**3GPP TSG-WG2 Meeting #110-e *R2-200xxxx***

**E-Meeting, 1st – 12th June, 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **36.300** | **CR** | **1281** | **rev** | **2** | **Current version:** | **16.1.0** |  |
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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:***  | Miscellaneous corrections to Rel-16 eMTC enhancements |
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| ***Source to WG:*** | Intel Corporation |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | LTE\_eMTC5-Core |  | ***Date:*** | 2020-06-xx |
|  |  |  |  |  |
| ***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 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-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:*** | The CR for Rel-16 eMTC enhancements was agreed in RAN#87, however some miscellaneous corrections are required and missed details.1. GWUS (or group WUS) is the name of the feature, but the actual signal or resource is still called WUS.
2. PUR: L1 ACK has been renamed RRC ACK in PUR configuration request, and the UE can also request the release of PUR.
3. Interworking between Cat. M UE and NR is addressed.
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| ***Summary of change:*** | 1. Change the resource name from GWUS to WUS
2. PUR: Change L1 ACK to RRC ACK in PUR Configuration Request, and clarify that UE can also request the release of PUR.
3. Interworking between Cat M and NR is not supported
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| ***Consequences if not approved:*** | The specification is ambiguous or incomplete. |
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| ***Clauses affected:*** | 7.3d.1, 7.3.d.2, 10.1.4, 23.7a |
|  |  |
|  | **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 ...  |
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| ***Other comments:*** |  |
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| ***This CR's revision history:*** | R2-2003918 agreed in principle in RAN2#109bis e-meeting |

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| Start of the change |

### 7.3d.1 General

Transmission using PUR allows one uplink transmission from RRC\_IDLE using a preconfigured uplink resource without performing the random access procedure.

Transmission using PUR is enabled by the (ng-)eNB if the UE and the (ng-)eNB support.

The UE may request to be configured with a PUR or to have a PUR configuration released while in RRC\_CONNECTED mode. The (ng-)eNB decides to configure a PUR that may be based on UE's request, UE's subscription information and/or local policy. The PUR is only valid in the cell where the configuration was received.

Transmission using PUR is triggered when the upper layers request the establishment or resumption of the RRC Connection and the UE has a valid PUR for transmission and meets the TA validation criteria as specified in TS 36.331 [16].

Transmission using PUR is only applicable to BL UEs, UEs in enhanced coverage and NB-IoT UEs.

### 7.3d.2 PUR Configuration Request and PUR configuration

The procedure for PUR configuration request and PUR configuration is common to the Control Plane CIoT EPS/5GS optimisations and the User Plane CIoT EPS/5GS optimisations and is illustrated in Figure 7.3d-1.



Figure 7.3d-1: PUR Configuration Request and PUR Configuration

0. The UE is in RRC\_CONNECTED and PUR is enabled in the cell.

1. Based on indication from the upper layers, the UE may indicate to the (ng-)eNB that it is interested in being configured with PUR by sending *PURConfigurationRequest* message providing information about the requested resource (e.g. No. of occurences, periodicity, time offset, TBS, RRC Ack, etc.). Alternatively, the UE may indicate to the (ng-)eNB in the *PURConfigurationRequest* message that it is interested in the configured PUR to be released.

2. When the (ng-)eNB moves the UE to RRC\_IDLE, based on a precedent UE PUR configuration request, subscription information and/or local policies, the (ng-)eNB may decide to provide a PUR resource to the UE or to release an existing PUR resource. The (ng-)eNB includes the details of the PUR configuration or a PUR release indication in the *RRCConnectionRelease* message.

NOTE: The PUR configuration can be implicitly released at the UE and (ng-)eNB, when the UE accesses in another cell, when PUR is no longer enabled in the cell, or when the PUR resource has not been used for a configured number of consecutive occasions.

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| Next change |

### 10.1.4 Paging and C-plane establishment

Paging groups (where multiple UEs can be addressed) are used on PDCCH:

- Precise UE identity is found on PCH;

- DRX configurable via BCCH and NAS;

- Only one subframe allocated per paging interval per UE;

- The network may divide UEs to different paging occasions in time;

- There is no grouping within paging occasion;

- One paging RNTI for PCH.

When extended DRX (eDRX) is used in idle mode, the following are applicable:

- The DRX cycle is extended up to and beyond 10.24s in idle mode, with a maximum value of 2621.44 seconds (43.69 minutes); For NB-IoT, the maximum value of the DRX cycle is 10485.76 seconds (2.91 hours);

- The hyper SFN (H-SFN) is broadcast by the cell and increments by one when the SFN wraps around;

- Paging Hyperframe (PH) refers to the H-SFN in which the UE starts monitoring paging DRX during a Paging Time Window (PTW) used in ECM-IDLE. The PH is determined based on a formula that is known by the MME/AMF, UE and (ng-)eNB as a function of eDRX cycle and UE identity;

- During the PTW, the UE monitors paging for the duration of the PTW (as configured by NAS) or until a paging message is including the UE's NAS identity received for the UE, whichever is earlier. The possible starting offsets for the PTW are uniformly distributed within the PH and defined in TS 36.304 [11];

- MME/AMF uses the formulas defined in TS 36.304 [11] to determine the PH as well as the beginning of the PTW and sends the S1 paging request just before the occurrence of the start of PTW or during PTW to avoid storing paging messages in the (ng-)eNB;

- ETWS, CMAS, PWS requirement may not be met when a UE is in eDRX. For EAB, if the UE supports SIB14, when in extended DRX, it acquires SIB14 before establishing the RRC connection;

- When the eDRX cycle is longer than the system information modification period, the UE verifies that stored system information remains valid before establishing an RRC connection. Paging message can be used for system information change notification, when including *systemInfoModification-eDRX*, for a UE configured with eDRX cycle longer than the system information modification period.

