**3GPP TSG-RAN WG2 Meeting #109bis-e R2-2003856**

**Electronic, 20th Apr. – 30th Apr. 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.321** | **CR** | **1468** | **rev** | **1** | **Current version:** | **16.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | CR on 36.321 for even further mobility enhancement in E-UTRAN | | | | | | | | | |
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| ***Source to WG:*** | vivo | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_feMob-Core | | | | |  | ***Date:*** | | | 2020-04-09 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
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| ***Reason for change:*** | | In RAN2#109bis-e meeting, the following conclusions are made:   1. All the functions in Figure 4.2.2-1 will be supported by the source and target MAC entity in DAPS HO. 2. LTE DAPS+ LTE RACH-less is not allowed. 3. Forbid data transmission of non-DAPS DRBs in MSG3 for CBRA. 4. Whether to support PHR reporting in another node have not been concluded during this meeting. If the answer is Yes, the multiple entry PHR for the DAPS handover should be introduced. Thus, the MAC may need to introduce a new trigger condition (e.g. addition of the target PCell) for the PHR report of DAPS. | | | | | | | | |
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| ***Summary of change:*** | | 1. Remove the Editor’s Note in section 4.2.1 for FFS which functions will be supported by the source and target MAC entity in DAPS HO. 2. Remove the Editor’s Note in section 5.1.6 for DAPS+Rach-less. 3. In 5.4.3.1, add the clarification to forbid data transmission of non-DAPS DRBs in MSG3 for CBRA. 4. In section 5.4.6, add an Editor’s Note for FFS whether to support PHR reporting in another node during DAPS handover. | | | | | | | | |
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| ***Consequences if not approved:*** | | The latest conclusions for FeMobility have not been catpured in the specificiation. | | | | | | | | |
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| ***Clauses affected:*** | | 4.2.1, 5.1.6, 5.4.3.1, 5.4.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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

### 4.2.1 MAC Entities

E-UTRA defines two MAC entities; one in the UE and one in the E-UTRAN. These MAC entities handle the following transport channels:

- Broadcast Channel (BCH);

- Downlink Shared Channel(s) (DL-SCH);

- Paging Channel (PCH);

- Uplink Shared Channel(s) (UL-SCH);

- Random Access Channel(s) (RACH);

- Multicast Channel(s) (MCH);

- Sidelink Broadcast Channel (SL-BCH);

- Sidelink Discovery Channel (SL-DCH);

- Sidelink Shared Channel (SL-SCH).

The exact functions performed by the MAC entities are different in the UE from those performed in the E-UTRAN.

The RN includes both types of MAC entities; one type for communication with UEs and one type for communication with the E-UTRAN.

In Dual Connectivity, two MAC entities are configured in the UE: one for the MCG and one for the SCG. In DAPS handover, two MAC entities are configured in the UE: one MAC entity for the source cell and one MAC entity for the target cell. Each MAC entity is configured by RRC with a serving cell supporting PUCCH transmission and contention based Random Access. In this specification, the term SpCell refers to such cell, whereas the term SCell refers to other serving cells. The term SpCell either refers to the PCell of the MCG or the PSCell of the SCG depending on if the MAC entity is associated to the MCG or the SCG, respectively. A Timing Advance Group containing the SpCell of a MAC entity is referred to as pTAG, whereas the term sTAG refers to other TAGs.

The functions of the different MAC entities in the UE operate independently if not otherwise indicated. The timers and paramenters used in each MAC entity are configured independently if not otherwise indicated. The Serving Cells, C-RNTI, radio bearers, logical channels, upper and lower layer entities, LCGs, and HARQ entities considered by each MAC entity refer to those mapped to that MAC entity if not otherwise indicated.

If the MAC entity is configured with one or more SCells, there are multiple DL-SCH and there may be multiple UL-SCH and RACH per MAC entity; one DL-SCH, one UL-SCH, and one RACH on the SpCell, one DL-SCH, zero or one UL-SCH and zero or one RACH for each SCell.

The physical layer may perform a listen-before-talk procedure, according to which transmissions are not performed if the channel is identified as being occupied or the physical layer may monitor for PUSCH trigger, as specified in TS 36.213 [2], according to which transmissions are not performed if PUSCH trigger B is not received. In both cases a MAC entity considers the transmission to have been performed anyway, unless stated otherwise.

