00 as specified in TS 38.133 [11] and to 1 otherwise. If *mpe-Reporting-FR2* is not configured or the Serving Cell operates on FR1, this field indicates whether power backoff is applied due to power management (as allowed by P-MPRc as specified in TS 38.101-1 [14], TS 38.101-2 [15], and TS 38.101-3 [16]). The MAC entity shall set the P field to 1 if the corresponding PCMAX,f,c field would have had a different value if no power backoff due to power management had been applied;

- PCMAX,f,c: If present, this field indicates the PCMAX,f,c (as specified in TS 38.213 [6]) for the NR Serving Cell and the PCMAX,c or P̃CMAX,c (as specified in TS 36.213 [17]) for the E-UTRA Serving Cell used for calculation of the preceding PH field. The reported PCMAX,f,c and the corresponding nominal UE transmit power levels are shown in Table 6.1.3.8-2 (the corresponding measured values in dBm for the NR Serving Cell are specified in TS 38.133 [11] while the corresponding measured values in dBm for the E-UTRA Serving Cell are specified in TS 36.133 [12]);

- MPE: If *mpe-Reporting-FR2* is configured, and the Serving Cell operates on FR2, and if the P field is set to 1, this field indicates the applied power backoff to meet MPE requirements, as specified in TS 38.101-2 [15]. This field indicates an index to Table 6.1.3.8-3 and the corresponding measured values of P-MPR levels in dB are specified in TS 38.133 [11]. The length of the field is 2 bits. If *mpe-Reporting-FR2* is not configured, or if the Serving Cell operates on FR1, or if the P field is set to 0, R bits or DPC is present instead.

- DPC: If *dpc-Reporting-FR1* is configured, and the Serving Cell operates on FR1, this field indicates the ΔPPowerClass, as specified in TS 38.101-1[14] and TS 38.101-3 [16]. This field indicates an index to Table 6.1.3.8-4 and the corresponding measured values of DPC levels in dB are specified in TS 38.133 [11], the DPC field is set to 0 if the criteria to report DPC is not met. The length of the field is 2 bits. If the Serving Cell operates on FR2, R bits or MPE is present instead.



Figure 6.1.3.9-1: Multiple Entry PHR MAC CE with the highest *ServCellIndex* of Serving Cell with configured uplink is less than 8



Figure 6.1.3.9-2: Multiple Entry PHR MAC CE with the highest ServCellIndex of Serving Cell with configured uplink is equal to or higher than 8

*NEXT CHANGE*

#### 6.1.3.79 Multiple Entry PHR with assumed PUSCH MAC CE

The Multiple Entry PHR with assumed PUSCH MAC CE is identified by a MAC subheader with eLCID as specified in Table 6.2.1-2.

It has a variable size, and includes the bitmap, a Type 2 PH field , an octet containing the associated PCMAX,f,c field (if reported) and an octet containing the associated PCMAX,f,c field for assumed PUSCH (if reported) for SpCell of the other MAC entity; a Type 1 PH field, an octet containing the associated PCMAX,f,c field (if reported) and an octet containing the associated PCMAX,f,c field for assumed PUSCH (if reported) for the PCell. It further includes, in ascending order based on the *ServCellIndex*, one or multiple of Type X PH fields, octets containing the associated PCMAX,f,c fields (if reported) and octets containing the associated PCMAX,f,c fields for assumed PUSCH (if reported) for Serving Cells other than PCell indicated in the bitmap. X is either 1 or 3 according to TS 38.213 [6] and TS 36.213 [17].

The presence of Type 2 PH field for SpCell of the other MAC entity is configured by *phr-Type2OtherCell* with value *true*.

A single octet bitmap is used for indicating the presence of PH per Serving Cell when the highest *ServCellIndex* of Serving Cell with configured uplink is less than 8, otherwise four octets are used.

Another single octet bitmap is used for indicating the presence of associated PCMAX,f,c fields for assumed PUSCH per Serving Cell when the highest *ServCellIndex* of Serving Cell with configured uplink is less than 8, otherwise four octets are used.

The MAC entity determines whether PH value for an activated Serving Cell is based on real transmission or a reference format by considering the configured grant(s) and downlink control information which has been received until and including the PDCCH occasion in which the first UL grant for a new transmission that can accommodate the MAC CE for PHR as a result of LCP as defined in clause 5.4.3.1 is received since a PHR has been triggered if the PHR MAC CE is reported on an uplink grant received on the PDCCH or until the first uplink symbol of PUSCH transmission minus PUSCH preparation time as defined in clause 7.7 of TS 38.213 [6] if the PHR MAC CE is reported on a configured grant.

For a band combination in which the UE does not support dynamic power sharing, the UE may omit the octets containing Power Headroom field and PCMAX,f,c field for Serving Cells in the other MAC entity except for the PCell in the other MAC entity and the reported values of Power Headroom and PCMAX,f,c for the PCell are up to UE implementation.

