**3GPP TSG-RAN WG2 Meeting #110-eR2-2005880**

**Online, June 1st – June 12 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **36.304** | **CR** | **0789** | **rev** | **3** | **Current version:** | **16.0.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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| ***Title:*** | Corrections to WUS group for eMTC | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_eMTC5-Core | | | | |  |  | | | 2020-06-16 |
|  |  | | | |  | |  | | |  |
| ***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:*** | | To capture the remaining RAN2 agreements related to GWUS monitoring | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | New section for WUS Resource identification for BL UE and UE in enhanced coverage. Cell selection criteria changes for standalone case. | | | | | | | | |
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| ***Consequences if not approved:*** | | Rel-16 eMTC enhancements for GWUS will not be complete. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.2.3.2, 7.5.1, 7.5.x(new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 36.331 CR 4239 | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 36.300 CR 1277 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |

|  |  |
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| ***This CR's revision history:*** |  |

First Change

#### 5.2.3.2 Cell Selection Criterion

For NB-IoT the cell selection criterion is defined in clause 5.2.3.2a.

The cell selection criterion S in normal coverage is fulfilled when:

|  |
| --- |
| Srxlev > 0 AND Squal > 0 |

where:

|  |
| --- |
| Srxlev = Qrxlevmeas – (Qrxlevmin + Qrxlevminoffset) – Pcompensation - Qoffsettemp  Squal = Qqualmeas – (Qqualmin + Qqualminoffset) - Qoffsettemp |

where:

|  |  |
| --- | --- |
| Srxlev | Cell selection RX level value (dB) |
| Squal | Cell selection quality value (dB) |
| Qoffsettemp | Offset temporarily applied to a cell as specified in TS 36.331 [3] (dB) |
| Qrxlevmeas | Measured cell RX level value (RSRP) |
| Qqualmeas | Measured cell quality value (RSRQ) |
| Qrxlevmin | Minimum required RX level in the cell (dBm) |
| Qqualmin | Minimum required quality level in the cell (dB) |
| Qrxlevminoffset | Offset to the signalled Qrxlevmin taken into account in the Srxlev evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5] |
| Qqualminoffset | Offset to the signalled Qqualmin taken into account in the Squal evaluation as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5] |
| Pcompensation | If the UE supports the *additionalPmax* in the *NS-PmaxList*, if present, in SIB1, SIB3 and SIB5:  max(PEMAX1 –PPowerClass, 0) – (min(PEMAX2, PPowerClass) – min(PEMAX1, PPowerClass)) (dB);  else:  if PPowerClass is 14 dBm:  max(PEMAX1 –(PPowerClass – Poffset), 0) (dB);  else:  max(PEMAX1 –PPowerClass, 0) (dB) |
| PEMAX1, PEMAX2 | Maximum TX power level an UE may use when transmitting on the uplink in the cell (dBm) defined as PEMAX in TS 36.101 [33]. PEMAX1 and PEMAX2 are obtained from the *p-Max* and the *NS-PmaxList* respectively in SIB1, SIB3 and SIB5 as specified in TS 36.331 [3]. |
| PPowerClass | Maximum RF output power of the UE (dBm) according to the UE power class as defined in TS 36.101 [33] |

The signalled values Qrxlevminoffset and Qqualminoffset are only applied when a cell is evaluated for cell selection as a result of a periodic search for a higher priority PLMN while camped normally in a VPLMN TS 23.122 [5]. During this periodic search for higher priority PLMN the UE may check the S criteria of a cell using parameter values stored from a different cell of this higher priority PLMN.

If cell selection criterion S in normal coverage is not fulfilled for a cell, UE shall consider itself to be in enhanced coverage if the cell selection criterion S for enhanced coverage is fulfilled, where:

|  |  |
| --- | --- |
| Qrxlevmin | UE applies coverage specific value Qrxlevmin\_CE (dBm) |
| Qqualmin | UE applies coverage specific value Qqualmin\_CE (dB) |

If cell selection criteria S in normal coverage is fulfilled for a cell, UE may consider itself to be in enhanced coverage if *SystemInformationBlockType1* cannot be acquired but UE is able to acquire *MasterInformationBlock, SystemInformationBlockType1-BR* and *SystemInformationBlockType2*.

