**3GPP TSG-RAN WG2 Meeting #119bis electronic R2-22xxxxx**

**E-Meeting, 10th – 19th Oct., 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **CR** | **1418** | **rev** | **1** | **Current version:** | **17.2.0** |  |
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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 on feMIMO |
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| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_feMIMO-Core |  | ***Date:*** | 2022-09-30 |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** | Rel-17 |
|  | *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:*** | The changes included in this CR aim to correct the functional corrections and minor errors in the specification.1. In LS from RAN1 (R2-2209151), RAN1 provides the agreement that UE does not expect CORESET#0 to be activated with two TCI states when it is associated with SS#0 for Type 0/0A/2 CSS.
2. For suppoting the unified TCI state for SRS resources, *unifiedTCI-StateType-r17,* if this element indicating as joint, the TCI state is configured within the DL BWP, otherwise, the TCI state is configured within the UL BWP. However, only UL BWP is indicated by such field.
3. “*mpe-ResourcePool*” is listed in PHR procedure text. However, “*mpe-ResourcePool*” has been changed to “*mpe-ResourcePoolToAddModList*”.
4. In some use cases of 5.4.4, need to further clarify that the term “BFD-RS set” corresponds to any BFD-RS set of mTRP.
5. In 5.17, the description about *candidateBeamRSList* about BFD-ST set specific lists is rather unclear and can be clarified for better readability.
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| ***Summary of change:*** | This CR includes the following change:1. In 6.1.3.44, add a note to clarify that the Enhanced TCI State Indication for UE specific PDCCH MAC CE is not applicable to the CORESET configured by *controlResourceSetZero* if the CORESET is associated with the search space configured by *searchSpaceZero* for Type0/0A/2-PDCCH CSS.
2. Clarify the BWP type in the field description of the TCI State BWP IDi:

If value of *unifiedTCI-StateType* in the serving cell indicated by TCI State Serving Cell IDi is joint, this field indicates a DL BWP. If value of *unifiedTCI-StageType* in the serving cell indicated by TCI State Serving Cell IDi is *separate*, this field indicates a UL BWP.1. Replace “*mpe-ResourcePool”* to *“mpe-ResourcePoolToAddModList”* in clause 5.4.6 Power Headroom Reporting.
2. Change the term “to beam failure recovery of BFD-RS set(s)” into “to beam failure recovery of a BFD-RS set” in 5.4.4.Change the term “BFD-RS set” into “a BFD-RS set” in some use cases of 5.4.4.
3. In 5.17, define the *candidateBeamRSList* for BFD-RS set as “list of candidate beams for beam failure recovery of a Serving Cell for BFR-RS set one/two”.
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| ***Consequences if not approved:*** | Miscellaneous errors will remain in the specification. |
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| ***Clauses affected:*** | 5.4.4, 5.4.6, 5.17, 6.1.3.44, 6.1.3.59 |
|  |  |
|  | **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:*** |  |

START OF CHANGE

### 5.4.4 Scheduling Request

The Scheduling Request (SR) is used for requesting UL-SCH resources for new transmission.

The MAC entity may be configured with zero, one, or more SR configurations. An SR configuration consists of a set of PUCCH resources for SR across different BWPs and cells. For a logical channel or for SCell beam failure recovery (see clause 5.17) and for consistent LBT failure recovery (see clause 5.21), at most one PUCCH resource for SR is configured per BWP. For a logical channel serving a radio bearer configured with SDT, PUCCH resource for SR is not configured for SDT. For beam failure recovery of BFD-RS set(s) of Serving Cell, up to two PUCCH resources for SR is configured per BWP. For positioning measurement gap activation/deactivation request, a dedicated SR configuration is configured.

Each SR configuration corresponds to one or more logical channels and/or to SCell beam failure recovery and/or to consistent LBT failure recovery and/or to beam failure recovery of a BFD-RS set and/or to positioning measurement gap activation/deactivation request. Each logical channel, SCell beam failure recovery, beam failure recovery of a BFD-RS set and consistent LBT failure recovery, may be mapped to zero or one SR configuration, which is configured by RRC. The SR configuration of the logical channel that triggered a BSR (clause 5.4.5) or the SCell beam failure recovery or the beam failure recovery of a BFD-RS set or the consistent LBT failure recovery (clause 5.21) (if such a configuration exists) or positioning measurement gap activation/deactivation request (clause 5.25) is considered as corresponding SR configuration for the triggered SR. Any SR configuration may be used for an SR triggered by Pre-emptive BSR (clause 5.4.7) or Timing Advance reporting (clause 5.4.8).

RRC configures the following parameters for the scheduling request procedure:

- *sr-ProhibitTimer* (per SR configuration);

- *sr-TransMax* (per SR configuration).

The following UE variables are used for the scheduling request procedure:

- *SR\_COUNTER* (per SR configuration).

If an SR is triggered and there are no other SRs pending corresponding to the same SR configuration, the MAC entity shall set the *SR\_COUNTER* of the corresponding SR configuration to 0.

When an SR is triggered, it shall be considered as pending until it is cancelled.