Figure 4.2.1-1 illustrates one possible structure for the UE side MAC entity when SCG is not configured and for each MAC entity during DAPS handover, and it should not restrict implementation.

Next change

### 5.1.6 Completion of the Random Access procedure

At completion of the Random Access procedure, the MAC entity shall:

- discard explicitly signalled *ra-PreambleIndex* and *ra-PRACH-MaskIndex*, if any;

- flush the HARQ buffer used for transmission of the MAC PDU in the Msg3 buffer;

- if the Random Access Procedure towards target cell for DAPS handover is successfully completed, indicate the successful completion of the Random Access Procedure to the upper layers.

In addition, the RN shall resume the suspended RN subframe configuration, if any.

Next change

#### 5.4.3.1 Logical channel prioritization

The Logical Channel Prioritization procedure is applied when a new transmission is performed.

RRC controls the scheduling of uplink data by signalling for each logical channel: *priority* where an increasing *priority* value indicates a lower priority level, *prioritisedBitRate* which sets the Prioritized Bit Rate (PBR), *bucketSizeDuration* which sets the Bucket Size Duration (BSD), and optionally *allowedTTI-Lengths* which sets the allowed TTI lengths. For NB-IoT, *prioritisedBitRate*, *bucketSizeDuration* and the corresponding steps of the Logical Channel Prioritisation procedure (i.e., Step 1 and Step 2 below) are not applicable.

The MAC entity shall maintain a variable Bj for each logical channel j. Bj shall be initialized to zero when the related logical channel is established, and incremented by the product PBR × TTI duration for each TTI, where PBR is Prioritized Bit Rate of logical channel j. However, the value of Bj can never exceed the bucket size and if the value of Bj is larger than the bucket size of logical channel j, it shall be set to the bucket size. The bucket size of a logical channel is equal to PBR × BSD, where PBR and BSD are configured by upper layers.

Before the successful completion of the Random Access procedure in DAPS handover, the logical channel(s) corresponding to the DRB(s) not configured with *dapsConfig* is not included in the following Logical Channel Prioritization procedure when the uplink grant is received in a Random Access Response.

The MAC entity shall perform the following Logical Channel Prioritization procedure when a new transmission is performed on an UL grant with a certain TTI length:

- The MAC entity shall allocate resources to the logical channels that are allowed to transmit using the TTI length of the grant, in the following steps:

- Step 1: All the allowed logical channels with Bj > 0 are allocated resources in a decreasing priority order. If the PBR of a logical channel is set to "infinity", the MAC entity shall allocate resources for all the data that is available for transmission on the logical channel before meeting the PBR of the lower priority logical channel(s);

- Step 2: the MAC entity shall decrement Bj by the total size of MAC SDUs served to logical channel j in Step 1;

NOTE 1: The value of Bj can be negative.

- Step 3: if any resources remain, all the allowed logical channels are served in a strict decreasing priority order (regardless of the value of Bj) until either the data for that logical channel or the UL grant is exhausted, whichever comes first. Logical channels configured with equal priority should be served equally.

- The UE shall also follow the rules below during the scheduling procedures above:

- the UE should not segment an RLC SDU (or partially transmitted SDU or retransmitted RLC PDU) if the whole SDU (or partially transmitted SDU or retransmitted RLC PDU) fits into the remaining resources of the associated MAC entity;

- if the UE segments an RLC SDU from the logical channel, it shall maximize the size of the segment to fill the grant of the associated MAC entity as much as possible;

- the UE should maximise the transmission of data.

- if the MAC entity is given an UL grant size that is equal to or larger than 4 bytes while having data available for transmission, the MAC entity shall not transmit only padding BSR and/or padding (unless the UL grant size is less than 7 bytes and an AMD PDU segment needs to be transmitted);

- for transmissions on serving cells operating according to Frame Structure Type 3, the MAC entity shall only consider logical channels for which *laa-UL-Allowed* has been configured;

- if a logical channel has been configured with *lch-CellRestriction* and if PDCP duplication is activated, for this logical channel the MAC entity shall not consider the cells indicated by *lch-CellRestriction* to be restricted for transmission.

- for NB-IoT UEs, BL UEs or UEs in enhanced coverage, if *edt-SmallTBS-Enabled* is set to *TRUE* for the corresponding PRACH resource, the UE shall choose a TB size among the set of possible TB sizes as described in clauses 8.6.2 and 16.3.3 of TS 36.213 [2]

The MAC entity shall not transmit data for a logical channel corresponding to a radio bearer that is suspended (the conditions for when a radio bearer is considered suspended are defined in TS 36.331 [8]).