The PHR MAC CEs are defined as follows:

- Ci: This field indicates the presence of a PH field for the Serving Cell with *ServCellIndex* i as specified in TS 38.331 [5]. The Ci field set to 1 indicates that a PH field for the Serving Cell with *ServCellIndex* i is reported. The Ci field set to 0 indicates that a PH field for the Serving Cell with *ServCellIndex* i is not reported;

- Ei: This field indicates the presence of a PCMAX,f,c for assumed PUSCH field for the Serving Cell with *ServCellIndex* i as specified in TS 38.331 [5]. The Ei field set to 1 indicates that a PCMAX,f,c for assumed PUSCH field for the Serving Cell with *ServCellIndex* i is reported when the Ci field is set to 1. The Ei field set to 0 indicates that a PCMAX,f,c for assumed PUSCH field for the Serving Cell with *ServCellIndex* i is not reported. For the E-UTRA Serving Cell, the corresponding Ei field is set to 0. The Ei field is set to 0 if Type 3 PH field is reported for the Serving Cell with *ServCellIndex* i;

- R: Reserved bit, set to 0;

- V: This field indicates if the PH value is based on a real transmission or a reference format. For Type 1 PH, the V field set to 0 indicates real transmission on PUSCH and the V field set to 1 indicates that a PUSCH reference format is used. For Type 2 PH, the V field set to 0 indicates real transmission on PUCCH and the V field set to 1 indicates that a PUCCH reference format is used. For Type 3 PH, the V field set to 0 indicates real transmission on SRS and the V field set to 1 indicates that an SRS reference format is used. Furthermore, for Type 1, Type 2, and Type 3 PH, the V field set to 0 indicates the presence of the octet containing the associated PCMAX,f,c field and the MPE field, and the V field set to 1 indicates that the octet containing the associated PCMAX,f,c field and the MPE field is omitted;

- Power Headroom (PH): This field indicates the power headroom level. The length of the field is 6 bits. The reported PH and the corresponding power headroom levels are shown in Table 6.1.3.8-1 (the corresponding measured values in dB for the NR Serving Cell are specified in TS 38.133 [11] while the corresponding measured values in dB for the E-UTRA Serving Cell are specified in TS 36.133 [12]);

- P: If *mpe-Reporting-FR2* is configured and the Serving Cell operates on FR2, the MAC entity shall set this field to 0 if the applied P-MPR value, to meet MPE requirements, as specified in TS 38.101-2 [15], is less than P-MPR\_00 as specified in TS 38.133 [11] and to 1 otherwise. If *mpe-Reporting-FR2* is not configured or the Serving Cell operates on FR1, this field indicates whether power backoff is applied due to power management (as allowed by P-MPRc as specified in TS 38.101-1 [14], TS 38.101-2 [15], and TS 38.101-3 [16]). The MAC entity shall set the P field to 1 if the corresponding PCMAX,f,c field would have had a different value if no power backoff due to power management had been applied;

- PCMAX,f,c: If present, this field indicates the PCMAX,f,c (as specified in TS 38.213 [6]) for the NR Serving Cell and the PCMAX,c or P̃CMAX,c (as specified in TS 36.213 [17]) for the E-UTRA Serving Cell used for calculation of the preceding PH field. The reported PCMAX,f,c and the corresponding nominal UE transmit power levels are shown in Table 6.1.3.8-2 (the corresponding measured values in dBm for the NR Serving Cell are specified in TS 38.133 [11] while the corresponding measured values in dBm for the E-UTRA Serving Cell are specified in TS 36.133 [12]);

- PCMAX,f,c for assumed PUSCH: If present, this field indicates the PCMAX,f,c for assumed PUSCH(as specified in TS 38.213 [6]) for the NR Serving Cell. The reported PCMAX,f,c and the corresponding nominal UE transmit power levels are shown in [Table 6.1.3.8-2] (the corresponding measured values in dBm for the NR Serving Cell are specified in TS 38.133 [11];

- MPE: If *mpe-Reporting-FR2* is configured, and the Serving Cell operates on FR2, and if the P field is set to 1, this field indicates the applied power backoff to meet MPE requirements, as specified in TS 38.101-2 [15]. This field indicates an index to Table 6.1.3.8-3 and the corresponding measured values of P-MPR levels in dB are specified in TS 38.133 [11]. The length of the field is 2 bits. If *mpe-Reporting-FR2* is not configured, or if the Serving Cell operates on FR1, or if the P field is set to 0, R bits are present instead.



Figure 6.1.3.79-1: Multiple Entry PHR with assumed PUSCH MAC CE with the highest *ServCellIndex* of Serving Cell with configured uplink is less than 8



Figure 6.1.3.79-2: Multiple Entry PHR with assumed PUSCH MAC CE with the highest ServCellIndex of Serving Cell with configured uplink is equal to or higher than 8