**3GPP TSG-RAN WG2 Meeting #117 electronic R2-22**

**Electronic Meeting, Feb 21– Mar 3, 2022**

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| --- |
| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **36.331** | **CR** | **draft** | **rev** | **-** | **Current version:** | **16.7.0** |  |
|  |
| *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 |  | Radio Access Network | **X** | Core Network |  |

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| --- |
|  |
| ***Title:***  | Solution for random access issue on multiCarrier in NB-IoT |
|  |  |
| ***Source to WG:*** | CMCC |
| ***Source to TSG:*** | RAN2 |
|  |  |
| ***Work item code:*** | NB\_IOTenh4\_LTE\_eMTC6-Core |  | ***Date:*** | 2022-02-21 |
|  |  |  |  |  |
| ***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)* |
|  |  |
| ***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.  |
|  |  |
| ***Summary of change:*** | Modify the 6.7.3.2 to add the RSRP Threshold for each non-anchor carrier in the IE NPRACH-ConfigSIB-NB1. **Impact analysis**
2. Impacted functionality:
3. Random Access
4. Inter-operability:

The coverage level on the non-anchor carriers can be determined by the RSRP Threshold of the non-anchor. |
|  |  |
| ***Consequences if not approved:*** | 1. Due to lower EPRE of non-anchor carrier than EPRE of anchor carrier, shrunken coverage of non-anchor carrier may result in MSG2 failure if same *npdcch-NumRepetitions-RA-r14* is configured for anchor carrier and non-anchor carrier. Non-anchor carrier is suffered more UL interference from the same frequency neighbor cell with uplink service terminals. This may degrade uplink performance, e.g., MSG 1 failure on non-anchor carrier.
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|  |  |
| ***Clauses affected:*** | 6.7.3.2 |
|  |  |
|  | **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 ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*Start of Change*

#### 6.7.3.2 NB-IoT Radio resource control information elements

/\*Partially omitted\*/

#### – *NPRACH-ConfigSIB-NB*

The IE *NPRACH-ConfigSIB-NB* is used to specify the NPRACH configuration for the anchor and non-anchor carriers.

*NPRACH-ConfigSIB-NB* information elements

-- ASN1START

NPRACH-ConfigSIB-NB-r13 ::= SEQUENCE {

 nprach-CP-Length-r13 ENUMERATED {us66dot7, us266dot7},

 rsrp-ThresholdsPrachInfoList-r13 RSRP-ThresholdsNPRACH-InfoList-NB-r13 OPTIONAL, -- Need OR

 nprach-ParametersList-r13 NPRACH-ParametersList-NB-r13

}

NPRACH-ConfigSIB-NB-v1330 ::= SEQUENCE {

 nprach-ParametersList-v1330 NPRACH-ParametersList-NB-v1330

}

NPRACH-ConfigSIB-NB-v1450 ::= SEQUENCE {

 maxNumPreambleAttemptCE-r14 ENUMERATED {n3, n4, n5, n6, n7, n8, n10, spare1}

}

NPRACH-ConfigSIB-NB-v1530 ::= SEQUENCE {

 tdd-Parameters-r15 SEQUENCE {

 nprach-PreambleFormat-r15 ENUMERATED {

 fmt0, fmt1, fmt2, fmt0-a, fmt1-a},

 dummy ENUMERATED {

 n1, n2, n4, n8, n16, n32, n64, n128,

 n256, n512, n1024},

 nprach-ParametersListTDD-r15 NPRACH-ParametersListTDD-NB-r15

 } OPTIONAL, -- Cond TDD

 fmt2-Parameters-r15 SEQUENCE {

 nprach-ParametersListFmt2-r15 NPRACH-ParametersListFmt2-NB-r15 OPTIONAL, -- Need OR

 nprach-ParametersListFmt2EDT-r15 NPRACH-ParametersListFmt2-NB-r15 OPTIONAL -- Cond EDT2

 } OPTIONAL, -- Need OR

 edt-Parameters-r15 SEQUENCE {

 edt-SmallTBS-Subset-r15 ENUMERATED {true} OPTIONAL, -- Need OR

 edt-TBS-InfoList-r15 EDT-TBS-InfoList-NB-r15,

 nprach-ParametersListEDT-r15 NPRACH-ParametersList-NB-r14 OPTIONAL -- Need OR

 } OPTIONAL -- Cond EDT1

}

NPRACH-ConfigSIB-NB-v1550 ::= SEQUENCE {

 tdd-Parameters-v1550 SEQUENCE {

 nprach-ParametersListTDD-v1550 NPRACH-ParametersListTDD-NB-v1550

 }

}

NPRACH-ConfigSIB-NB-v16xy ::= SEQUENCE {

rsrp-ThresholdsPrachNonAnchorInfoList-r16 RSRP-ThresholdsNPRACH-NonAnchorInfoList-NB-r16 OPTIONAL -- Need OR

}

NPRACH-ParametersList-NB-r13 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF NPRACH-Parameters-NB-r13

NPRACH-ParametersList-NB-v1330 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF NPRACH-Parameters-NB-v1330