All pending SR(s) for BSR triggered according to the BSR procedure (clause 5.4.5) prior to the MAC PDU assembly shall be cancelled and each respective *sr-ProhibitTimer* shall be stopped when the MAC PDU is transmitted and this PDU includes a Long or Short BSR MAC CE which contains buffer status up to (and including) the last event that triggered a BSR (see clause 5.4.5) prior to the MAC PDU assembly. All pending SR(s) for BSR triggered according to the BSR procedure (clause 5.4.5) shall be cancelled and each respective *sr-ProhibitTimer* shall be stopped when the UL grant(s) can accommodate all pending data available for transmission.

The MAC entity shall for each pending SR not triggered according to the BSR procedure (clause 5.4.5) for a Serving Cell:

1> if this SR was triggered by Pre-emptive BSR procedure (see clause 5.4.7) prior to the MAC PDU assembly and a MAC PDU containing the relevant Pre-emptive BSR MAC CE is transmitted; or

1> if this SR was triggered by beam failure recovery (see clause 5.17) of an SCell and a MAC PDU is transmitted and this PDU includes a MAC CE for BFR which contains beam failure recovery information for this SCell; or

1> if this SR was triggered by beam failure recovery (see clause 5.17) for a BFD-RS set of a Serving Cell and a MAC PDU is transmitted and this PDU includes an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE which contains beam failure recovery information for this BFD-RS set of the Serving Cell; or

1> if this SR was triggered by beam failure recovery (see clause 5.17) of an SCell and this SCell is deactivated (see clause 5.9); or

1> if this SR was triggered by beam failure recovery (see clause 5.17) for a BFD-RS set of an SCell and this SCell is deactivated (see clause 5.9); or

1> if the SR is triggered by positioning measurement gap activation/deactivation request (see clause 5.25) and the Positioning Measurement Gap Activation/Deactivation Request MAC CE that triggers the SR has already been cancelled; or

1> if this SR was triggered by consistent LBT failure recovery (see clause 5.21) of an SCell and a MAC PDU is transmitted and the MAC PDU includes an LBT failure MAC CE that indicates consistent LBT failure for this SCell; or

1> if this SR was triggered by consistent LBT failure recovery (see clause 5.21) of an SCell and all the triggered consistent LBT failure(s) for this SCell are cancelled:

2> cancel the pending SR and stop the corresponding *sr-ProhibitTimer*, if running.

Only PUCCH resources on a BWP which is active at the time of SR transmission occasion are considered valid.

As long as at least one SR is pending, the MAC entity shall for each pending SR:

1> if the MAC entity has no valid PUCCH resource configured for the pending SR:

2> initiate a Random Access procedure (see clause 5.1) on the SpCell and cancel the pending SR.

1> else, for the SR configuration corresponding to the pending SR:

2> when the MAC entity has an SR transmission occasion on the valid PUCCH resource for SR configured; and

2> if *sr-ProhibitTimer* is not running at the time of the SR transmission occasion; and

2> if the PUCCH resource for the SR transmission occasion does not overlap with a measurement gap:

3> if the PUCCH resource for the SR transmission occasion overlaps with neither a UL-SCH resource whose simultaneous transmission with the SR is not allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups* nor an SL-SCH resource; or

3> if the MAC entity is able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource; or

3> if the MAC entity is configured with *lch-basedPrioritization*, and the PUCCH resource for the SR transmission occasion does not overlap with the PUSCH duration of an uplink grant received in a Random Access Response or with the PUSCH duration of an uplink grant addressed to Temporary C-RNTI or with the PUSCH duration of a MSGA payload, and the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.4.5 overlaps with any other UL-SCH resource(s), and the physical layer can signal the SR on one valid PUCCH resource for SR, and the priority of the logical channel that triggered SR is higher than the priority of the uplink grant(s) for any UL-SCH resource(s) where the uplink grant was not already de-prioritized and its simultaneous transmission with the SR is not allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCHgroups*, and the priority of the uplink grant is determined as specified in clause 5.4.1; or

3> if both *sl-PrioritizationThres* and *ul-PrioritizationThres* are configured and the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.22.1.5 overlaps with any UL-SCH resource(s) carrying a MAC PDU, and the value of the priority of the triggered SR determined as specified in clause 5.22.1.5 is lower than *sl-PrioritizationThres* and the value of the highest priority of the logical channel(s) in the MAC PDU is higher than or equal to *ul-PrioritizationThres* and any MAC CE prioritized as described in clause 5.4.3.1.3 is not included in the MAC PDU and the MAC PDU is not prioritized by upper layer according to TS 23.287 [19]; or

3> if an SL-SCH resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.4.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource, and either transmission on the SL-SCH resource is not prioritized as described in clause 5.22.1.3.1a or the priority value of the logical channel that triggered SR is lower than *ul-PrioritizationThres*, if configured; or

3> if an SL-SCH resource overlaps with the PUCCH resource for the SR transmission occasion for the pending SR triggered as specified in clause 5.22.1.5, and the MAC entity is not able to perform this SR transmission simultaneously with the transmission of the SL-SCH resource, and the priority of the triggered SR determined as specified in clause 5.22.1.5 is higher than the priority of the MAC PDU determined as specified in clause 5.22.1.3.1a for the SL-SCH resource:

4> consider the SR transmission as a prioritized SR transmission.

4> consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s), except for the overlapping uplink grant(s) whose simultaneous transmission is allowed by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup* or *simultaneousSR-PUSCH-diffPUCCH-Groups*;

4> if the de-prioritized uplink grant(s) is a configured uplink grant configured with *autonomousTx* whose PUSCH has already started:

5> stop the *configuredGrantTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s);

5> stop the *cg-RetransmissionTimer* for the corresponding HARQ process of the de-prioritized uplink grant(s).

4> if *SR\_COUNTER* < *sr-TransMax*:

5> instruct the physical layer to signal the SR on one valid PUCCH resource for SR;

5> if LBT failure indication is not received from lower layers:

6> increment *SR\_COUNTER* by 1;

6> start the *sr-ProhibitTimer*.

5> else if *lbt-FailureRecoveryConfig* is not configured:

6> increment *SR\_COUNTER* by 1.

4> else:

5> notify RRC to release PUCCH for all Serving Cells;

5> notify RRC to release SRS for all Serving Cells;

5> clear any configured downlink assignments and uplink grants;

5> clear any PUSCH resources for semi-persistent CSI reporting;

5> initiate a Random Access procedure (see clause 5.1) on the SpCell and cancel all pending SRs.

3> else:

4> consider the SR transmission as a de-prioritized SR transmission.

NOTE 1: Except for SR for SCell beam failure recovery, the selection of which valid PUCCH resource for SR to signal SR on when the MAC entity has more than one overlapping valid PUCCH resource for the SR transmission occasion is left to UE implementation.

NOTE 2: If more than one individual SR triggers an instruction from the MAC entity to the PHY layer to signal the SR on the same valid PUCCH resource, the *SR\_COUNTER* for the relevant SR configuration is incremented only once.

NOTE 3: When the MAC entity has pending SR for SCell beam failure recovery and the MAC entity has one or more PUCCH resources (other than PUCCH resources of pending SR for beam failure recovery of a BFD-RS set) overlapping with PUCCH resource for SCell beam failure recovery for the SR transmission occasion, the MAC entity considers only the PUCCH resource for SCell beam failure recovery as valid. When the MAC entity has pending SR for beam failure recovery of a BFD-RS set of Serving Cell and the MAC entity has one or more PUCCH resources (other than PUCCH resources of pending SR for beam failure recovery) overlapping with PUCCH resource for beam failure recovery of that BFD-RS set for the SR transmission occasion, the MAC entity considers only the PUCCH resource for beam failure recovery of that BFD-RS set as valid.

NOTE 4: For a UE operating in a semi-static channel access mode as described in TS 37.213 [18], PUCCH resources overlapping with the set of consecutive symbols where the UE does not transmit before the start of a next channel occupancy time are not considered valid.

NOTE 5: If the MAC entity is configured with *lch-basedPrioritization*, the MAC entity does not take UCI multiplexing according to the procedure specified in TS 38.213 [6] into account when determining whether the valid PUCCH resource for the SR transmission can be signalled by the physical layer and the SR transmission occasion overlaps with the PUSCH duration of an uplink grant of a MSGA payload.

NOTE 6: When the MAC entity has PUCCH resource for pending SR for SCell beam failure recovery overlapping with PUCCH resource for pending SR for beam failure recovery of a BFD-RS set for the SR transmission occasion, it's up to UE implementation to select PUCCH resource for SCell beam failure recovery or PUCCH resource for beam failure recovery of a BFD-RS set

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for BSR, which was initiated by the MAC entity prior to the MAC PDU assembly and which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes a BSR MAC CE which contains buffer status up to (and including) the last event that triggered a BSR (see clause 5.4.5) prior to the MAC PDU assembly; or

- the UL grant(s) can accommodate all pending data available for transmission.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for SL-BSR and/or SL-CSI reporting, which was initiated by the MAC entity prior to the sidelink MAC PDU assembly and which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes an SL-BSR MAC CE which contains buffer status up to (and including) the last event that triggered an SL-BSR (see clause 5.22.1.6) prior to the MAC PDU assembly; or

- the SL grant(s) can accommodate all pending data available and/or SL-CSI reporting MAC CE for transmission.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for BFR of an SCell, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU contains a MAC CE for BFR which includes beam failure recovery information of that SCell; or

- the SCell is deactivated (as specified in clause 5.9) and all triggered BFRs for SCells are cancelled.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for BFR of a BFD-RS set of a Serving Cell, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU contains an Enhanced BFR MAC CE or a Truncated Enhanced BFR MAC CE which includes beam failure recovery information of that BFD-RS set of the Serving Cell.

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for consistent LBT failure recovery, which has no valid PUCCH resources configured, if:

- a MAC PDU is transmitted using a UL grant other than a UL grant provided by Random Access Response or a UL grant determined as specified in clause 5.1.2a for the transmission of the MSGA payload, and this PDU includes an LBT failure MAC CE that indicates consistent LBT failure for all the SCells that triggered consistent LBT failure; or

- all the SCells that triggered consistent LBT failure recovery are deactivated (see clause 5.9).

The MAC entity may stop, if any, ongoing Random Access procedure due to a pending SR for positioning measurement gap activation/deactivation request, which has no valid PUCCH resources configured, if:

- the Positioning Measurement Gap Activation/Deactivation Request MAC CE that triggers the SR corresponding to the Random Access procedure has already been cancelled.

