**3GPP TSG-RAN2 Meeting #106 *R2-1908368***

 **Reno, Nevada, Unites States, 13th May 2019 - 17th May 2019**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **38.331** | **CR** | **-** | **rev** | **-** | **Current version:** | **15.5.0** |  |
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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 NR-DC specific UE capabilities inside the band combination |
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| ***Source to WG:*** | NTT DOCOMO, INC. |
| ***Source to TSG:*** | n/a (to be merged into Rapporteur's CR on Late drops |
|  |  |
| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2019-05-17 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-15 |
|  | *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:*** | RAN1 informed RAN2 of their agreements on NR-DC UE capabilities as in LS-in, R2-1905515. In their agreement, the following affects the UE capability structure.*For the capability parameters and components that are presently not defined as ‘across all CC’ and that are of per band combination, per band per band combination or per CC per band per band combination, the same band combinations need to be allowed to be listed separately for CA and DC with allowing different capability contents.*On the other hand, this approach results in repeating the same band combination twice in the UE capability signalling. Thus, increased overhead is a valid concern. There is an alternative approach fulfilling the RAN1 intention to allow different functional support between NR-DC and NR CA. Similar to LTE DC capability, DC-specific per-BC capabilities and per band/per BC capabilities can be defined inside the band combination signalling. By doing this, the resulting signalling size can be reduced, compared with the way of duplicating the same band combination. |
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| ***Summary of change:*** | Per-BC parameters and feature set combination ID specific to NR-DC are defined inside the band combination signalling. If these parameters are absent, the same per-BC parameters and feature set combination ID supported for NR-CA are applied for NR-DC, as well. |
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| ***Consequences if not approved:*** | The signalling size of UE capability signalling is increased due to supporinting NR-DC, as well as NR CA. |
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| ***Clauses affected:*** | 6.3.3 |
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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:*** |  |
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| ***This CR's revision history:*** | This CR is drafted based on Rapporteur’s CR for late drops, R2-1907408. The delta from R2-1907408 is marked with yellow. |

### 6.3.3 UE capability information elements

#### – *AccessStratumRelease*

The IE *AccessStratumRelease* indicates the release supported by the UE.

*AccessStratumRelease* information element

-- ASN1START

-- TAG-ACCESSSTRATUMRELEASE-START

AccessStratumRelease ::= ENUMERATED {

 rel15, spare7, spare6, spare5, spare4, spare3, spare2, spare1, ... }

-- TAG-ACCESSSTRATUMRELEASE-STOP

-- ASN1STOP

#### – *BandCombinationList*

The IE *BandCombinationList* contains a list of NR CA and/or MR-DC band combinations (also including DL only or UL only band).

*BandCombinationList* information element

-- ASN1START

-- TAG-BANDCOMBINATIONLIST-START

BandCombinationList ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination

BandCombinationList-v1540 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1540

BandCombinationList-v1550 ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v1550

BandCombinationList-v15xy ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination-v15xy

BandCombination ::= SEQUENCE {

 bandList SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParameters,

 featureSetCombination FeatureSetCombinationId,

 ca-ParametersEUTRA CA-ParametersEUTRA OPTIONAL,

 ca-ParametersNR CA-ParametersNR OPTIONAL,

 mrdc-Parameters MRDC-Parameters OPTIONAL,

 supportedBandwidthCombinationSet BIT STRING (SIZE (1..32)) OPTIONAL,

 powerClass-v1530 ENUMERATED {pc2} OPTIONAL

}

BandCombination-v1540::= SEQUENCE {

 bandList-v1540 SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandParameters-v1540,

 ca-ParametersNR-v1540 CA-ParametersNR-v1540 OPTIONAL

}

BandCombination-v1550 ::= SEQUENCE {

 ca-ParametersNR-v1550 CA-ParametersNR-v1550

}

BandCombination-v15xy::= SEQUENCE {

 dc-Support DC-Support OPTIONAL

}

BandParameters ::= CHOICE {

 eutra SEQUENCE {

 bandEUTRA FreqBandIndicatorEUTRA,

 ca-BandwidthClassDL-EUTRA CA-BandwidthClassEUTRA OPTIONAL,

 ca-BandwidthClassUL-EUTRA CA-BandwidthClassEUTRA OPTIONAL

 },

 nr SEQUENCE {

 bandNR FreqBandIndicatorNR,

 ca-BandwidthClassDL-NR CA-BandwidthClassNR OPTIONAL,

 ca-BandwidthClassUL-NR CA-BandwidthClassNR OPTIONAL

 }

}

BandParameters-v1540 ::= SEQUENCE {

 srs-CarrierSwitch CHOICE {

 nr SEQUENCE {

 srs-SwitchingTimesListNR SEQUENCE (SIZE (1..maxSimultaneousBands)) OF SRS-SwitchingTimeNR