NPRACH-Parameters-NB-r13::= SEQUENCE {

 nprach-Periodicity-r13 ENUMERATED {ms40, ms80, ms160, ms240,

 ms320, ms640, ms1280, ms2560},

 nprach-StartTime-r13 ENUMERATED {ms8, ms16, ms32, ms64,

 ms128, ms256, ms512, ms1024},

 nprach-SubcarrierOffset-r13 ENUMERATED {n0, n12, n24, n36, n2, n18, n34, spare1},

 nprach-NumSubcarriers-r13 ENUMERATED {n12, n24, n36, n48},

 nprach-SubcarrierMSG3-RangeStart-r13 ENUMERATED {zero, oneThird, twoThird, one},

 maxNumPreambleAttemptCE-r13 ENUMERATED {n3, n4, n5, n6, n7, n8, n10, spare1},

 numRepetitionsPerPreambleAttempt-r13 ENUMERATED {n1, n2, n4, n8, n16, n32, n64, n128},

 npdcch-NumRepetitions-RA-r13 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

 r256, r512, r1024, r2048,

 spare4, spare3, spare2, spare1},

 npdcch-StartSF-CSS-RA-r13 ENUMERATED {v1dot5, v2, v4, v8, v16, v32, v48, v64},

 npdcch-Offset-RA-r13 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

}

NPRACH-Parameters-NB-v1330 ::= SEQUENCE {

 nprach-NumCBRA-StartSubcarriers-r13 ENUMERATED {n8, n10, n11, n12, n20, n22, n23, n24,

 n32, n34, n35, n36, n40, n44, n46, n48}

}

NPRACH-ParametersList-NB-r14 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF

 NPRACH-Parameters-NB-r14

NPRACH-Parameters-NB-r14 ::= SEQUENCE {

 nprach-Parameters-r14 SEQUENCE {

 nprach-Periodicity-r14 ENUMERATED {ms40, ms80, ms160, ms240,

 ms320, ms640, ms1280, ms2560}

 OPTIONAL, -- NEED OP

 nprach-StartTime-r14 ENUMERATED {ms8, ms16, ms32, ms64,

 ms128, ms256, ms512, ms1024}

 OPTIONAL, -- NEED OP

 nprach-SubcarrierOffset-r14 ENUMERATED {n0, n12, n24, n36, n2, n18, n34, spare1}

 OPTIONAL, -- NEED OP

 nprach-NumSubcarriers-r14 ENUMERATED {n12, n24, n36, n48}

 OPTIONAL, -- NEED OP

 nprach-SubcarrierMSG3-RangeStart-r14 ENUMERATED {zero, oneThird, twoThird, one}

 OPTIONAL, -- NEED OP

 npdcch-NumRepetitions-RA-r14 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

 r256, r512, r1024, r2048,

 spare4, spare3, spare2, spare1}

 OPTIONAL, -- NEED OP

 npdcch-StartSF-CSS-RA-r14 ENUMERATED {v1dot5, v2, v4, v8, v16, v32, v48, v64}

 OPTIONAL, -- NEED OP

 npdcch-Offset-RA-r14 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

 OPTIONAL, -- NEED OP

 nprach-NumCBRA-StartSubcarriers-r14 ENUMERATED {n8, n10, n11, n12, n20, n22, n23, n24,

 n32, n34, n35, n36, n40, n44, n46, n48}

 OPTIONAL, -- NEED OP

 npdcch-CarrierIndex-r14 INTEGER (1..maxNonAnchorCarriers-NB-r14)

 OPTIONAL, -- Need OP

 ...

 } OPTIONAL -- Need OR

}

NPRACH-ParametersListTDD-NB-r15 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF

 NPRACH-ParametersTDD-NB-r15

NPRACH-ParametersTDD-NB-r15 ::= SEQUENCE {

 nprach-Parameters-r15 SEQUENCE {

 nprach-Periodicity-r15 ENUMERATED {ms80, ms160, ms320, ms640,

 ms1280, ms2560, ms5120, ms10240}

 OPTIONAL, -- NEED OP

 nprach-StartTime-r15 ENUMERATED {ms10, ms20, ms40, ms80,

 ms160, ms320, ms640, ms1280,

 ms2560, ms5120, spare6, spare5,

 spare4, spare3, spare2, spare1}

 OPTIONAL, -- NEED OP

 nprach-SubcarrierOffset-r15 ENUMERATED {n0, n12, n24, n36, n2, n18, n34, spare1}

 OPTIONAL, -- NEED OP

 nprach-NumSubcarriers-r15 ENUMERATED {n12, n24, n36, n48}

 OPTIONAL, -- NEED OP

 nprach-SubcarrierMSG3-RangeStart-r15 ENUMERATED {zero, oneThird, twoThird, one}

 OPTIONAL, -- NEED OP

 npdcch-NumRepetitions-RA-r15 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

 r256, r512, r1024, r2048,

 spare4, spare3, spare2, spare1}

 OPTIONAL, -- NEED OP

 npdcch-StartSF-CSS-RA-r15 ENUMERATED {v4, v8, v16, v32, v48, v64, v96, v128}

 OPTIONAL, -- NEED OP

 npdcch-Offset-RA-r15 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

 OPTIONAL, -- NEED OP

 nprach-NumCBRA-StartSubcarriers-r15 ENUMERATED {n8, n10, n11, n12, n20, n22, n23, n24,

 n32, n34, n35, n36, n40, n44, n46, n48}

 OPTIONAL, -- NEED OP

 ...

