**3GPP TSG-RAN WG2 Meeting #110-e *draft\_R2-2005922***

**Online, 1st – 12th June 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.300** | **CR** | **1277** | **rev** | **3** | **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 TS 36.300 for Rel-16 NB-IoT | | | | | | | | | |
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| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NB\_IOTenh3-Core | | | | |  | ***Date:*** | | | 2020-06-xx |
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| ***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:*** | | The Rel-16 CR for NB-IoT Rel-16 additional enhancements was agreed in RAN#87.  Some details are missing and some cleanup is needed.  GWUS:  1. GWUS (or group WUS) is the name of the feature, but the actual signal or resource is still called WUS.  2. WUS/GWUS is applicable to idle mode only.  SON:  1. ANR measurement report is discarded upon RAT change and after 96 hours  2. RLF report is discarded upon reporting availability and returning to idle, RAT change, Power off or detach or 48 hours after failure detection.  PUR:  1. L1 ACK has been renamed RRC ACK in PUR configuration request  2. UE can also request the release of PUR  3. For the CP solution:   * It is up to eNB implementation how UE and PUR configuration are linked according to the configured PUR resources. * an optional 20-bit identifier can be provided to identify the PUR configuration in eNB.   Resource reservation for NR coexistence does not apply to PUR | | | | | | | | |
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| ***Summary of change:*** | | GWUS:  1. Change the resource name from GWUS to WUS  2. Clarify that UE uses (G)WUS only in RRC\_IDLE  SON: capture the additional conditions for discarding the ANR and RLF reports  PUR:  1. Change L1 ACK to RRC ACK in PUR Configuration Request  2. Clarify that UE can also request the release of PUR  NR coexistence: Clarify this applies to unicast transmission in connected mode | | | | | | | | |
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| ***Consequences if not approved:*** | | The specification is ambiguous or incomplete. | | | | | | | | |
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| ***Clauses affected:*** | | 7.3d.1, 7.3d.2, 10.1.4, 16.1.11, 22.3.4b, 22.4.5 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS 36.331 CR 4287  TS 36.321 CR 1472  TS 36.304 CR 0788 | | |
| ***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:*** | | rev2:  - (G)WUS: clarification it applies to paging in idlle mode  - NR coexistence: clarification it applies to unicast transmission in connected mode | | | | | | | | |

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| First 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. the

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.

For UEs using the Control Plane CIoT EPS/5GS optimisations, the (ng-)eNB may provide a PUR configuration ID with the PUR configuration. If available, the UE includes the PUR configuration ID in *RRCConnectionSetupComplete* message when establishing RRC connection(s) not using the PUR resource.

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.

NOTE 1: It is up to (ng-)eNB implementation how UE and PUR configuration are linked according to the configured PUR resources.

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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 RRC\_IDLE, 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 RRC\_IDLE, 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. 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 GWUS 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 |

### 16.1.11 Resource reservation for co-existence with NR

E-UTRAN may reserve resources in uplink and downlink on a NB-IoT non-anchor carrier to avoid resource overlap with NR when NB-IoT is deployed within an NR carrier. The resource reservation signalled to the UE is carrier specific and is for use in unicast transmission in connected mode.

For BL UEs or UEs in enhanced coverage, E-UTRAN may reserve resources in uplink and downlink to avoid resource overlap with NR when it is deployed within an NR carrier. The resource reservation signalled to the UE is cell specific and is for use in unicast transmission.

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| next change |

### 22.3.4b Automatic Neighbour Relation Function in NB-IoT

The ANR (Automatic Neighbour Relation) function relies on cells broadcasting their identity on global level, E-UTRAN Cell Global Identifier (ECGI).



Figure 22.3.4b-1: Automatic Neighbour Relation Function in case of NB-IoT

The purpose of SON/ANR reporting in NB-IoT is network optimisation. The measurements are performed when the UE is in RRC\_IDLE and reported next time the UE enters RRC\_CONNECTED. ANR measurement reporting is not supported when the UE uses the Control Plane CIoT EPS Optimisation.

The function works as follows:

The eNB serving cell A has an ANR function. During connected mode, the eNB can configure the UE to perform measurements on a frequency and read the CGI of the strongest cell if the quality is above a given RSRP threshold. The eNB may use different policies for instructing the UE to do measurements.

1 When releasing the RRC connection, the eNB configures the UE to perform ANR measurements on one or more frequencies. The RRC connection is released and the UE enters RRC\_IDLE.

When the UE is in RRC\_IDLE and remains camped on the cell from which the ANR measurement configuration was received, the UE performs the ANR measurements requested by the eNB:

2a For each of the configured frequency, the UE performs measurements, identifies the strongest cell and stores the cell measurement results for later reporting.

2b For each of the configured frequency, if the NRSRP of the strongest cell is above the configured threshold, the UE reads the ECGI, the TAC and all available PLMN ID(s) of the related neighbour cell and stores the information for later reporting.

NOTE: While performing an ANR measurement, the UE performs inter-frequency measurements on the configured frequency regardless of the measurement rules for cell re-selection and the relaxed monitoring measurement rules as specified in TS 36.304 [11].

When the UE establishes or resumes the RRC connection:

3 The UE reports the availability of an ANR report.

When the eNB receives the indication of the ANR report availability, the following sequence may be used whilst UE is in RRC\_CONNECTED mode:

4 The eNB requests the UE to provide the report.

5 The UE reports the stored cells and associated information.

The UE discards the ANR configuration and the ANR report when returning to RRC\_IDLE after it has indicated the availability of the ANR report, after 96 hours of receiving the configuration, upon power off, upon detach or upon RAT change.

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| next change |

### 22.4.5 Radio Link Failure report

The RLF Report from the UE can be used for both coverage optimisation and mobility robustness optimisation.

Except for NB-IoT, the UE stores the latest RLF or handover failure related information, and indicates RLF report availability at each subsequent LTE RRC connection (re-)establishment and handover to an LTE cell until the RLF report is fetched by the network or for 48 hours after the RLF or handover failure is detected.

Except for NB-IoT, the UE keeps the information during state transitions and RAT changes, and indicates RLF report availability again after it returns to the LTE RAT.

For NB-IoT, the UE stores the latest RLF related information and indicates RLF report availability at the subsequent RRC connections (re-)establishment. The UE discards the RLF report when returning to RRC\_IDLE after it has indicated RLF report availability, after 48 hours of the RLF detection, upon power off, upon detach or upon RAT change.

The UE only indicates RLF report availability and only provides the RLF report to the network if the current RPLMN is a PLMN that was present in the UE's EPLMN List or was the RPLMN at the time the RLF or handover failure was detected.UE reporting of RLF information is not supported for a NB-IoT UE using the Control Plane CIoT EPS Optimisation.