**3GPP TSG-RAN WG2 Meeting #111-e *R2-2008593***

**Online, 17th – 28th August 2020**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **36.304** | **CR** | **0796** | **rev** | **3** | **Current version:** | **16.1.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network | **X** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | System support for Wake Up Signal | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NB\_IOTenh2-Core, LTE\_eMTC4-Core,  NB\_IOTenh3-Core, LTE\_eMTC5-Core | | | | |  | ***Date:*** | | | 2020-09-07 |
|  |  | | | |  | |  | | |  |
| ***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)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | SA2 sent LS (S2-2001578, S2-2003217) indicating that SA2 has discussed the impact of WUS on the MME paging strategy and concluded that some MME paging strategies, e.g. always paging a UE in the entire TA list, may lead to increased power consumption for UEs using WUS.  SA2 has approved a CR which restricts the usage of WUS to the last used cell (i.e. the cell in which the UE’s RRC connection was last released/ suspended).  SA2 also sent LS (R2-2008544/S2-2006478) confirming the scenario where a UE could be unreachable for a period if it remains in the same cell, after a release occurs and the S1 connection was not established, and be better addressed at RAN level. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Specify that Paging with (Group) Wake up Signal is only used in the last used cell.  **Impact analysis**  Impacted functionality:  Paging with (Group) Wake Up Signal  Inter-operability:  If the UE is implemented according to this CR and the network is not, there is no inter-operability issue.  If the network is implemented according to the CR and the UE is not, the UE may misinterpret the non indication of WUS and miss the paging.  Backward compatibiliy:  The CR is considered mandatory to support (G)WUS. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Depending on MME paging strategy, (G)WUS may increase rather than decrease UE power consumption | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 7.4, 7.5.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 23.401 CR 3600, 3583  TS 23.501 CR 2407  TS 25.502 CR 2345  TS 36.300 CR 1265  TS 36.331 CR 4447 | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | Functionally, this CR is a mirror CR to CR 0795. It also applies to R16 GWUS and connection to 5GC. | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## 7.4 Paging with Wake Up Signal

Paging with Wake Up Signal is only used in the cell in which the UE most recently entered RRC\_IDLE triggered by:

- reception of *RRCEarlyDataComplete*; or

- reception of *RRCConnectionRelease* not including *noLastCellUpdate*; or

- reception of *RRCConnectionRelease* including *noLastCellUpdate* and the UE was using WUS in this cell prior to this RRC connection attempt.

If the UE is not using GWUS according to clause 7.5 and the UE supports WUS and WUS configuration is provided in system information, the UE shall monitor WUS using the WUS parameters provided in System Information. When DRX is used and the UE detects WUS the UE shall monitor the following PO. When extended DRX is used and the UE detects WUS the UE shall monitor the following *numPOs* POs or until a paging message including the UE's NAS identity is received, whichever is earlier. If the UE does not detect WUS the UE is not required to monitor the following PO(s). If the UE missed a WUS occasion (e.g. due to cell reselection), it monitors every PO until the start of next WUS or until the PTW ends, whichever is earlier.

- *numPOs* = Number of consecutive Paging Occasions (PO) mapped to one WUS provided in system information where (*numPOs*≥1).

The WUS configuration, provided in system information, includes time-offset between end of WUS and start of the first PO of the *numPOs* POs UE is required to monitor. The timeoffset in subframes, used to calculate the start of a subframe *g*0 (see TS 36.213 [6]), is defined as follows:

- for UE using DRX, it is the signalled *timeoffsetDRX*;

- for UE using eDRX, it is the signalled *timeoffset-eDRX-Short* if *timeoffset-eDRX-Long* is not broadcasted;

- for UE using eDRX, it is the value determined according to Table 7.4-1 if *timeoffset-eDRX-Long* is broadcasted

Table 7.4-1: Determination of GAP between end of WUS and associated PO

|  |  |  |  |
| --- | --- | --- | --- |
|  | | *timeoffset-eDRX-Long* | |
| *1000ms* | *2000ms* |
| *UE Reported wakeUpSignalMinGap-eDRX* | ***40ms or not reported*** | *timeoffset-eDRX-Short* | *timeoffset-eDRX-Short* |
| ***240ms*** | *timeoffset-eDRX-Short* | *timeoffset-eDRX-Short* |
| ***1000ms*** | *timeoffset-eDRX-Long* | *timeoffset-eDRX-Long* |
| ***2000ms*** | *timeoffset-eDRX-Short* | *timeoffset-eDRX-Long* |

The timeoffset is used to determine the actual subframe *g*0 as follows (taking into consideration resultant SFN and/or H-SFN wrap-around of this computation):

*g*0 = PO – timeoffset, where PO is the Paging Occasion subframe as defined in clause 7.1

For UE using eDRX, the same timeoffset applies between the end of WUS and associated first PO of the *numPOs* POs for all the WUS occurrences for a PTW.

The timeoffset, *g*0, is used to calculate the start of the WUS as defined in TS 36.213 [6].

## 7.5 Paging with Group Wake Up Signal

### 7.5.1 General

Paging with Group Wake Up Signal is only used in the cell in which the UE most recently entered RRC\_IDLE triggered by:

- reception of *RRCEarlyDataComplete*; or

- reception of *RRCConnectionRelease* not including *noLastCellUpdate*; or

- reception of *RRCConnectionRelease* including *noLastCellUpdate* and the UE was using WUS in this cell prior to this RRC connection attempt.

When the UE supports GWUS and GWUS configuration (*gwus-Config*) is provided in system information, the UE shall monitor GWUS using the GWUS parameters provided in System Information.

A UE supporting GWUS can be configured to monitor a group WUS and a common WUS. Upon detecting either of the WUS, UE shall monitor POs as defined in clause 7.4.

For NB-IoT, E-UTRAN may configure up to 2 WUS resources (numbered 0 and 1). The time offset, *g*0, from the end of WUS resource 0 to the start of corresponding PO is determined as defined in subclasue 7.4. When both *wus-Config-r15* and g*wus-Config-r16* are present, WUS resource 0 shares radio resources with *wus-Config-r15*.The time offset from the end of WUS resource 1 to the start of corresponding PO is sum of the time offset *g*0 and the maximum WUS duration.

UE selects the WUS group set as specified in clause 7.5.2. From the selected WUS group set, UE selects one WUS group as defined in subcaluse 7.5.3.

The timeoffset, *g*0, is used to calculate the start of the WUS as defined in TS 36.213 [6].