NEXT CHANGE

### 5.4.6 Power Headroom Reporting

The Power Headroom reporting procedure is used to provide the serving gNB with the following information:

- Type 1 power headroom: the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH transmission per activated Serving Cell;

- Type 2 power headroom: the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH and PUCCH transmission on SpCell of the other MAC entity (i.e. E-UTRA MAC entity in EN-DC, NE-DC, and NGEN-DC cases);

- Type 3 power headroom: the difference between the nominal UE maximum transmit power and the estimated power for SRS transmission per activated Serving Cell;

- MPE P-MPR: the power backoff to meet the MPE FR2 requirements for a Serving Cell operating on FR2.

RRC controls Power Headroom reporting by configuring the following parameters:

- *phr-PeriodicTimer*;

- *phr-ProhibitTimer*;

- *phr-Tx-PowerFactorChange*;

- *phr-Type2OtherCell*;

- *phr-ModeOtherCG*;

- *multiplePHR*;

- *mpe-Reporting-FR2*;

- *mpe-ProhibitTimer*;

- *mpe-Threshold*;

- *numberOfN*;

- *mpe-ResourcePoolToAddModList* ;

- *twoPHRMode*.

A Power Headroom Report (PHR) shall be triggered if any of the following events occur:

- *phr-ProhibitTimer* expires or has expired and the path loss has changed more than *phr-Tx-PowerFactorChange* dB for at least one RS used as pathloss reference for one activated Serving Cell of any MAC entity of which the active DL BWP is not dormant BWP since the last transmission of a PHR in this MAC entity when the MAC entity has UL resources for new transmission;

NOTE 1: The path loss variation for one cell assessed above is between the pathloss measured at present time on the current pathloss reference and the pathloss measured at the transmission time of the last transmission of PHR on the pathloss reference in use at that time, irrespective of whether the pathloss reference has changed in between. The current pathloss reference for this purpose does not include any pathloss reference configured using *pathlossReferenceRS-Pos* in TS 38.331 [5].

- *phr-PeriodicTimer* expires;

- upon configuration or reconfiguration of the power headroom reporting functionality by upper layers, which is not used to disable the function;

- activation of an SCell of any MAC entity with configured uplink of which *firstActiveDownlinkBWP-Id* is not set to dormant BWP;

- activation of an SCG;

- addition of the PSCell except if the SCG is deactivated (i.e. PSCell is newly added or changed);

- *phr-ProhibitTimer* expires or has expired, when the MAC entity has UL resources for new transmission, and the following is true for any of the activated Serving Cells of any MAC entity with configured uplink:

- there are UL resources allocated for transmission or there is a PUCCH transmission on this cell, and the required power backoff 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]) for this cell has changed more than *phr-Tx-PowerFactorChange* dB since the last transmission of a PHR when the MAC entity had UL resources allocated for transmission or PUCCH transmission on this cell.

- Upon switching of activated BWP from dormant BWP to non-dormant DL BWP of an SCell of any MAC entity with configured uplink;

- if *mpe-Reporting-FR2* is configured, and *mpe-ProhibitTimer* is not running:

- the measured P-MPR applied to meet FR2 MPE requirements as specified in TS 38.101-2 [15] is equal to or larger than *mpe-Threshold* for at least one activated FR2 Serving Cell since the last transmission of a PHR in this MAC entity; or

- the measured P-MPR applied to meet FR2 MPE requirements as specified in TS 38.101-2 [15] has changed more than *phr-Tx-PowerFactorChange* dB for at least one activated FR2 Serving Cell since the last transmission of a PHR due to the measured P-MPR applied to meet MPE requirements being equal to or larger than *mpe-Threshold* in this MAC entity.

 in which case the PHR is referred below to as 'MPE P-MPR report'.

NOTE 2: The MAC entity should avoid triggering a PHR when the required power backoff due to power management decreases only temporarily (e.g. for up to a few tens of milliseconds) and it should avoid reflecting such temporary decrease in the values of PCMAX,f,c/PH when a PHR is triggered by other triggering conditions.

NOTE 3: If a HARQ process is configured with *cg-RetransmissionTimer* and if the PHR is already included in a MAC PDU for transmission on configured grant by this HARQ process, but not yet transmitted by lower layers, it is up to UE implementation how to handle the PHR content.

If the MAC entity has UL resources allocated for a new transmission the MAC entity shall:

1> if it is the first UL resource allocated for a new transmission since the last MAC reset:

2> start *phr-PeriodicTimer*.

1> if the Power Headroom reporting procedure determines that at least one PHR has been triggered and not cancelled; and

1> if the allocated UL resources can accommodate the MAC CE for PHR which the MAC entity is configured to transmit, plus its subheader, as a result of LCP as defined in clause 5.4.3.1:

2> if *multiplePHR* with value *true* is configured:

3> for each activated Serving Cell with configured uplink associated with any MAC entity of which the active DL BWP is not dormant BWP; and

3> for each activated Serving Cell with configured uplink associated with E-UTRA MAC entity:

4> if this MAC entity is configured with *twoPHRMode*:

5> if this Serving Cell is configured with multiple TRP PUSCH repetition and the MAC entity this Serving Cell belongs to is configured with *twoPHRMode*:

6> obtain two values of the Type 1 or the value of Type 3 power headroom for the corresponding uplink carrier as specified in clause 7.7 of TS 38.213 [6] for NR Serving Cell.