 } OPTIONAL -- Need OR

}

NPRACH-ParametersListTDD-NB-v1550 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF

 NPRACH-ParametersTDD-NB-v1550

NPRACH-ParametersTDD-NB-v1550 ::= SEQUENCE {

 maxNumPreambleAttemptCE-v1550 ENUMERATED {n3, n4, n5, n6, n7, n8, n10, spare1},

 numRepetitionsPerPreambleAttempt-v1550 ENUMERATED {n1, n2, n4, n8, n16, n32, n64, n128,

 n256, n512, n1024}

}

NPRACH-ParametersListFmt2-NB-r15 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF NPRACH-ParametersFmt2-NB-r15

NPRACH-ParametersFmt2-NB-r15 ::= SEQUENCE {

 nprach-Parameters-r15 SEQUENCE {

 nprach-Periodicity-r15 ENUMERATED {ms40, ms80, ms160, ms320,

 ms640, ms1280, ms2560, ms5120}

 OPTIONAL, -- NEED OP

 nprach-StartTime-r15 ENUMERATED {ms8, ms16, ms32, ms64,

 ms128, ms256, ms512, ms1024}

 OPTIONAL, -- NEED OP

 nprach-SubcarrierOffset-r15 ENUMERATED {n0, n36, n72, n108, n6, n54, n102, n42,

 n78, n90, n12, n24, n48, n84, n60, n18}

 OPTIONAL, -- NEED OP

 nprach-NumSubcarriers-r15 ENUMERATED {n36, n72, n108, n144}

 OPTIONAL, -- NEED OP

 nprach-SubcarrierMSG3-RangeStart-r15 ENUMERATED {zero, oneThird, twoThird, one}

 OPTIONAL, -- NEED OP

 npdcch-NumRepetitions-RA-r15 ENUMERATED {r1, r2, r4, r8, r16, r32, r64, r128,

 r256, r512, r1024, r2048,

 spare4, spare3, spare2, spare1}

 OPTIONAL, -- NEED OP

 npdcch-StartSF-CSS-RA-r15 ENUMERATED {v1dot5, v2, v4, v8, v16, v32, v48, v64}

 OPTIONAL, -- NEED OP

 npdcch-Offset-RA-r15 ENUMERATED {zero, oneEighth, oneFourth, threeEighth}

 OPTIONAL, -- NEED OP

 nprach-NumCBRA-StartSubcarriers-r15 ENUMERATED {

 n24, n30, n33, n36, n60, n66, n69, n72,

 n96, n102, n105, n108, n120, n132, n138, n144}

 OPTIONAL, -- NEED OP

 npdcch-CarrierIndex-r15 INTEGER (1..maxNonAnchorCarriers-NB-r14)

 OPTIONAL, -- Need OP

 ...

 } OPTIONAL -- Need OR

} RSRP-Range

RSRP-ThresholdsNPRACH-InfoList-NB-r13 ::= SEQUENCE (SIZE(1..2)) OF RSRP-Range

EDT-TBS-InfoList-NB-r15 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF EDT-TBS-NB-r15

EDT-TBS-NB-r15 ::= SEQUENCE {

 edt-SmallTBS-Enabled-r15 BOOLEAN,

 edt-TBS-r15 ENUMERATED {b328, b408, b504, b584, b680, b808, b936, b1000}

}

RSRP-ThresholdsNPRACH-NonAnchorInfoList-NB-r16 ::= SEQUENCE (SIZE(1..2)) OF RSRP-Range