If the MAC PDU includes only the MAC CE for padding BSR or periodic BSR with zero MAC SDUs and there is no aperiodic CSI requested for this TTI, as specified in TS 36.213 [2], the MAC entity shall not generate a MAC PDU for the HARQ entity in the following cases:

- in case the MAC entity is configured with *skipUplinkTxDynamic* and the grant indicated to the HARQ entity was addressed to a C-RNTI; or

- in case the MAC entity is configured with *skipUplinkTxSPS* and the grant indicated to the HARQ entity is a configured uplink grant activated by the MAC entity's Semi-Persistent Scheduling C-RNTI or by the MAC entity's UL Semi-Persistent Scheduling V-RNTI; or

- in case the grant indicated to the HARQ entity is a configured uplink grant activated by the MAC entity's AUL C-RNTI; or

- in case the grant indicated to the HARQ entity is a preconfigured uplink grant.

For the Logical Channel Prioritization procedure, the MAC entity shall take into account the following relative priority in decreasing order:

- MAC control element for C-RNTI or data from UL-CCCH;

- MAC control element for DPR;

- MAC control element for SPS confirmation;

- MAC control element for AUL confirmation;

- MAC control element for BSR, with exception of BSR included for padding;

- MAC control element for PHR, Extended PHR, or Dual Connectivity PHR;

- MAC control element for Sidelink BSR, with exception of Sidelink BSR included for padding;

- MAC control element for DCQR and AS RAI, with exception of when DCQR is to be included in Msg3;

- data from any Logical Channel, except data from UL-CCCH;

- MAC control element for DCQR and AS RAI, when DCQR is to be included in Msg3;

- MAC control element for Recommended bit rate query;

- MAC control element for BSR included for padding;

- MAC control element for Sidelink BSR included for padding.

When AS RAI has been triggered, DCQR and AS RAI MAC control element shall have higher priority than data from any Logical Channel, except data from UL-CCCH, only if after logical channel prioritization including AS RAI in the resulting MAC PDU does not require segmenting RLC SDU. Otherwise data from any Logical Channel shall have higher priority than DCQR and AS RAI MAC control element.

NOTE 2: When the MAC entity is requested to transmit multiple MAC PDUs in one TTI, steps 1 to 3 and the associated rules may be applied either to each grant independently or to the sum of the capacities of the grants. Also the order in which the grants are processed is left up to UE implementation. It is up to the UE implementation to decide in which MAC PDU a MAC control element is included when MAC entity is requested to transmit multiple MAC PDUs in one TTI. When the UE is requested to generate MAC PDU(s) in two MAC entities in one TTI, it is up to UE implementation in which order the grants are processed.

Next change

### 5.4.6 Power Headroom Reporting

The Power Headroom reporting procedure is used to provide the serving eNB with information about the difference between the nominal UE maximum transmit power and the estimated power for UL-SCH transmission or SRS transmission per activated Serving Cell and also with information about the difference between the nominal UE maximum power and the estimated power for UL-SCH and PUCCH/SPUCCH transmission on SpCell and PUCCH SCell.

The reporting period, delay and mapping of Power Headroom are defined in TS 36.133 [9] and TS 38.133 [19]. RRC controls Power Headroom reporting by configuring the two timers *periodicPHR-Timer* and *prohibitPHR-Timer*, and by signalling *dl-PathlossChange* which sets the change in measured downlink pathloss and the required power backoff due to power management (as allowed by P-MPRc, see TS 36.101 [10] and TS 38.101-3 [21]) to trigger a PHR, as specified in TS 36.331 [8].

Editor’s Note: FFS whether to support PHR reporting in another node during DAPS handover.

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

- *prohibitPHR-Timer* expires or has expired and the path loss has changed more than *dl-PathlossChange* dB for at least one activated Serving Cell of any MAC entity which is used as a pathloss reference since the last transmission of a PHR in this MAC entity when the MAC entity has UL resources for new transmission;

- *periodicPHR-Timer* expires;

- upon configuration or reconfiguration of the power headroom reporting functionality by upper layers, as specified in TS 36.331 [8], which is not used to disable the function;

- activation of an SCell of any MAC entity with configured uplink;

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

*- prohibitPHR-Timer* expires or has expired, when the MAC entity has UL resources for new transmission, and the following is true in this TTI 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/SPUCCH transmission on this cell, and the required power backoff due to power management (as allowed by P-MPRc, see TS 36.101 [10] and TS 38.101-3 [21]) for this cell has changed more than *dl-PathlossChange* dB since the last transmission of a PHR when the MAC entity had UL resources allocated for transmission or PUCCH/SPUCCH transmission on this cell.