5> else:

6> obtain the value of the Type 1 or Type 3 power headroom for the corresponding uplink carrier as specified in clause 7.7 of TS 38.213 [6] for NR Serving Cell and clause 5.1.1.2 of TS 36.213 [17] for E-UTRA Serving Cell.

4> else (i.e. this MAC entity is not configured with *twoPHRMode*):

5> if this Serving Cell is configured with multiple TRP PUSCH repetition and the MAC entity this Serving Cell belongs to is configured with *twoPHRMode*:

6> if there is at least one real PUSCH transmission at the slot where the PHR MAC CE is transmitted:

7> obtain the value of the Type 1 power headroom of the first real transmission of the corresponding uplink carrier as specified in clause 7.7 of TS 38.213[6] for NR Serving Cell.

6> else if there is no real PUSCH transmission at the slot where the PHR MAC CE is transmitted:

7> obtain the value of the type 1 power headroom of the reference PUSCH transmission associated with the SRS-ResourceSet with a lower SRS-resourceSetID or the value of the type 3 power headroom for the corresponding uplink carrier as specified in clause 7.7 of TS 38.213[6] for NR serving cell.

5> else:

6> obtain the value of the Type 1 or Type 3 power headroom for the corresponding uplink carrier as specified in clause 7.7 of TS 38.213 [6] for NR Serving Cell and clause 5.1.1.2 of TS 36.213 [17] for E-UTRA Serving Cell.

4> if this MAC entity has UL resources allocated for transmission on this Serving Cell; or

4> if the other MAC entity, if configured, has UL resources allocated for transmission on this Serving Cell and *phr-ModeOtherCG* is set to *real* by upper layers:

5> obtain the value for the corresponding PCMAX,f,c field from the physical layer.

5> if *mpe-Reporting-FR2* is configured and this Serving Cell operates on FR2 and this Serving Cell is associated to this MAC entity:

6> obtain the value for the corresponding MPE field from the physical layer.

5> if *mpe-Reporting-FR2-r17* is configured and this Serving Cell operates on FR2 and this Serving Cell is associated to this MAC entity:

6> obtain the value for the corresponding MPEi field from the physical layer;

6> obtain the value for the corresponding Resourcei field from the physical layer.

3> if *phr-Type2OtherCell* with value *true* is configured:

4> if the other MAC entity is E-UTRA MAC entity:

5> obtain the value of the Type 2 power headroom for the SpCell of the other MAC entity (i.e. E-UTRA MAC entity);

5> if *phr-ModeOtherCG* is set to *real* by upper layers:

6> obtain the value for the corresponding PCMAX,f,c field for the SpCell of the other MAC entity (i.e. E-UTRA MAC entity) from the physical layer.

3> instruct the Multiplexing and Assembly procedure to generate and transmit the Enhanced Multiple entry PHR as defined in clause 6.1.3.49 if this MAC entity is configured with *mpe-Reporting-FR2-r17* or the Enhanced Multiple Entry PHR for multiple TRP MAC CE as defined in clause 6.1.3.51 if this MAC entity is configured with *twoPHRMode* or the Multiple Entry PHR MAC CE as defined in clause 6.1.3.9 otherwise based on the values reported by the physical layer.

2> else (i.e. Single Entry PHR format is used):

3> if this MAC entity is configured with *twoPHRMode*:

4> obtain two values of the Type 1 power headroom from the physical layer for the corresponding uplink carrier of the PCell.

3> else:

4> obtain the value of the Type 1 power headroom from the physical layer for the corresponding uplink carrier of the PCell.

3> obtain the value for the corresponding PCMAX,f,c field from the physical layer;

3> if *mpe-Reporting-FR2* is configured and this Serving Cell operates on FR2:

4> obtain the value for the corresponding MPE field from the physical layer.

3> if *mpe-Reporting-FR2-r17* is configured and this Serving Cell operates on FR2 and this Serving Cell is associated to this MAC entity:

4> obtain the value for the corresponding MPEi field from the physical layer;

4> obtain the value for the corresponding Resourcei field from the physical layer.

3> instruct the Multiplexing and Assembly procedure to generate and transmit the Enhanced Single entry PHR as defined in clause 6.1.3.48 if this MAC entity is configured with *mpe-Reporting-FR2-r17* or the Enhanced Single Entry PHR for multiple TRP MAC CE as defined in clause 6.1.3.50 if this MAC entity is configured with *twoPHRMode* or the Single Entry PHR MAC CE as defined in clause 6.1.3.8 otherwise based on the values reported by the physical layer.

2> if this PHR report is an MPE P-MPR report:

3> start or restart the *mpe-ProhibitTimer*;

3> cancel triggered MPE P-MPR reporting for Serving Cells included in the PHR MAC CE.

2> start or restart *phr-PeriodicTimer*;

2> start or restart *phr-ProhibitTimer*;

2> cancel all triggered PHR(s).

All triggered PHRs shall be cancelled when there is an ongoing SDT procedure as in clause 5.27 and the UL grant(s) can accommodate all pending data available for transmission but is not sufficient to additionally accommodate the PHR MAC CE plus its subheader.