-- ASN1STOP

| *NPRACH-ConfigSIB-NB* field descriptions |
| --- |
| ***dummy***This field is not used in the specification. If received it shall be ignored by the UE. |
| ***edt-SmallTBS-Enabled***Value TRUE indicates UE performing EDT is allowed to select TBS smaller than *edt-TBS* for Msg3 according to the corresponding NPRACH resource, as specified in TS 36.213 [23]. |
| ***edt-SmallTBS-Subset***Presence indicates only two of the TBS values can be used according to *edt-TBS* corresponding to the NPRACH resource, as specified in TS 36.213 [23]. When the field is not present, any of the TBS values according to *edt-TBS* corresponding to the NPRACH resource can be used. This field is applicable for a NPRACH resource only when *edt-SmallTBS-Enabled* is included for the corresponding NPRACH resource. |
| ***edt-TBS***Largest TBS for Msg3 for a NPRACH resource applicable to a UE performing EDT. Value in bits. Value b328 corresponds to 328 bits, value b408 corresponds to 408 bits and so on. See TS 36.213 [23]. |
| ***maxNumPreambleAttemptCE***Maximum number of preamble transmission attempts per NPRACH resource. See TS 36.321 [6].If the UE supports enhanced random access power control and *maxNumPreambleAttemptCE-r14* is included, the UE shall use *maxNumPreambleAttemptCE-r14* instead of *maxNumPreambleAttemptCE-r13* for the first entry in *nprach-ParametersList*.*maxNumPreambleAttemptCE-r13* applies to FDD and *maxNumPreambleAttemptCE-v1550* applies to TDD. |
| ***npdcch-CarrierIndex***For FDD: Index of the carrier in the list of DL non anchor carriers. The first entry in the list has index '1', the second entry has index '2' and so on.If the UE supports mixed operation mode and *dl-ConfigListMixed* is present in *systemInformationBlockType22-NB*, the UE creates a combined list of DL carriers for random access by appending *dl-ConfigListMixed* to the *dl-ConfigList* while maintaining the order among both *dl-ConfigList* and *dl-ConfigListMixed*; only the first *maxNonAnchorCarriers-NB-r14* DL non-anchor carriers in the concatenated list can be used for random access.If the field is absent in the entry in *nprach-ParametersListEDT* in *SystemInformationBlockType22-NB*, the value of *npdcch-CarrierIndex* in the corresponding entry of *nprach-ParametersList* applies, if present. If the field is absent in an entry in *nprach-ParametersListFmt2EDT* in *SystemInformationBlockType23-NB*, the value of *npdcch-CarrierIndex* in the corresponding entry of *nprach-ParametersListFmt2* applies, if present. Otherwise, the DL anchor carrier is used.For TDD: This parameter is absent and the same carrier is used in uplink and downlink. |
| ***npdcch-NumRepetitions-RA***Maximum number of repetitions for NPDCCH common search space (CSS) for RAR, Msg3 retransmission and Msg4, see TS 36.213 [23], clause 16.6.See NOTE. |
| ***npdcch-Offset-RA***Fractional period offset of starting subframe for NPDCCH common search space (CSS Type 2), see TS 36.213 [23], clause 16.6.See NOTE. |
| ***npdcch-StartSF-CSS-RA***Starting subframe configuration for NPDCCH common search space (CSS), including RAR, Msg3 retransmission, and Msg4, see TS 36.213 [23], clause 16.6.See NOTE. |
| ***nprach-CP-Length***Cyclic prefix length for NPRACH transmission (TCP), see TS 36.211 [21], clause 10.1.6. Value us66dot7 corresponds to 66.7 microseconds and value us266dot7 corresponds to 266.7 microseconds. If the UE uses a NPRACH resource for preamble format 2*,* the UE ignores the value signalled in *nprach-CP-Length* and considers the value to be800 microseconds. |
| ***nprach-NumCBRA-StartSubcarriers***The number of start subcarriers from which a UE can randomly select a start subcarrier as specified in TS 36.321 [6].If *nprach-Config-v1330* is not included in *SystemInformationBlockType2-NB*, the UE sets the value of *nprach-NumCBRA-StartSubcarriers-r13* to the value signalled by *nprach-NumSubcarriers-r13* for the corresponding NPRACH resource.The start subcarrier indices that the UE is allowed to randomly select from, are given by:*nprach-SubcarrierOffset* + [0, *nprach-NumCBRA-StartSubcarriers* - 1].See NOTE. |
| ***nprach-NumSubcarriers***Number of sub-carriers in a NPRACH resource, see TS 36.211 [21], clause 10.1.6. In number of subcarriers.See NOTE. |
| ***nprach-ParametersList, nprach-ParametersListEDT***Configures NPRACH parameters for each NPRACH resource. Up to three PRACH resources can be configured in *nprach-ParametersList* in a cell. Each NPRACH resource is associated with a different number of NPRACH repetitions.E-UTRAN includes the same number of entries, and listed in the same order for *nprach-ParametersListEDT*, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB*.The NPRACH resources in *nprach-ParametersListEDT* are used to initiateEDT. Each NPRACH resource is associated with a TBS signalled in the corresponding entry of *edt-TBS-InfoList.*For TDD: The UE shall use *nprach-ParametersListTDD* and ignore *nprach-ParametersList.* |
| ***nprach-ParametersListTDD***For TDD: Configure NPRACH parameters for each NPRACH. Up to three NPRACH resources can be configured in a cell. Each NPRACH resource is associated with a different number of NPRACH repetitions. |
| ***nprach-ParametersListFmt2, nprach-ParametersListFmt2EDT***Configures NPRACH parameters for each NPRACH resource format 2. Up to three NPRACH resources can be configured on one carrier. Each NPRACH resource is associated with a different number of NPRACH repetitions. E-UTRAN includes the same number of entries, and listed in the same order, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB*.The NPRACH resources in *nprach-ParametersListFmt2EDT* are used to initiate EDT. Each NPRACH resource is associated with a TBS signalled in the corresponding entry of *edt-TBS-InfoList.*E-UTRAN configures the NPRACH resources format 2 so that they do not overlap in time domain with the NPRACH resources configured in *nprach-ParametersList* and *nprach-ParametersListEDT*.If there is no NPRACH resource in *nprach-ParametersListFmt2* (respectively *nprach-ParametersListFmt2EDT*) on any UL carrier for one NPRACH repetition level, the UE uses the NPRACH resources in *nprach-ParametersList* (respectively *nprach-ParametersListEDT*) for this NPRACH repetition level. Otherwise, the UE uses only NPRACH resources in *nprach-ParametersListFmt2* (respectively *nprach-ParametersListFmt2EDT*). |
| ***nprach-Periodicity***Periodicity of a NPRACH resource, see TS 36.211 [21], clause10.1.6. Unit in millisecond.See NOTE. |
| ***nprach-PreambleFormat***TDD: TDD preamble format, see TS 36.211 [21]. clause 10.1.6,Value *fmt0* corresponds to preamble format 0, value *fmt1* corresponds to preamble format 1 and so on. |
| ***nprach-StartTime***Start time of the NPRACH resource in one period, see TS 36.211 [21], clause 10.1.6. Unit in millisecond.See NOTE. |
| ***nprach-SubcarrierOffset***Frequency location of the NPRACH resource, see TS 36.211 [21], clause 10.1.6. In number of subcarriers, offset from sub-carrier 0.See NOTE. |
| ***nprach-SubcarrierMSG3-RangeStart***Fraction for calculating the starting subcarrier index of the range reserved for indication of UE support for multi-tone Msg3 transmission, within the NPRACH resource, see TS 36.211 [21], clause 10.1.6. Multi-tone Msg3 transmission is not supported for {32, 64, 128} repetitions of NPRACH. For at least one of the NPRACH resources with the number of NPRACH repetitions other than {32, 64, 128}, the value of *nprach-SubcarrierMSG3-RangeStart* should not be 0.If *nprach-SubcarrierMSG3-RangeStart* is equal to zero, no start subcarrier index for the single-tone Msg3 NPRACH is allocated and the start subcarrier indexes for the multi-tone Msg3 NPRACH partition are given by *nprach-SubcarrierOffset* + [0, *nprach-NumCBRA-StartSubcarriers* - 1].If *nprach-SubcarrierMSG3-RangeStart* is equal to oneThirdor twoThird, the start subcarrier indexes for the two partitions are given by:*nprach-SubcarrierOffset* + [0, FLOOR (*nprach-NumCBRA-StartSubcarriers \** *nprach-SubcarrierMSG3-RangeStart*) -1]for the single-tone Msg3 NPRACH partition;*nprach-SubcarrierOffset* + [FLOOR (*nprach-NumCBRA-StartSubcarriers \* nprach-SubcarrierMSG3-RangeStart*)*, nprach-NumCBRA-StartSubcarriers* - 1]for the multi-tone Msg3 NPRACH partition;If *nprach-SubcarrierMSG3-RangeStart* is equal to one, the start subcarrier indexes for the single-tone Msg3 NPRACH are given by *nprach-SubcarrierOffset* + [0, *nprach-NumCBRA-StartSubcarriers* - 1] and no start subcarrier index for the multi-tone Msg3 NPRACH partition is allocated.See NOTE. |
| ***numRepetitionsPerPreambleAttempt***Number of NPRACH repetitions per attempt for each NPRACH resource, See TS 36.211 [21], clause 10.1.6. *numRepetitionsPerPreambleAttempt-r13* applies to FDD and *numRepetitionsPerPreambleAttempt-v1550* applies to TDD. |
| ***rsrp-ThresholdsPrachInfoList***The criterion for UEs to select a NPRACH resource. Up to 2 RSRP threshold values can be signalled. The first element corresponds to RSRP threshold 1, the second element corresponds to RSRP threshold 2. See TS 36.321 [6]. If absent, there is only one NPRACH resource.A UE that supports *powerClassNB-14dBm-r14* shall correct the RSRP threshold values before applying them as follows:RSRP threshold = Signalled RSRP threshold - min{0, (14-min(23, P-Max))} where P-Max*:*is the value of *p-Max* field in *SystemInformationBlockType1-NB.* |
| ***rsrp-ThresholdsPrachNonAnchorInfoList***The criterion for UEs to select a NPRACH resource on the Non-Anchor carriers. Up to 2 RSRP threshold values can be signalled. The first element corresponds to RSRP threshold 1, the second element corresponds to RSRP threshold 2. See TS 36.321 [6]. If absent, there is only one NPRACH resource. The number of RSRP threshold for the non-anchor carrier is same to the number of RSRP threshold.A UE that supports *powerClassNB-14dBm-r14* shall correct the RSRP threshold values before applying them as follows:RSRP threshold = Signalled RSRP threshold - min{0, (14-min(23, P-Max))} where P-Max*:*is the value of *p-Max* field in *SystemInformationBlockType1-NB.* |