 },

 eutra SEQUENCE {

 srs-SwitchingTimesListEUTRA SEQUENCE (SIZE (1..maxSimultaneousBands)) OF SRS-SwitchingTimeEUTRA

 }

 } OPTIONAL,

 srs-TxSwitch-v1540 SEQUENCE {

 supportedSRS-TxPortSwitch ENUMERATED {t1r2, t1r4, t2r4, t1r4-t2r4, t1r1, t2r2, t4r4, notSupported},

 txSwitchImpactToRx INTEGER (1..32) OPTIONAL,

 txSwitchWithAnotherBand INTEGER (1..32) OPTIONAL

 } OPTIONAL

}

DC-Support ::= SEQUENCE {

 ca-ParametersDC-Diff OCTET STRING OPTIONAL,

 featureSetCombinationDC FeatureSetCombinationId OPTIONAL

}

-- TAG-BANDCOMBINATIONLIST-STOP

-- ASN1STOP

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| *BandCombination* field descriptions |
| ***BandCombinationList-v1540, BandCombinationList-v15xy***The UE shall include the same number of entries, and listed in the same order, as in *BandCombinationList* (without suffix).  |
| ***powerClass***Power class that the UE supports when operating according to this band combination. If the field is absent, the UE supports the default power class. If this power class is higher than the power class that the UE supports on the individual bands of this band combination (*ue-PowerClass* in *BandNR*), the latter determines maximum TX power available in each band. The UE sets the new power class parameter only in band combinations with two FR1 uplink serving cells.  |
| ***supportedBandwidthCombinationSet***For NR SA and for inter-band EN-DC, the field defines the bandwidth combinations for the NR part of the band combination. For intra-band EN-DC, the field indicates the supported bandwidth combination set applicable to the NR and LTE band combinations. The first (left-most) bit in the bitmap corresponds to the BWCS#0 and so on. If the bit is set to 1, the UE supports the corresponding BWCS. |
| ***srs-SwitchingTimesListNR***Indicates, for a particular pair of NR bands, the RF retuning time when switching between a NR carrier corresponding to this band entry and another (PUSCH-less) NR carrier corresponding to the band entry in the order indicated below:- For the first NR band, the UE shall include the same number of entries for NR bands as in *bandList*, i.e. first entry corresponds to first NR band in *bandList* and so on,- For the second NR band, the UE shall include one entry less, i.e. first entry corresponds to the second NR band in *bandList* and so on- And so on |
| ***srs-SwitchingTimesListEUTRA***Indicates, for a particular pair of E-UTRA bands, the RF retuning time when switching between an E-UTRA carrier corresponding to this band entry and another (PUSCH-less) E-UTRA carrier corresponding to the band entry in the order indicated below:- For the first E-UTRA band, the UE shall include the same number of entries for E-UTRA bands as in *bandList,* i.e. first entry corresponds to first E-UTRA band in *bandList* and so on,- For the second E-UTRA band, the UE shall include one entry less, i.e. first entry corresponds to the second E-UTRA band in *bandList* and so on - And so on |

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| *DC-Support* field descriptions |
| ***ca-ParametersDC-Diff***contains the IE *CA-ParametersNR* and its extension IEs. The first entry of the container starting from the left-most / most significant bit is *CA-ParametersNR* (without suffix) and the second entry is *CA-ParametersNR-v1540*, and so on. Namely, the extension IEs are included in the ascending order of the suffix "‑vXYZ".If this field is present for a band combination, it reports the UE capabilities when NR-DC is configured with the band combination. If UE capabilities within this field is not present for a band combination, the UE capabilities in the *ca-ParametersNR* (with an without suffix) in *BandCombination* is applicable to the UE configured with NR-DC for the band combination. |
| ***featureSetCombinationDC***If this field is present for a band combination, it reports the feature set combination supported for the band combination when NR-DC is configured. If this field is not present for a band combination, the *featureSetCombination* in *BandCombination* (without suffix) is applicable to the UE configured with NR-DC for the band combination. |

#### – *CA-BandwidthClassEUTRA*

-- ASN1START

-- TAG-CA-BANDWIDTHCLASSEUTRA-START

CA-BandwidthClassEUTRA ::= ENUMERATED {a, b, c, d, e, f, ...}

-- TAG-CA-BANDWIDTHCLASSEUTRA-STOP

-- ASN1STOP

#### – *CA-BandwidthClassNR*

-- ASN1START

-- TAG-CA-BANDWIDTHCLASSNR-START

CA-BandwidthClassNR ::= ENUMERATED {a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, ...}

-- TAG-CA-BANDWIDTHCLASSNR-STOP

-- ASN1STOP

#### – *CA-ParametersEUTRA*

The IE *CA-ParameterEUTRA* contains the E-UTRA part of band combination parameters for a given MR-DC band combination.