NEXT CHANGE

## 5.17 Beam Failure Detection and Recovery procedure

The MAC entity may be configured by RRC per Serving Cell with a beam failure recovery procedure which is used for indicating to the serving gNB of a new SSB or CSI-RS when beam failure is detected on the serving SSB(s)/CSI-RS(s). Beam failure is detected by counting beam failure instance indication from the lower layers to the MAC entity. If *beamFailureRecoveryConfig* is reconfigured by upper layers during an ongoing Random Access procedure for beam failure recovery for SpCell, the MAC entity shall stop the ongoing Random Access procedure and initiate a Random Access procedure using the new configuration. When the SCG is deactivated, the UE performs beam failure detection on the PSCell if *bfd-and-RLM* is set to *true*.

RRC configures the following parameters in the *beamFailureRecoveryConfig*, *beamFailureRecoverySpCellConfig*, *beamFailureRecoverySCellConfig* and the *radioLinkMonitoringConfig* for the Beam Failure Detection and Recovery procedure:

- *beamFailureInstanceMaxCount* for the beam failure detection (per Serving Cell or per BFD-RS set of Serving Cell configured with two BFD-RS sets);

- *beamFailureDetectionTimer* for the beam failure detection (per Serving Cell or per BFD-RS set of Serving Cell configured with two BFD-RS sets);

- *beamFailureRecoveryTimer* for the beam failure recovery procedure;

- *rsrp-ThresholdSSB*: an RSRP threshold for the SpCell beam failure recovery;

- *rsrp-ThresholdBFR*: an RSRP threshold for the SCell beam failure recovery or for the beam failure recovery of BFD-RS set of Serving Cell;

- *powerRampingStep*: *powerRampingStep* for the SpCell beam failure recovery;

- *powerRampingStepHighPriority*: *powerRampingStepHighPriority* for the SpCell beam failure recovery;

- *preambleReceivedTargetPower*: *preambleReceivedTargetPower* for the SpCell beam failure recovery;

- *preambleTransMax*: *preambleTransMax* for the SpCell beam failure recovery;

- *scalingFactorBI*: *scalingFactorBI* for the SpCell beam failure recovery;

- *ssb-perRACH-Occasion*: *ssb-perRACH-Occasion* for the SpCell beam failure recovery using contention-free Random Access Resources;

- *ra-ResponseWindow*: the time window to monitor response(s) for the SpCell beam failure recovery using contention-free Random Access Resources;

- *prach-ConfigurationIndex*: *prach-ConfigurationIndex* for the SpCell beam failure recovery using contention-free Random Access Resources;

- *ra-ssb-OccasionMaskIndex*: *ra-ssb-OccasionMaskIndex* for the SpCell beam failure recovery using contention-free Random Access Resources;

- *ra-OccasionList*: *ra-OccasionList* for the SpCell beam failure recovery using contention-free Random Access Resources;

- *candidateBeamRSList*: list of candidate beams for SpCell beam failure recovery;

- *candidateBeamRS-List-r16*: list of candidate beams for SCell beam failure recovery or list of candidate beams for beam failure recovery of a Serving Cell for BFR-RS set one;

- *candidateBeamRS-List2-r17*: list of candidate beams for beam failure recovery of a Serving Cell for BFD-RS set two.

The following UE variables are used for the beam failure detection procedure:

- *BFI\_COUNTER* (per Serving Cell or per BFD-RS set of Serving Cell configured with two BFD-RS sets): counter for beam failure instance indication which is initially set to 0.

The MAC entity shall for each Serving Cell configured for beam failure detection:

1> if the Serving Cell is configured with two BFD-RS sets:

2> if beam failure instance indication for a BFD-RS set has been received from lower layers:

3> start or restart the *beamFailureDetectionTimer* of the BFD-RS set;

3> increment *BFI\_COUNTER* of the BFD-RS set by 1;

3> if *BFI\_COUNTER* of the BFD-RS set >= *beamFailureInstanceMaxCount*:

4> trigger a BFR for this BFD-RS set of the Serving Cell;

2> if BFR is triggered for both BFD-RS sets of the SpCell and the Beam Failure Recovery procedure is not successfully completed for any of the BFD-RS sets:

3> initiate a Random Access procedure (see clause 5.1) on the SpCell;

2> if the Serving Cell is SpCell and the Random Access procedure initiated for beam failure recovery of both BFD-RS sets of SpCell is successfully completed (see clause 5.1):

3> set *BFI\_COUNTER* of each BFD-RS set of SpCell to 0.

3> consider the Beam Failure Recovery procedure successfully completed.

2> if the *beamFailureDetectionTimer* of this BFD-RS set expires; or

2> if *beamFailureDetectionTimer*, *beamFailureInstanceMaxCount*, or any of the reference signals used for beam failure detection is reconfigured by upper layers or by the BFD-RS Indication MAC CE associated with a BFD-RS set of the Serving Cell:

3> set *BFI\_COUNTER* of the BFD-RS set to 0.

2> if a PDCCH addressed to C-RNTI indicating uplink grant for a new transmission is received for the HARQ process used for the transmission of the Enhanced BFR MAC CE or Truncated Enhanced BFR MAC CE which contains beam failure recovery information of this BFD-RS set of the Serving Cell:

3> set *BFI\_COUNTER* of the BFD-RS set to 0;

3> consider the Beam Failure Recovery procedure successfully completed for this BFD-RS set and cancel all the triggered BFRs of this BFD-RS set of the Serving Cell.