NOTE:

- If the field is absent in an entry of *nprach-ParametersList* in *SystemInformationBlockType22-NB*, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in the entry in *nprach-ParametersListEDT*, the value of the same field in the corresponding entry of *nprach-ParametersList* on the same UL carrierapplies, if present. Otherwise, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in an entry of *nprach-ParametersListTDD* in *SystemInformationBlockType22-NB*, the value of the same field in the corresponding entry of *nprach-ParametersListTDD* in *SystemInformationBlockType2-NB* applies. The field is mandatory present in *nprach-ParametersListTDD* in *SystemInformationBlockType2-NB.*

- If the field is absent in an entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType23-NB*, the value of the same field, if present, in the corresponding entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB* applies. Otherwise the value of the same field, if present,in thecorresponding entry of the first occurence of *nprach-ParametersListFmt2* in the non anchor carrier list applies. Otherwise, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in an entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB*, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in an entry of *nprach-ParametersListFmt2EDT* in *SystemInformationBlockType23-NB*, the value of the same field, if present, in the corresponding entry of *nprach-ParametersListFmt2* on the same UL carrierapplies. Otherwise, the value of the same field, if present, in the corresponding entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB* applies. Otherwise the value of the same field, if present,in thecorresponding entry of the first occurence of *nprach-ParametersListFmt2* in the non anchor carrier list applies. Otherwise, the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