NB-IoT UEs, BL UEs or UEs in enhanced coverage can use (G)WUS, when configured in the cell, to reduce the power consumption related to paging monitoring.

When GWUS is used in idle mode, the following are applicable:

- Multiple WUS groups, possibly distributed over multiple WUS resources, can be configured in the cell;

- If the UE supports WUS assistance information, the MME/AMF may provide the UE with UE paging probability information (see TS 24.301 [20] and TS 24.501 [91]);

- UE selects one WUS group based on its UE paging probability information and /or its UE NAS identity as defined in TS 36.304 [11];

- A common WUS group may be used to wake up all UEs monitoring the same WUS resource.

When (G)WUS is used in idle mode, the following are applicable:

- The WUS or WUS group is used to indicate that the UE shall monitor MPDCCH or NPDCCH to receive paging in that cell;

- For a UE not configured with extended DRX, the WUS or WUS group is associated to one paging occasion (N = 1);

- For a UE configured with extended DRX, the WUS or WUS group can be associated to one or multiple paging occasion(s) (N ≥ 1) in a PTW;

- If UE detects the WUS or WUS group, the UE shall monitor the following N paging occasions unless it has received a paging message;

- The paging operation in the MME is not aware of the use of the WUS in the eNB.

The timing between WUS and the paging occasion (PO) is illustrated in Figure 10.1.4-1. The timing between GWUS and the paging occasion (PO) is illustrated in Figure 10.1.4-2 and Figure 10.1.4-3. The UE can expect WUS repetitions during "Configured maximum WUS duration" but the actual WUS transmission can be shorter, e.g. for UE in good coverage. The UE does not monitor WUS during the non-zero "Gap".



Figure 10.1.4-1: Illustration of WUS timing



Figure 10.1.4-2: Illustration of GWUS timing for NB-IoT UEs

Gap

Configured maximum

WUS duration

PO

t

Configured maximum

WUS duration

WUS 2

f

WUS 3

WUS 1

WUS 0

Figure 10.1.4-3: Illustration of WUS timing for BL UEs and UEs in enhanced coverage

NOTE: WUS1/WUS3 could be higher or lower frequency than WUS0/WUS2.

For NB-IoT, UE in RRC\_IDLE receives paging on the anchor carrier or on a non anchor carrier based on system information.

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| Next change |

## 23.7a Support of Bandwidth Reduced Low Complexity UEs

A bandwidth reduced low complexity (BL) UE can operate in any LTE system bandwidth but with a limited channel bandwidth of 6 PRBs (corresponding to the maximum channel bandwidth available in a 1.4 MHz LTE system) in downlink and uplink. Interworking with NR is not supported by BL UE (e.g. functions like NR measurement reporting, reselection to NR, handover to NR, redirection to NR are not supported).

To enable higher data rates a BL UE can optionally support a larger maximum PDSCH/PUSCH channel bandwidth of 24 PRBs in downlink and a non-BL UE operating in enhanced coverage can optionally support a larger maximum PDSCH/PUSCH channel bandwidth of 24 or 96 PRBs in downlink, and 24 PRBs in uplink in connected mode for unicast transmission. Table 23.7.a-1 summarizes the maximum PDSCH/PUSCH bandwidth in connected mode for unicast transmission depending on the UE category and enhanced coverage mode (see clause 23.7b). The maximum PDSCH/PUSCH channel bandwidth is configured separately for PDSCH and PUSCH via dedicated RRC signaling.

Table 23.7a-1: Maximum PDSCH/PUSCH bandwidth (in PRBs)

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| UE category/CE mode | CE mode A | CE mode B |
| BL (Category M1) | 6/6 | 6/6 |
| BL (Category M2) | 24/24 | 24/6 |
| Non-BL (Category 0 and higher) | 96 (or 24)/24 | 96 (or 24)/6 |

A Category M2 BL UE supports a larger DL and UL maximum TBS size for unicast compared to a Category M1 BL UE. A Category M1 BL UE may support a larger UL maximum TBS size indicated by a separate UE capability.

A BL UE may access a cell only if the MIB of the cell indicates that scheduling information for SIB1 specific for BL UEs is scheduled. If not, the UE considers the cell as barred.

A BL UE receives a separate occurrence of system information blocks (sent using different time/frequency resources). A BL UE has a transport block size (TBS) limited to 1000 bit for broadcast. The BL UE determines the scheduling information for SIB1 specific for BL UEs based on information in MIB. Scheduling information for other SIBs is given in SIB1 specific for BL UEs. The BCCH modification period for BL UEs is a multiple of the BCCH modification period provided in SIB2. The SIB transmission occasions within an SI-window are provided in the SIB1 specific for BL UEs. A BL UE can acquire SI messages across SI windows. The maximum number of SI messages that can be acquired across SI windows is 4. A BL UE is not required to detect SIB change when in RRC\_CONNECTED.

A BL UE is paged based on paging occasions in time domain, and paging narrowbands in frequency domain. The starting subframe of a paging occasion is determined in the same way as the paging occasion in the legacy paging mechanism.

A set of PRACH resources (e.g. time, frequency, preamble), each associated with BL UEs in normal coverage, is provided in SIB. Number of PRACH repetitions and number of maximum preamble transmission attempts for BL UEs in normal coverage are provided in SIB. Time/frequency resources and repetition factor for random access response messages for BL UEs are derived from the used PRACH resources.

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| End of the change |