2> if the Serving Cell is SCell and the SCell is deactivated as specified in clause 5.9:

3> set *BFI\_COUNTER* of each BFD-RS set of SCell to 0;

3> consider the Beam Failure Recovery procedure successfully completed and cancel all the triggered BFRs of all BFD-RS sets of the Serving Cell.

1> else:

2> if beam failure instance indication has been received from lower layers:

3> start or restart the *beamFailureDetectionTimer*;

3> increment *BFI\_COUNTER* by 1;

3> if *BFI\_COUNTER* >= *beamFailureInstanceMaxCount*:

4> if the Serving Cell is SCell:

5> trigger a BFR for this Serving Cell;

4> else if the Serving Cell is PSCell and, the SCG is deactivated:

5> if beam failure of the PSCell has not been indicated to upper layers since the SCG was deactivated or since the deactivated SCG was last reconfigured with BFD-RS:

6> indicate beam failure of the PSCell to upper layers.

NOTE: After beam failure is indicated to upper layers, the UE may stop the *beamFailureDetectionTimer* and lower layer beam failure indication while *BFI\_COUNTER* >= *beamFailureInstanceMaxCount* for the deactivated SCG.

4> else:

5> initiate a Random Access procedure (see clause 5.1) on the SpCell.

2> if the *beamFailureDetectionTimer* expires; or

2> if *beamFailureDetectionTimer*, *beamFailureInstanceMaxCount*, or any of the reference signals used for beam failure detection is reconfigured by upper layers associated with this Serving Cell:

3> set *BFI\_COUNTER* to 0.

2> if the Serving Cell is SpCell and the Random Access procedure initiated for SpCell beam failure recovery is successfully completed (see clause 5.1):

3> set *BFI\_COUNTER* to 0;

3> stop the *beamFailureRecoveryTimer*, if configured;

3> consider the Beam Failure Recovery procedure successfully completed.

2> else if the Serving Cell is SCell, and a PDCCH addressed to C-RNTI indicating uplink grant for a new transmission is received for the HARQ process used for the transmission of the MAC CE for BFR which contains beam failure recovery information of this Serving Cell; or

2> if the SCell is deactivated as specified in clause 5.9:

3> set *BFI\_COUNTER* to 0;

3> consider the Beam Failure Recovery procedure successfully completed and cancel all the triggered BFRs for this Serving Cell.

The MAC entity shall:

1> if the Beam Failure Recovery procedure determines that at least one BFR has been triggered and not cancelled for an SCell for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed and if none of the Serving Cell(s) of this MAC entity are configured with two BFD-RS sets:

2> if UL-SCH resources are available for a new transmission and if the UL-SCH resources can accommodate the BFR MAC CE plus its subheader as a result of LCP:

3> instruct the Multiplexing and Assembly procedure to generate the BFR MAC CE.

2> else if UL-SCH resources are available for a new transmission and if the UL-SCH resources can accommodate the Truncated BFR MAC CE plus its subheader as a result of LCP:

3> instruct the Multiplexing and Assembly procedure to generate the Truncated BFR MAC CE.

2> else:

3> trigger the SR for SCell beam failure recovery for each SCell for which BFR has been triggered, not cancelled, and for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed.

1> if the Beam Failure Recovery procedure determines that at least one BFR for any BFD-RS set has been triggered and not cancelled for an SCell for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed; or

1> if the Beam Failure Recovery procedure determines that at least one BFR for only one BFD-RS set has been triggered and not cancelled for an SpCell for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed; or

1> if the Beam Failure Recovery procedure determines that at least one BFR has been triggered and not cancelled for an SCell for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed and if at least one Serving Cell of this MAC entity is configured with two BFD-RS sets:

2> if UL-SCH resources are available for a new transmission and if the UL-SCH resources can accommodate the Enhanced BFR MAC CE plus its subheader as a result of LCP:

3> instruct the Multiplexing and Assembly procedure to generate the Enhanced BFR MAC CE.

2> else if UL-SCH resources are available for a new transmission and if the UL-SCH resources can accommodate the Truncated Enhanced BFR MAC CE plus its subheader as a result of LCP:

3> instruct the Multiplexing and Assembly procedure to generate the Truncated Enhanced BFR MAC CE.

2> else:

3> trigger the SR for beam failure recovery of each BFD-RS set for which BFR has been triggered, not cancelled, and for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed;

3> trigger the SR for SCell beam failure recovery for each SCell for which BFR has been triggered, not cancelled, and for which evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed.

All BFRs triggered for an SCell shall be cancelled when a MAC PDU is transmitted and this PDU includes a MAC CE for BFR which contains beam failure information of that SCell. All BFRs triggered for a BFD-RS set of a Serving Cell shall be cancelled when a MAC PDU is transmitted and this PDU includes an Enhanced BFR MAC CE or Truncated Enhanced BFR MAC CE which contains beam failure recovery information of that BFD-RS set of the Serving Cell.