- If the field is absent in an entry of *nprach-ParametersListFmt2EDT* in *SystemInformationBlockType2-NB*, the value of the same field, if present, in the corresponding entry of *nprach-ParametersListFmt2* in *SystemInformationBlockType2-NB* applies. Otherwise the value of the same field in the corresponding entry of *nprach-ParametersList* in *SystemInformationBlockType2-NB* applies.

| Conditional presence | Explanation |
| --- | --- |
| *EDT1* | The field is mandatory present if *cp-EDT*, *cp-EDT-5GC*, *up-EDT* or *up-EDT-5GC* in *SystemInformationBlockType2-NB* is present; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *EDT2* | The field is optionally present, Need OR, if *edt-Parameters* is present; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *TDD* | This field is mandatory present for TDD; otherwise the field is not present and the UE shall delete any existing value for this field. |

/\*Partially omitted\*/

**– *SystemInformationBlockType22-NB***

The IE *SystemInformationBlockType22-NB* contains radio resource configuration for paging and random access procedure on non-anchor carriers.

*SystemInformationBlockType22-NB* information element

-- ASN1START

SystemInformationBlockType22-NB-r14 ::= SEQUENCE {

 dl-ConfigList-r14 DL-ConfigCommonList-NB-r14 OPTIONAL, -- Need OR

 ul-ConfigList-r14 UL-ConfigCommonList-NB-r14 OPTIONAL, -- Need OR

 pagingWeightAnchor-r14 PagingWeight-NB-r14 OPTIONAL, -- Cond pcch-config

 nprach-ProbabilityAnchorList-r14 NPRACH-ProbabilityAnchorList-NB-r14 OPTIONAL, -- Cond nprach-config

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 ...,

 [[ mixedOperationModeConfig-r15 SEQUENCE {

 dl-ConfigListMixed-r15 DL-ConfigCommonList-NB-r14 OPTIONAL, -- Cond dl-ConfigList

 ul-ConfigListMixed-r15 UL-ConfigCommonList-NB-r14 OPTIONAL, -- Cond ul-ConfigList

 pagingDistribution-r15 ENUMERATED {true} OPTIONAL, -- Need OR

 nprach-Distribution-r15 ENUMERATED {true} OPTIONAL -- Need OR

 } OPTIONAL, -- Need OR

 ul-ConfigList-r15 UL-ConfigCommonListTDD-NB-r15 OPTIONAL -- Cond TDD

 ]]

 ul-ConfigList-r16 UL-ConfigCommonList-NB-r16 OPTIONAL, -- Need OR

}

DL-ConfigCommonList-NB-r14 ::= SEQUENCE (SIZE (1.. maxNonAnchorCarriers-NB-r14)) OF

 DL-ConfigCommon-NB-r14

UL-ConfigCommonList-NB-r14 ::= SEQUENCE (SIZE (1.. maxNonAnchorCarriers-NB-r14)) OF

 UL-ConfigCommon-NB-r14

UL-ConfigCommonList-NB-r16 ::= SEQUENCE (SIZE (1.. maxNonAnchorCarriers-NB-r16)) OF

 UL-ConfigCommon-NB-r16

UL-ConfigCommonListTDD-NB-r15 ::= SEQUENCE (SIZE (1.. maxNonAnchorCarriers-NB-r14)) OF

 UL-ConfigCommonTDD-NB-r15

DL-ConfigCommon-NB-r14 ::= SEQUENCE {

 dl-CarrierConfig-r14 DL-CarrierConfigCommon-NB-r14,

 pcch-Config-r14 PCCH-Config-NB-r14 OPTIONAL, -- Need OR

 ...,

 [[ wus-Config-r15 WUS-ConfigPerCarrier-NB-r15 OPTIONAL -- Cond WUS

 ]],

 [[ gwus-Config-r16 WUS-ConfigPerCarrier-NB-r15 OPTIONAL -- Cond GWUS

 ]]

}

PCCH-Config-NB-r14 ::= SEQUENCE {

 npdcch-NumRepetitionPaging-r14 ENUMERATED {

 r1, r2, r4, r8, r16, r32, r64, r128,

 r256, r512, r1024, r2048,

 spare4, spare3, spare2, spare1} OPTIONAL, -- Need OP

 pagingWeight-r14 PagingWeight-NB-r14 DEFAULT w1,

 ...

}

PagingWeight-NB-r14 ::= ENUMERATED {w1, w2, w3, w4, w5, w6, w7, w8,

 w9, w10, w11, w12, w13, w14, w15, w16}

UL-ConfigCommon-NB-r14 ::= SEQUENCE {

 ul-CarrierFreq-r14 CarrierFreq-NB-r13,

 nprach-ParametersList-r14 NPRACH-ParametersList-NB-r14 OPTIONAL, -- Need OR

 ...,

 [[ nprach-ParametersListEDT-r15 NPRACH-ParametersList-NB-r14 OPTIONAL -- Cond EDT

 ]]

}

UL-ConfigCommonTDD-NB-r15 ::= SEQUENCE {

 tdd-UL-DL-AlignmentOffset-r15 TDD-UL-DL-AlignmentOffset-NB-r15,

 nprach-ParametersListTDD-r15 NPRACH-ParametersListTDD-NB-r15 OPTIONAL, -- Need OR

 ...