NOTE: If an additional E-UTRA band combination parameters are defined in TS 36.331 [10], which are supported for MR-DC, they will be defined here as well.

-- ASN1START

-- TAG-CA-PARAMETERSEUTRA-START

CA-ParametersEUTRA ::= SEQUENCE {

 multipleTimingAdvance ENUMERATED {supported} OPTIONAL,

 simultaneousRx-Tx ENUMERATED {supported} OPTIONAL,

 supportedNAICS-2CRS-AP BIT STRING (SIZE (1..8)) OPTIONAL,

 additionalRx-Tx-PerformanceReq ENUMERATED {supported} OPTIONAL,

 ue-CA-PowerClass-N ENUMERATED {class2} OPTIONAL,

 supportedBandwidthCombinationSetEUTRA-v1530 BIT STRING (SIZE (1..32)) OPTIONAL,

 ...

}

-- TAG-CA-PARAMETERSEUTRA-STOP

-- ASN1STOP

#### – *CA-ParametersNR*

The IE *CA-ParametersNR* contains carrier aggregation related capabilities that are defined per band combination.

*CA-ParametersNR* information element

-- ASN1START

-- TAG-CA-PARAMETERSNR-START

CA-ParametersNR ::= SEQUENCE {

 multipleTimingAdvances ENUMERATED {supported} OPTIONAL,

 parallelTxSRS-PUCCH-PUSCH ENUMERATED {supported} OPTIONAL,

 parallelTxPRACH-SRS-PUCCH-PUSCH ENUMERATED {supported} OPTIONAL,

 simultaneousRxTxInterBandCA ENUMERATED {supported} OPTIONAL,

 simultaneousRxTxSUL ENUMERATED {supported} OPTIONAL,

 diffNumerologyAcrossPUCCH-Group ENUMERATED {supported} OPTIONAL,

 diffNumerologyWithinPUCCH-Group ENUMERATED {supported} OPTIONAL,

 supportedNumberTAG ENUMERATED {n2, n3, n4} OPTIONAL,

 ...

}

CA-ParametersNR-v1540 ::= SEQUENCE {

 simultaneousSRS-AssocCSI-RS-AllCC INTEGER (5..32) OPTIONAL,

 csi-RS-IM-ReceptionForFeedbackPerBandComb SEQUENCE {

 maxNumberSimultaneousNZP-CSI-RS-ActBWP-AllCC INTEGER (1..64) OPTIONAL,

 totalNumberPortsSimultaneousNZP-CSI-RS-ActBWP-AllCC INTEGER (2..256) OPTIONAL

 } OPTIONAL,

 simultaneousCSI-ReportsAllCC INTEGER (5..32) OPTIONAL,

 dualPA-Architecture ENUMERATED {supported} OPTIONAL

}

CA-ParametersNR-v1550 ::= SEQUENCE {

 aperiodic-CSI-diffSCS ENUMERATED {supported} OPTIONAL

}

-- TAG-CA-PARAMETERSNR-STOP

-- ASN1STOP

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| *CA-ParametersNR field description* |
| ***maxNumberSimultaneousNZP-CSI-RS-ActBWP-AllCC***Limits the total number of NZP-CSI-RS resources that the NW may configure across all CCs (irrespective of the associated codebook type). The network applies this limit in addition to the limits signalled in *MIMO-ParametersPerBand*-> *maxNumberSimultaneousNZP-CSI-RS-PerCC* and in *Phy-ParametersFRX-Diff*-> *maxNumberSimultaneousNZP-CSI-RS-PerCC*. |
| ***simultaneousCSI-ReportsAllCC***This parameter may further limit *simultaneousCSI-ReportsPerCC* in *MIMO-ParametersPerBand* and *Phy-ParametersFRX-Diff* for each band in a given band combination. |
| ***simultaneousSRS-AssocCSI-RS-AllCC***This parameter may further limit *simultaneousSRS-AssocCSI-RS-PerCC* in *MIMO-ParametersPerBand* and *Phy-ParametersFRX-Diff* for each band in a given band combination. |
| ***totalNumberPortsSimultaneousNZP-CSI-RS-ActBWP-AllCC***Limits the total number of ports that the NW may configure across all NZP-CSI-RS resources across all CCs (irrespective of the associated codebook type). The network applies this limit in addition to the limits signalled in *MIMO-ParametersPerBand*-> *totalNumberPortsSimultaneousNZP-CSI-RS-PerCC* and in *Phy-ParametersFRX-Diff*-> t*otalNumberPortsSimultaneousNZP-CSI-RS-PerCC*. |