NEXT CHANGE

#### 6.1.3.44 Enhanced TCI States Indication for UE-specific PDCCH MAC CE

The Enhanced TCI States Indication for UE-specific PDCCH MAC CE is identified by a MAC PDU subheader with eLCID as specified in Table 6.2.1-1b. It has a fixed size of 24 bits with following fields:

- Serving Cell ID: This field indicates the identity of the Serving Cell for which the MAC CE applies. The length of the field is 5 bits. If the indicated Serving Cell is configured as part of a *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2* as specified in TS 38.331 [5], this MAC CE applies to all theServing Cells in the set *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2*, respectively;

- CORESET ID: This field indicates a Control Resource Set identified with *ControlResourceSetId* as specified in TS 38.331 [5], for which the TCI State is being indicated. In case the value of the field is 0, the field refers to the Control Resource Set configured by *controlResourceSetZero* as specified in TS 38.331 [5]. The length of the field is 4 bits;

- TCI state IDi: This field indicates the TCI state identified by *TCI-StateId* as specified in TS 38.331 [5] applicable to the Control Resource Set identified by CORESET ID field. If the field of CORESET ID is set to the other value than 0, this field indicates a *TCI-StateId* configured by *tci-StatesPDCCH-ToAddList* and *tci-StatesPDCCH-ToReleaseList* in the *controlResourceSet* identified by the indicated CORESET ID. The length of the field is 7 bits.

NOTE 1: The Enhanced TCI State Indication for UE specific PDCCH MAC CE is not applicable to any of the configured CORESETs in a BWP if the CORESETs are configured with different *CORESETPoolindex* values in the BWP.

NOTE 2: The Enhanced TCI State Indication for UE specific PDCCH MAC CE is applied only if *sfnSchemePdcch* is configured.

NOTE 3: The Enhanced TCI State Indication for UE specific PDCCH MAC CE is not applicable to the CORESET configured by *controlResourceSetZero* if the CORESET is associated with the search space configured by *pdcch-ConfigSIB1 in MIB,* or *searchSpaceSIB1*, *searchSpaceZero*, *searchSpaceOtherSystemInformation*, or *pagingSearchSpace* in *PDCCH-ConfigCommon*.



Figure 6.1.3.44-1: Enhanced TCI States Indication for UE-specific PDCCH MAC CE

NEXT CHANGE

#### 6.1.3.59 SP/AP SRS TCI State Indication MAC CE

The SP/AP SRS TCI State Indication MAC CE is identified by a MAC subheader with eLCID as specified in Table 6.2.1-1b. It has a variable size with following fields:

- A/D: This field indicates whether to activate or deactivate indicated SP SRS resource set. The field is set to 1 to indicate activation, otherwise it indicates deactivation. If the indicated SRS resource set ID is for the AP SRS resource set, MAC entity shall ignore this field;

- SRS Resource Set's Cell ID: This field indicates the identity of the Serving Cell, which contains the indicated SP/AP SRS Resource Set. If the C field is set to 0, this field also indicates the identity of the Serving Cell associated with all TCI states indicated by the TCI State IDi fields. The length of the field is 5 bits;

- SRS Resource Set's BWP ID: This field indicates a UL BWP as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9], which contains the indicated SP/AP SRS Resource Set. If the C field is set to 0, this field also indicates the identity of the BWP associated with all TCI states indicated by the TCI State IDi fields. The length of the field is 2 bits;

- C: This field indicates whether the octets containing TCI State Serving Cell ID field(s) and TCI State BWP ID field(s) are present. If this field is set to 1, TCI State Serving Cell ID field(s) and TCI State BWP ID field(s) are present, otherwise they are not present so MAC entity shall ignore TCI State Serving Cell ID field(s) and TCI State BWP ID field(s);

- SUL: This field indicates whether the MAC CE applies to the NUL carrier or SUL carrier configuration. This field is set to 1 to indicate that it applies to the SUL carrier configuration, and it is set to 0 to indicate that it applies to the NUL carrier configuration;

- SRS Resource Set ID: This field indicates the SP/AP SRS Resource Set ID identified by *SRS-ResourceSetId* as specified in TS 38.331 [5]. The length of the field is 4 bits;

- TCI State Serving Cell IDi: This field indicates the identity of the Serving Cell on which the TCI State used for SRS resource i is located. The length of the field is 5 bits;

- TCI State BWP IDi: This field indicates a BWP as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9], on which the TCI State used for SRS resource i is located. If value of *unifiedTCI-StateType* in the serving cell indicated by TCI State Serving Cell IDi is joint, this field indicates a DL BWP. If value of *unifiedTCI-StageType* in the serving cell indicated by TCI State Serving Cell IDi is *separate*, this field indicates a UL BWP. The length of the field is 2 bits;

- TCI State IDi: This field contains an identifier of the TCI state used for SRS resource i. TCI State ID0 refers to the first SRS resource within the resource set, TCI State ID1 refers to the second one and so on. If joint/downlink TCI State is used, 7-bits length TCI state ID i.e. *TCI-StateId* as specified in TS 38.331 [5] is used. If separate downlink and uplink TCI State is used, the most significant bit of TCI state ID is considered as a reserved bit and the remaining 6 bits indicate the *UL-TCIState-Id* as specified in TS 38.331 [5]. The length of the field is 7 bits. This field is only present if MAC CE is used for activation of SP SRS resource set, i.e. the A/D field is set to 1, or for AP SRS resource set;

- R: Reserved bit, set to 0.



Figure 6.1.3.59-1: SP/AP SRS TCI State Indication MAC CE

END OF CHANGE