**3GPP TSG-2 Meeting #111-e  *draft\_R2-2008313***

**Online, 17th - 28th August 2020**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **36.304** | **CR** | **0808** | **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 NB-IoT Rel-16 enhancements |
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| ***Source to WG:*** | Huawei, HiSilicon, ZTE Corporation, Sanechips, Qualcomm Incorporated |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | NB\_IOTenh3-Core |  | ***Date:*** | 2020-09-04 |
|  |  |  |  |  |
| ***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:*** | 1. Rel-16 NB-IoT enhancements introduce connection to 5GC. However, Camping on E-UTRA connected to 5GC is excluded of NB-IoT functionality in Idle Mode.2. UE specific DRX is supported for NB-IoT in Rel-16, but there is still the description of “UE specific DRX is not applicable for NB-IoT”, which should be deleted.3. In section 7.6, Index i\_s is defined as a parameter used in the formula calculating PF, which is not correct.4. In section 7.6, the order of the parameters in the formula calculating PO\_Index is different from usual. |
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| ***Summary of change:*** | 1. In section 4.1, remove ‘Camping on E-UTRA connected to 5GC’ from the list of excluded functionalities.2. In section 7.1, remove the sentence “UE specific DRX is not applicable for NB-IoT”.3. In section 7.6, correct the indentation of the bullet defining index i\_s and clarify the definition.4. In section 7.6, change the order of the parameters in the formula calculating PO\_Index so that it looks similar to legacy equation for PO\_Index.5. Minor editorials corrections**Impact analysis**Impacted functionality: Connection to 5GCUE specific DRXNRS presence on non-anchor carrierInter-operability:Change 1: The CR only impacts the UE idle mode procedure. There is no interoperability issue.Change 2: The CR corrects misalignment with the following paragraph. There is no interoperability issue.Change 3 – 5 : Editorial  |
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| ***Consequences if not approved:*** | The specification is incorrect or ambiguous. |
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| ***Clauses affected:*** | 4.4, 7.1, 7.6 |
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|  | **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:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| First change |

## 4.4 NB-IoT functionality in Idle Mode

This specification is applicable to NB-IoT, except for the following functionality which is not applicable to NB-IoT:

- Acceptable cell

- Accessibility measurements

- Access Control based on ACDC categories

- Camped on Any cell state

- CSG, including support for manual CSG selection and CSG or Hybrid cell related functionality in PLMN selection, or HNB name (SIB9), Cell selection and Cell reselection.

- Emergency call

- E-UTRAN Inter-frequency Redistribution procedure

- Inter-RAT Cell Selection and Reselection including measurements in other RATs

- Logged measurements

- Mobility History Information

- Mobility states of a UE

- Priority based reselection

- Public warning system including CMAS, ETWS, PWS.

- RAN-assisted WLAN interworking

- RRC\_INACTIVE state

- Sidelink operation

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| Next change |

## 7.1 Discontinuous Reception for paging

The UE may use Discontinuous Reception (DRX) in idle mode in order to reduce power consumption. One Paging Occasion (PO) is a subframe where there may be P-RNTI transmitted on PDCCH or MPDCCH or, for NB-IoT on NPDCCH addressing the paging message. In P-RNTI transmitted on MPDCCH case, PO refers to the starting subframe of MPDCCH repetitions. In case of P-RNTI transmitted on NPDCCH, PO refers to the starting subframe of NPDCCH repetitions unless subframe determined by PO is not a valid NB-IoT downlink subframe then the first valid NB-IoT downlink subframe after PO is the starting subframe of the NPDCCH repetitions. The paging message is same for both RAN initiated paging and CN initiated paging.

The UE initiates RRC Connection Resume procedure upon receiving RAN paging. If the UE receives a CN initiated paging in RRC\_INACTIVE state, the UE moves to RRC\_IDLE and informs NAS.

One Paging Frame (PF) is one Radio Frame, which may contain one or multiple Paging Occasion(s). When DRX is used the UE needs only to monitor one PO per DRX cycle.

One Paging Narrowband (PNB) is one narrowband, on which the UE performs the paging message reception.

PF, PO, and PNB are determined by following formulae using the DRX parameters provided in System Information:

PF is given by following equation:

SFN mod T= (T div N)\*(UE\_ID mod N)

Index i\_s pointing to PO from subframe pattern defined in 7.2 will be derived from following calculation:

i\_s = floor(UE\_ID/N) mod Ns

If P-RNTI is monitored on MPDCCH, the PNB is determined by the following equation:

PNB = floor(UE\_ID/(N\*Ns)) mod Nn

If P-RNTI is monitored on NPDCCH and the UE supports paging on a non-anchor carrier, and if paging configuration for non-anchor carrier is provided in system information, then the paging carrier is determined by the paging carrier with smallest index n (0 ≤ n ≤ Nn-1) fulfilling the following equation:

floor(UE\_ID/(N\*Ns)) mod W < W(0) + W(1) + … + W(n)

System Information DRX parameters stored in the UE shall be updated locally in the UE whenever the DRX parameter values are changed in SI. If the UE has no IMSI, for instance when making an emergency call without USIM, the UE shall use as default identity UE\_ID = 0 in the PF, i\_s, and PNB formulas above. If the UE has no 5G-S-TMSI, for instance when the UE has not yet registered onto the network, the UE shall use as default identity UE\_ID = 0 in the PF and i\_s formulas above.

