**3GPP TSG-RAN WG2 Meeting #117 electronic R2-220**

**Electronic Meeting, Feb 21– Mar 03, 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **36.321** | **CR** | **1535** | **rev** | **-(to be 1)** | **Current version:** | **16.6.0** |  |
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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:***  | Introduction of carrier specific NRSRP thresholds for NPRACH resource selection |
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| ***Source to WG:*** | CMCC |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NB\_IOTenh-Core, TEI16 |  | ***Date:*** | 2022-03-10 |
|  |  |  |  |  |
| ***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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | In real NB-IoT network, single-carrier cells are deployed to meet coverage requirements for most scenarios, and multi-carriers cells are deployed for concurrent service scenarios to meet capacity expansion requirements. The anchor carriers are deployed with inter frequency to reduce interference among cells, and it’s generally that the non-anchor carriers in one cell are deployed on the same frequency as the anchor carrier in the neighbour cells. The downlink narrowband reference-signal EPRE (Energy Per Resource Element) of the non-anchor carriers is generally lower relative to the downlink narrowband reference-signal EPRE of the anchor carrier to reduce the interference between the non-anchor carrier and the neighbour cells using the same frequency. Due to lower EPRE of non-anchor carrier than EPRE of anchor carrier, coverage of non-anchor carrier is shrunken than the anchor carrier. Non-anchor carrier suffered more UL interference from the same frequency neighborhood cell with uplink service terminals. This may degrade uplink performance. According to the actual coverage, there is the overlapping area that the UE’s CE levels is different between on the anchor carrier and non-anchor carriers, and CE level on the non-anchor carriers is usually worse than the CE level for the anchor carrier. The UE may fail to access to the non-anchor carrier or try more times to access to the non-anchor carrier with the nprach resource based on the anchor carrier’s CE level.  |
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| ***Summary of change:*** | Modify 5.1.2 to exclude the non-anchor carriers with different CEL than the anchor carrier when building the list of NPRACH resources, if the UE supports carrier specific NRSRP thresholds for NPRACH resource selection and rsrp-ThresholdsPrachnfoList-r16.**Impact analysis**Impacted functionality:Random Access for multi-carriersInter-operability:If the network implements the change but not the UE, there is no inter-operability issue.If the UE implements the change but not the network, there is no inter-operability issue. Implementation of this CR from Rel-14 will not cause interoperability issues. |
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| ***Consequences if not approved:*** | In some cases the UE may use more repetitions during random access or even fail random access on a non-anchor carrier with the NPRACH resource based on the anchor carrier’s CE level thresholds. |
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| ***Clauses affected:*** | 5.1.2 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 36.331 CR 4777TS 36.306 CR 1844 |
| ***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:*** |  |

*Start of Change*

/\*Partially omitted\*/

### 5.1.2 Random Access Resource selection

The Random Access Resource selection procedure shall be performed as follows:

- for BL UEs or UEs in enhanced coverage or NB-IoT UEs, if EDT is initiated by the upper layers:

- if the message size (UL data available for transmission plus MAC header and, where required, MAC control elements) is larger than the TB size signalled in *edt-TBS* for the selected enhanced coverage level for EDT; or

- if the PRACH resource associated with EDT for the selected enhanced coverage level is not available:

- indicate to upper layers that EDT is cancelled;

- for BL UEs or UEs in enhanced coverage, select the PRACH resource set corresponding to the selected enhanced coverage level. For EDT, the PRACH resource set shall correspond to the set associated with EDT for the selected enhanced coverage level.

- if, except for NB-IoT, *ra-PreambleIndex* (Random Access Preamble) and *ra-PRACH-MaskIndex* (PRACH Mask Index) have been explicitly signalled and *ra-PreambleIndex* is not 000000:

- the Random Access Preamble and the PRACH Mask Index are those explicitly signalled;

- else if, for NB-IoT, *ra-PreambleIndex* (Random Access Preamble) and PRACH resource have been explicitly signalled:

- the PRACH resource is that explicitly signalled;

- if the *ra-PreambleIndex* signalled is not 000000:

- if *ra-CFRA-Config* is configured:

- the Random Access Preamble is set to *nprach-SubcarrierOffset* + *nprach-NumCBRA-StartSubcarriers* + (*ra-PreambleIndex* modulo (*nprach-NumSubcarriers* - *nprach-NumCBRA-StartSubcarriers*)), where *nprach-SubcarrierOffset*, *nprach-NumCBRA-StartSubcarriers* and *nprach-NumSubcarriers* are parameters in the currently used PRACH resource.

- else:

- the Random Access Preamble is set to *nprach-SubcarrierOffset* + (*ra-PreambleIndex* modulo *nprach-NumSubcarriers*), where *nprach-SubcarrierOffset* and *nprach-NumSubcarriers* are parameters in the currently used PRACH resource.

- else:

- select the Random Access Preamble group according to the PRACH resource and the support for multi-tone Msg3 transmission. A UE supporting multi-tone Msg3 shall only select the single-tone Msg3 Random Access Preambles group if there is no multi-tone Msg3 Random Access Preambles group.

- randomly select a Random Access Preamble within the selected group.