}

UL-ConfigCommon-NB-r16::= SEQUENCE {

nprach-Config-v16xy NPRACH-ConfigSIB-NB-v16xy OPTIONAL, -- Need OR

}

NPRACH-ProbabilityAnchorList-NB-r14 ::= SEQUENCE (SIZE (1.. maxNPRACH-Resources-NB-r13)) OF

 NPRACH-ProbabilityAnchor-NB-r14

NPRACH-ProbabilityAnchor-NB-r14 ::= SEQUENCE {

 nprach-ProbabilityAnchor-r14 ENUMERATED {

 zero, oneSixteenth, oneFifteenth, oneFourteenth,

 oneThirteenth, oneTwelfth, oneEleventh, oneTenth,

 oneNinth, oneEighth, oneSeventh, oneSixth,

 oneFifth, oneFourth, oneThird, oneHalf}

 OPTIONAL -- Need OP

}

-- ASN1STOP

| *SystemInformationBlockType22-NB* field descriptions |
| --- |
| ***dl-CarrierConfig***For FDD: Provides the configuration of the DL non-anchor carrier.For TDD: Provides the configuration of the non-anchor carrier. |
| ***dl-ConfigList, dl-ConfigListMixed***For FDD: List of DL non-anchor carriers and associated configuration that can be used for paging and/or random access. E-UTRAN configures DL non-anchor carriers operating in mixed operation mode only in *dl-ConfigListMixed* and only a UE that supports mixed operation mode uses the carriers in *dl-ConfigListMixed*. A given carrier is either signalled in the *dl-ConfigList* or in *dl-ConfigListMixed*.If *dl-ConfigListMixed* is present and at least one of the carriers in *dl-ConfigListMixed* is configured for paging:- If *pagingDistribution* is present, the UE supporting mixed operation mode creates a combined list of DL carriers for paging by appending *dl-ConfigListMixed* to the *dl-ConfigList* while maintaining the order among *dl-ConfigList* and *dl-ConfigListMixed*; the total number of signalled DL non-anchor carriers cannot be more than *maxNonAnchorCarriers-NB-r14*.- If *pagingDistribution* is absent, the UE supporting mixed operation mode uses the list of DL carriers for paging provided in *dl-ConfigListMixed* and considers *pagingWeightAncho*r being set to w0, i.e. the anchor carrier is not used*.*Otherwise, the *pagingDistribution* field is not applicable and the UE shall ignore the value.For TDD: List of non-anchor carriers and associated configuration that can be used for paging and/or random access. |
| ***gwus-Config***For FDD: Carrier specific GWUS Configuration.If both *gwus-Config* and *wus-Config* are present for the carrier, E-UTRAN configures the same value for both fields. |
| ***mixedOperationModeConfig***For FDD: Provides the configuration of DL and UL non-anchor carriers that can be used for paging and random access by a UE that supports mixed operation mode.For TDD: This parameter is absent. |
| ***npdcch-NumRepetitionPaging***Maximum number of repetitions for NPDCCH common search space (CSS) for paging, see TS 36.213 [23], clause 16.6.If the field is absent, the value *of npdcch-NumRepetitionPaging* configured in *SystemInformationBlockType2-NB* in IE *pcch-Config* applies. |
| ***nprach-Distribution***Indicates which UL carriers a UE supporting mixed operation mode uses for random access as defined in description of *ul-ConfigList, ul-ConfigListMixed*.  |
| ***nprach-ParametersList, nprach-ParametersList-EDT***Configure NPRACH parameters for each NPRACH resource on one non-anchor UL carrier. Up to three NPRACH resources can be configured on one non-anchor UL carrier. Each NPRACH resource is associated with a different number of NPRACH repetitions.NPRACH resources in *nprach-ParametersListEDT* are used to initiateEDT. Each NPRACH resource is associated with a maximum TBS signalled in the corresponding entry of *edt-TBS-InfoList* in *SystemInformationBlockType2-NB*.E-UTRAN includes the same number of entries, and listed in the same order, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB*. |
| ***nprach-ParametersListTDD***For TDD: Configure NPRACH parameters for each NPRACH resource on one non-anchor UL carrier. Up to three NPRACH resources can be configured on one non-anchor UL carrier. Each NPRACH resource is associated with a different number of NPRACH repetitions.E-UTRAN includes the same number of entries in *nprach-ParametersListTDD*, and listed in the same order, as in *nprach-ParametersListTDD* in *SystemInformationBlockType2-NB*.. |
| ***nprach-ProbabilityAnchor***Configure the selection probability for the anchor carrier NPRACH resource, see TS 36.321 [6]. Value zero corresponds to a probability of 0, oneSixteenth corresponds to the probability of 1/16, oneFifteenth corresponds to the probability of 1/15, and so on.If the field is absent, the selection probability of the anchor carrier NPRACH resource is 1.All non-anchor carriers NPRACH resources have equal probability between them.If there is no NPRACH resource defined on the anchor carrier for one repetition level in *nprach-ParametersList-EDT*, (respectively *nprach-ParametersListFmt2*, *nprach-ParametersListFmt2-EDT*), the UE shall use the value 'zero' and ignore the signalled value of *nprach-ProbabilityAnchor* for this repetition level for the NPRACH resources defined by *nprach-ParametersList-EDT* (respectively *nprach-ParametersListFmt2*, *nprach-ParametersListFmt2-EDT*). |
| ***nprach-ProbabilityAnchorList***Configures the selection probability for each NPRACH resource on the anchor carrier.E-UTRAN includes the same number of entries, and listed in the same order, as in *nprach-ParametersList* in *SystemInformationBlockType2-NB.* |
| ***pagingDistribution***Indicates which DL carriers a UE supporting mixed operation mode monitors for paging as defined in description of *dl-ConfigList, dl-ConfigListMixed*. |
| ***pagingWeight***Weight of the non-anchor paging carrier for uneven paging load distribution across the carriers. Value w1 corresponds to a relative weight of 1, w2 corresponds to a relative weight of 2, and so on.The paging load for a carrier 'i' is equal to w(i)/W where i is equal to 0 for the anchor carrier and equal to the index of the carrier in the *dl-ConfigList* / *dl-ConfigListMixed* for a non-anchor carrier, W is the sum of the weights of all paging carriers.To avoid correlation between paging carrier and paging occasion, the weights should be assigned such that: nB \* W <= 16384. |
| ***pagingWeightAnchor***Weight of the anchor carrier for uneven paging load distribution across the carriers. Value w1 corresponds to a relative weight of 1, w2 corresponds to a relative weight of 2, and so on.If the field is absent, the (default) value of w0 is applied, i.e. the anchor carrier is not used for paging. |
| ***pcch-Config***Configure the PCCH parameters for the non-anchor DL carrier. |
| ***tdd-UL-DL-AlignmentOffset***Indicates the offset between the UL carrier frequency center with respect to DL carrier frequency center for the non-anchor carrier. |
| ***ul-CarrierFreq***For FDD: UL carrier frequency of the non-anchor carrier as defined in TS 36.101 [42], clause 5.7.3F.For TDD: This field is absent and the uplink carrier frequency is same as the downlink frequency. |
| ***ul-ConfigList, ul-ConfigListMixed***For FDD: List of UL non-anchor carriers and associated configuration that can be used for random access. E-UTRAN configures UL non-anchor carriers operating in mixed operation mode only in *ul-ConfigListMixed* and only a UE that supports mixed operation mode uses the carriers in *ul-ConfigListMixed*. A given carrier is either signalled in the *ul-ConfigList* or in *ul-ConfigListMixed*.If *ul-ConfigListMixed* is present and at least one of the carriers in *ul-ConfigListMixed* is configured for random access:- If *nprach-Distribution* is present, the UE supporting mixed operation mode creates a combined list of UL carriers for random access by appending *ul-ConfigListMixed* to the *ul-ConfigList* while maintaining the order among both *ul-ConfigList* and *ul-ConfigListMixed*; the total number of signalled UL non-anchor carriers cannot be more than *maxNonAnchorCarriers-NB-r14*.- If *nprach-Distribution* is absent, the UE supporting mixed operation mode uses the list of UL carriers for random access provided in *ul-ConfigListMixed* and considers *nprach-ProbabiliyAnchor* being set to zero for each NPRACH resource, i.e. the anchor carrier is not used for random access*.*Otherwise, the *nprach-Distribution* field is not applicable and the UE shall ignore the value.For TDD: E-UTRAN configures *ul-ConfigList-r15* and includes the same number of entries as in *dl-ConfigList*. The UL carrier frequency of the non-anchor carrier is same as the DL carrier frequency. |
| ***wus-Config***For FDD: Carrier specific WUS Configuration. |