If cell selection criterion S in normal coverage is not fulfilled for a cell and UE does not consider itself in enhanced coverage based on coverage specific values Qrxlevmin\_CE and Qqualmin\_CE, UE shall consider itself to be in enhanced coverage if UE supports CE Mode B and CE mode B is not restricted by upper layers and the cell selection criterion S for enhanced coverage is fulfilled, where:

|  |  |
| --- | --- |
| Qrxlevmin | UE applies coverage specific value Qrxlevmin\_CE1 (dBm) |
| Qqualmin | UE applies coverage specific value Qqualmin\_CE1 (dB) |

For the UE in enhanced coverage, coverage specific values Qrxlevmin\_CE and Qqualmin\_CE (orQrxlevmin\_CE1 and Qqualmin\_CE1)are only applied for the suitability check in enhanced coverage (i.e. not used for measurement and reselection thresholds).

Next Change

7.4 Paging with Wake Up Signal

When 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 the UE supports GWUS and GWUS configuration is provided in system information, UE shall monitor WUS using the GWUS parameters provided in System Information as defined in clause 7.5. 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].

Next Change

## 7.5 Paging with Group Wake Up Signal

### 7.5.1 General

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.

For BL UEs and UEs in enhanced coverage, E-UTRAN may configure up to 4 WUS resources. The resource number, time and frequency location of these resources is determined as specified in subclause 7.5.x.

Next change

### 7.5.x WUS Resource Location for BL UEs and UEs in Enhanced coverage

A BL UE or UE in enhanced coverage determines the time/frequency location of WUS resources based on the number of configured WUS resources and the frequency location of WUS Resource 0 (. If *wus-Config* is present, frequency location for WUS Resource 0 is defined by *frequencyLocation* parameter in *wus-Config*. Otherwise, frequency location for WUS Resource 0 is defined by *resourceLocationWithoutWUS* in *gwus-Config*. The frequency location of other WUS Resources (Resource ID 1,2,3), based on frequency location of WUS Resource 0, is given in Table 7.5.x-1.

Table 7.5.x-1: WUS Resource frequency location

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***WUS Resource***  ***()*** | ***Frequency location of WUS Resource ID 0*** | | | |
| ***n0*** | ***n2*** | | ***n4 (Note 1)*** |
| ***NB frequency < centre frequency*** | ***NB frequency > centre frequency*** |
| WUS Resource 1,3 | n2 | n4 | n0 | n2 |
| WUS Resource 2 | n0 | n2 | n2 | n4 |
| WUS Resource 2  (Note 2) | n4 | n0 | n4 | n0 |
| Note 1: This column is applicable if *wus-Config* is present.  Note 2: This row is applicable if *resourceLocationWithWUS* is primary3FDM | | | | |

The time offset, *g*0, from the end of WUS resource 0 and WUS resource 1 to the start of corresponding PO is determined as defined in subclause 7.4. The time offset from the end of WUS resource 2 and WUS resource 3 to the start of corresponding PO is sum of the time offset *g*0 and the maximum WUS duration for all value of Resource Location in *resourceMappingPattern* except when *resourceLocationWithWUS* is set to *primary3FDM* . The time offset, *g*0, for WUS resource 2 is same as WUS resource 0 and 1 if *resourceLocationWithWUS* is set to *primary3FDM*.

The resource pattern ID (rp-ID) which indicates the WUS Resources applicable for WUS Groups is derived based on *resourceMappingPattern* and the configured number of WUS resources as follows:

If *resourceLocationWithWUS* is configured

rp-ID = 2\*(maxWR – 1) if *resourceLocationWithWUS* is set to *primary*

rp-ID= 2\*maxWR - 1 if *resourceLocationWithWUS* is set to *secondary*

rp-ID=7 if *resourceLocationWithWUS* is set to *primary3FDM*.

If *resourceLocationWithoutWUS* is configured

rp-ID = 2\*(maxWR-1)

where maxWR is *maxWR* is the total number of WUS resources configured in *numGroupsList* for the gap.

The WUS Resource IDs corresponding to the resource pattern ID are determined as defined in Table 7.5.x-2.

Table 7.5.x-2: WUS Resources applicable for Resource Pattern

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **Resource Pattern\_ID** | | | | | | | |
| ***0*** | ***1*** | ***2*** | ***3*** | ***4*** | ***5*** | ***6*** | ***7*** |
| **WUS Resource**  ***()*** | ***0*** | X |  | X |  | X |  | X | X |
| ***1*** |  | X | X | X | X | X | X | X |
| ***2*** |  |  |  | X | X | X | X | X |
| ***3*** |  |  |  |  |  | X | X |  |

If = 0 is not used, the first entry in the *numGroupsList* corresponds to = 1. Otherwise, is the index of the WUS resources in *numGroupsList*.

End of Changes