- else the Random Access Preamble shall be selected by the MAC entity as follows:

- if the UE is a BL UE or UE in enhanced coverage and EDT is initiated:

- select the Random Access Preambles group corresponding to PRACH resource for EDT for the selected enhanced coverage level.

- else if the UE is a BL UE or UE in enhanced coverage and Random Access Preamble group B does not exist:

- select the Random Access Preambles group corresponding to the selected enhanced coverage level.

- else if the UE is an NB-IoT UE:

- if the UE supports carrier specific NRSRP thresholds for NPRACH resource selection and *rsrp-ThresholdsPrachInfoList-r16* is signalled for a carrier in *ul-ConfigList*:

- if the enhanced coverage level of the carrier determined using *rsrp-ThresholdsPrachInfoList-r16* is different from the selected enhanced coverage level for the anchor carrier:

 - do not consider the PRACH resource on this carrier for PRACH resource selection.

- randomly select one of the PRACH resources corresponding to the selected enhanced coverage level according to the configured probability distribution, and select the Random Access Preambles group corresponding to the PRACH resource and the support for multi-tone Msg3 transmission. A UE supporting multi-tone Msg3 shall only select the single-tone Msg3 Random Access Preambles group if there is no multi-tone Msg3 Random Access Preambles group. For EDT, the PRACH resource shall correspond to resource associated with EDT for the selected enhanced coverage level.

- else if Msg3 has not yet been transmitted, the MAC entity shall:

- if Random Access Preambles group B exists and any of the following events occur:

- the potential message size (UL data available for transmission plus MAC header and, where required, MAC control elements) is greater than *messageSizeGroupA* and the pathloss is less than PCMAX,c (of the Serving Cell performing the Random Access Procedure) – *preambleInitialReceivedTargetPower* – *deltaPreambleMsg3* – *messagePowerOffsetGroupB*;

- the Random Access procedure was initiated for the CCCH logical channel and the CCCH SDU size plus MAC header is greater than *messageSizeGroupA*;

- select the Random Access Preambles group B;

- else:

- select the Random Access Preambles group A.

- else, if Msg3 is being retransmitted, the MAC entity shall:

- select the same group of Random Access Preambles as was used for the preamble transmission attempt corresponding to the first transmission of Msg3.

- randomly select a Random Access Preamble within the selected group. The random function shall be such that each of the allowed selections can be chosen with equal probability;

- except for NB-IoT, set PRACH Mask Index to 0.

- determine the next available subframe containing PRACH permitted by the restrictions given by the *prach-ConfigIndex* (except for NB-IoT)*,* the PRACH Mask Index (except for NB-IoT, see clause 7.3), physical layer timing requirements, as specified in TS 36.213 [2], and in case of NB-IoT, the subframes occupied by PRACH resources related to a higher enhanced coverage level (a MAC entity may take into account the possible occurrence of measurement gaps when determining the next available PRACH subframe);

- except for NB-IoT:

- if the transmission mode is TDD and the PRACH Mask Index is equal to zero:

- if *ra-PreambleIndex* was explicitly signalled and it was not 000000 (i.e., not selected by MAC):

- randomly select, with equal probability, one PRACH from the PRACHs available in the determined subframe.

- else:

- randomly select, with equal probability, one PRACH from the PRACHs available in the determined subframe and the next two consecutive subframes.

- else:

- determine a PRACH within the determined subframe in accordance with the requirements of the PRACH Mask Index, if any.

- for NB-IoT UEs, BL UEs or UEs in enhanced coverage, select the *ra-ResponseWindowSize* and *mac-ContentionResolutionTimer* corresponding to the selected enhanced coverage level and PRACH.

- proceed to the transmission of the Random Access Preamble (see clause 5.1.3).

*Next Change*

Annex D (normative):
List of CRs Containing Early Implementable Features and Corrections

This annex lists the Change Requests (CRs) whose changes may be implemented by a UE of an earlier release than which the CR was approved in (i.e. CRs that contain on their coversheets the sentence "Implementation of this CR from Rel-N will not cause interoperability issues").

**Table D-1: List of CRs Containing Early Implementable Features and Corrections**

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| **TDoc Number (RP-xxxxxx): CR Title** | **CR Number(s)** | **CR Revision Number(s)** | **Earliest Implementable Release** | **Additional Information** |
| RP-181232: Clarifying PDCCH Period Definition | 1300 | 2 | Release 13  |  |
| RP-181961: Defining PDCCH-Subframes for NB-IoT UE | 1327 | 1 | Release 13 |  |
| RP-191385: Clarification of Length field for DPR | 1450 | 1 | Release 13 |  |
| RP-192941: Clarification of PDCCH monitoring when not fully aligned with PDCCH periods | 1459 | 2 | Release 13 |  |
| RP-210700: Recommended bit rate query handling at MAC reset | 1521 | 1 | Release 14 |  |
| RP-22xxxx: Introduction of carrier specific NRSRP thresholds for NPRACH resource selection | 1535 | - | Release 16 |  |
| NOTE 1: In case a CR has mirror CR(s), the mirror CR(s) are not listed.NOTE 2: The Additional Information column briefly describes the content of a CR in cases where the CR title may not be descriptive enough. If the CR is descriptive enough, then the Additional Information column may be left blank. |

*End of Change*