The following Parameters are used for the calculation of the PF, i\_s, PNB, and the NB-IoT paging carrier:

- T: DRX cycle of the UE.

 Except for NB-IoT: If a UE specific extended DRX value of 512 radio frames is configured by upper layers according to 7.3, T =512. Otherwise, T is determined by the shortest of the UE specific DRX value, if allocated by upper layers, and a default DRX value broadcast in system information. If UE specific DRX is not configured by upper layers, the default value is applied. In RRC\_INACTIVE state, if extended DRX is not configured by upper layers as defined in 7.3, T is determined by the shortest of the RAN paging cycle, the UE specific paging cycle, and the default paging cycle, if allocated by upper layers. Otherwise, in RRC\_INACTIVE state when extended DRX is configured by upper layers, T is determined by the shortest of the RAN paging cycle, the UE specific paging cycle, if allocated by upper layers and the default paging cycle during the PTW as defined in 7.3, and by the RAN paging cycle outside the PTW.

 For NB-IoT: If UE specific DRX value is allocated by upper layers and minimum UE specific DRX value is broadcast in system information, T = min (default DRX value, max (UE specific DRX value, minimum UE specific DRX value broadcast in system information)). If UE specific DRX is not configured by upper layers or if the minimum UE specific DRX value is not broadcast in system information, the default DRX value is applied.

- nB: 4T, 2T, T, T/2, T/4, T/8, T/16, T/32, T/64, T/128, and T/256, and for NB-IoT also T/512, and T/1024.

- N: min(T,nB)

- Ns: max(1,nB/T)

- Nn: number of paging narrowbands (for P-RNTI monitored on MPDCCH) or paging carriers (for P-RNTI monitored on NPDCCH) determined as follows:

If UE supports GWUS and *gwus-Config* is present in system information:

this is the number of paging narrowbands (paging carriers) that are configured with GWUS.

else:

this is the number of paging narrowbands (paging carriers) provided in system information.

- UE\_ID:

If the UE supports E-UTRA connected to 5GC and NAS indicated to use 5GC for the selected cell:

5G-S-TMSI mod 1024, if P-RNTI is monitored on PDCCH.

5G-S-TMSI mod 16384, if P-RNTI is monitored on NPDCCH or MPDCCH.

else

IMSI mod 1024, if P-RNTI is monitored on PDCCH.

IMSI mod 4096, if P-RNTI is monitored on NPDCCH.

IMSI mod 16384, if P-RNTI is monitored on MPDCCH or if P-RNTI is monitored on NPDCCH and the UE supports paging on a non-anchor carrier, and if paging configuration for non-anchor carrier is provided in system information.

- W(i): Weight for NB-IoT paging carrier i.

- W: Total weight of all NB-IoT paging carriers, i.e. W = W(0) + W(1) + … + W(Nn-1). If GWUS is configured, Total weight of all NB-IoT paging carriers configured with GWUS.

IMSI is given as sequence of digits of type Integer (0..9), IMSI shall in the formulae above be interpreted as a decimal integer number, where the first digit given in the sequence represents the highest order digit.

For example:

 IMSI = 12 (digit1=1, digit2=2)

In the calculations, this shall be interpreted as the decimal integer "12", not "1x16+2 = 18".

5G-S-TMSI is a 48 bit long bit string as defined in TS 23.501 [39]. 5G-S-TMSI shall in the PF and i\_s formulae above be interpreted as a binary number where the left most bit represents the most significant bit.

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| Next change |

## 7.6 NRS presence on non-anchor paging carrier in NB-IoT

For FDD, when *nrs-NonAnchorConfig* is signalled in system information, the POs with associated NRS are determined using the DRX parameters broadcast in *systeminformationBlockType2-NB*:

- T is the value of *defaultPagingCycle* broadcast in system information.

- nB is the value corresponding to *nB* broadcast in system information: 4T, 2T, T, T/2, T/4, T/8, T/16, T/32, T/64, T/128, T/256, T/512, and T/1024.

The POs are determined by:

 - Paging Frame (PF) given by: SFN mod T= (T div N) \* k

where:

- N: min(T, nB)

- k: 0, 1, .., N-1

-    Paging subframe given by index i\_s

where:

- Index i\_s: values pointing to a subframe for which a PO is defined in the row referenced by Ns in clause 7.2.

- Ns: max(1, nB/T)

The POs with associated NRS are determined as follows:

- if nB is equal to 4T, 2T, T or T/2:

POs for which R = 1 have associated NRS

where:

R = (PO\_Index+ Offset) mod 2

where:

- PO\_Index = (SFN \* nB/T + i\_s) mod nB

- Offset = (FLOOR ((SFN + 1024\*H-SFN) / T)) mod 2

- SFN is the SFN corresponding to the PO

- H-SFN is the H-SFN corresponding to the PO

- i\_s is the index i\_s corresponding to the PO

- else:

all POs have associated NRS.