| Conditional presence | Explanation |
| --- | --- |
| *dl-ConfigList* | This field is optionally present, Need OR, if the field *dl-ConfigList* is present. Otherwise the field is not present. |
| *EDT* | The field is optionally present, Need OR, if *edt-Parameters* in *SystemInformationBlockType2-NB* is present; otherwise the field is not present and the UE shall delete any existing value for this field. |
| *GWUS* | This field is optionally present, Need OR, if g*wus-Config-r16* is present in *SystemInformationBlockType2-NB*. Otherwise the field is not present. |
| *pcch-config* | This field is optionally present, Need OP, if the field *dl-ConfigList* is present and at least one of the carriers in *dl-ConfigList* is configured for paging. Otherwise the field is not present and only the anchor carrier is used for paging. |
| *nprach-config* | This field is mandatory present, if the field *ul-ConfigList* is present and at least one of the carriers in *ul-ConfigList* is configured for random access. Otherwise the field is not present and only the anchor carrier is used for random access. |
| *TDD* | This field is optionally present, Need OR, for TDD. Otherwise the field is not present. |
| *ul-ConfigList* | This field is optionally present, Need OR, if the field *ul-ConfigList* is present. Otherwise the field is not present. |
| *WUS* | This field is mandatory present, if the field *wus-Config* is present in *SystemInformationBlockType2-NB*. Otherwise the field is not present, Need OR. |

*End of Change*