NOTE 1: 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,c/PH when a PHR is triggered by other triggering conditions.

NOTE 2: If UL HARQ operation is autonomous for the HARQ entity and if the PHR is already included in a MAC PDU for transmission by this HARQ entity, 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 new transmission for this TTI the MAC entity shall:

- if it is the first UL resource allocated for a new transmission since the last MAC reset, start *periodicPHR-Timer*;

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

- if the allocated UL resources can accommodate the MAC control element for PHR which the MAC entity is configured to transmit, plus its subheader, as a result of logical channel prioritization:

- if *extendedPHR* is configured:

- for each activated Serving Cell with configured uplink:

- obtain the value of the Type 1 or Type 3 power headroom;

- if the MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI:

- obtain the value for the corresponding PCMAX,c field from the physical layer;

- if *simultaneousPUCCH-PUSCH* is configured or a serving cell operating according to Frame Structure Type 3 with uplink is configured and activated:

- obtain the value of the Type 2 power headroom for the PCell;

- obtain the value for the corresponding PCMAX,c field from the physical layer (see clause 5.1.1.2 of TS 36.213 [2]);

- instruct the Multiplexing and Assembly procedure to generate and transmit an Extended PHR MAC control element for *extendedPHR* as defined in clause 6.1.3.6a based on the values reported by the physical layer;

- else if *extendedPHR2* is configured:

- for each activated Serving Cell with configured uplink:

- obtain the value of the Type 1 or Type 3 power headroom;

- if the MAC entity has UL resources allocated for transmission on this Serving Cell for this TTI:

- obtain the value for the corresponding PCMAX,c field from the physical layer;

- if a PUCCH SCell is configured and activated:

- obtain the value of the Type 2 power headroom for the PCell and PUCCH SCell;

- obtain the values for the corresponding PCMAX,c fields from the physical layer (see clause 5.1.1.2 ofTS 36.213 [2]);

- else:

- if *simultaneousPUCCH-PUSCH* is configured for the PCell or a serving cell operating according to Frame Structure Type 3 with uplink is configured and activated:

- obtain the value of the Type 2 power headroom for the PCell;

- obtain the value for the corresponding PCMAX,c field from the physical layer (see clause 5.1.1.2 of TS 36.213 [2]);

- instruct the Multiplexing and Assembly procedure to generate and transmit an Extended PHR MAC control element for *extendedPHR2* according to configured *ServCellIndex* and the PUCCH(s) for the MAC entity as defined in clause 6.1.3.6a based on the values reported by the physical layer;

- else if *dualConnectivityPHR* is configured:

- for each activated Serving Cell with configured uplink associated with any MAC entity:

- obtain the value of the Type 1 or Type 3 power headroom;

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

- obtain the value for the corresponding PCMAX,c field from the physical layer;

- if *simultaneousPUCCH-PUSCH* is configured or a serving cell operating according to Frame Structure Type 3 with uplink is configured and activated:

- obtain the value of the Type 2 power headroom for the SpCell;

- obtain the value for the corresponding PCMAX,c field for the SpCell from the physical layer (see clause 5.1.1.2 of TS 36.213 [2]);

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

- obtain the value of the Type 2 power headroom for the SpCell of the other MAC entity.

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

- obtain the value for the corresponding PCMAX,c field for the SpCell of the other MAC entity from the physical layer (see clause 5.1.1.2 of TS 36.213 [2]);

- instruct the Multiplexing and Assembly procedure to generate and transmit a Dual Connectivity PHR MAC control element as defined in clause 6.1.3.6b based on the values reported by the physical layer;

- else:

- obtain the value of the Type 1 power headroom from the physical layer;

- instruct the Multiplexing and Assembly procedure to generate and transmit a PHR MAC control element as defined in clause 6.1.3.6 based on the value reported by the physical layer;

- start or restart *periodicPHR-Timer*;

- start or restart *prohibitPHR-Timer*;

- cancel all triggered PHR(s).

End of change