**3GPP TSG-RAN WG2#101 *DRAFT R2-180xxxx***

**Athens, Greece, 26th Feb. – 2nd Mar. 2018**

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| *CR-Form-v11.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.331** | **CR** | **0005** | **rev** | **6** | **Current version:** | **15.0.1** |  |
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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:***  | Updates on UE capabilities |
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| ***Source to WG:*** | Intel Corporation |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2018-02-02 |
|  |  |  |  |  |
| ***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:*** | Update UE capabilities according to the following agreements (RAN2 NR AH and RAN2#101):1. Linking MR-DC BCs to BPCs (R2-1800909)
2. BC structure with UL and DL decoupling (R2-181620)
3. Clarifications on BPC capabilities (R2-1801532)
4. UE capabilities on dynamic power sharing (R2-1801520)
5. L2/3 capabilities (R2-1801608)
6. I.044 (R2-1800955)
7. N.037, N.038, N.040, N.045, N.046, N.221, N.222 (R2-1800831)
8. 5.6, 5.7 to 5.7.1 (E.027), 6.3.3 (C.033, M.052, M.054, Z.078, I.078, I.083. H.277) in RIL 38.331
9. Update UE capabilities according to the following agreements (RAN2#101)
10. Add UE capabilities on L1/RF/RRM features in accordance with RAN1/4 inputs in R1-1803513 and R4-1803564.
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| ***Summary of change:*** | 1. Remove “FFS if supportedBasebandProcessingCombination-MRDC is included here or BandCombinationList” in the ASN.1.
2. Fill in the blanks of BandCombinationList with UL and DL decoupling.
3. Updates supportedBW-PerCC and modulationOrder as per CC capability.
4. Add dynamicPowerSharing in MR-DC container.
5. Update L2/3 capabilities:
* Relocate intraBandAsyncFDD into RF-Parameters in MR-DC container.
* Add intraAndInterF-MeasAndReport and eventA-MeasAndReport into MeasParameters in UE-NR-Capability.
* Add splitSRB-WithOneUL-Path and directSN-Addition into generalParameters in MR-DC container.
* Add fdd-UE-MRDC-Capability, tdd-UE-MRDC-Capability, fdd-UE-NR-Capability, and tdd-UE-NR-Capability.
* Remove “FFS utra, geran-cs, geran-ps and cdma2000-1XRTT”
1. Remove volteOverNR-PDCP from NR ASN.1
2. Change MR-DC to eutra-nr in RAT-Type, add FreqBandList IE and replace requestedFreqBandList by FreqBandList in 5.6.1.4.
3. Update the following changes:
* Change sentence to “if FreqBandList is received:” in 5.6.1.4.
* Change maxSimultaneousBands to maxRequestedBands.
* Add “MN” and “SN” into each basebandProcessingCombinationIndex in LinkedBasebandProcessingCombination.
* Change maxServCell to maxNrofCC.
* Change subCarrierSpacing to supportedSubCarrierSpacingList.
* Clarify maxRateDRB-IP is removed.
* Remove SupportedBandCombination ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombination.
* Update field description to remove E-UTRA in RAT-Type.
1. Update the following changes:
* Add ENUMERATED {supported} for multipleSR-Configurations and multipleConfiguredGrantConfigurations.
* Remove directSN-Addition and dataRateDRB-IP.
* Add splitDRB-withUL-Both-MCG-SCG and srb3 into UE-MRDC-Capability.
* Move tdm-Pattern from UE-EUTRA-Capability to UE-MRDC-Capability.
* Add UECapabilityInformation message.
* Implement RAN1/RAN4 type 3 parameters that is per band per band combination into the “BPC” structure.
* Add explicit linking from the RF band combinations to BPCs.
* Add additional SFTD related capability into UE-MRDC-Capability.
1. Add UE capabilities on L1/RF/RRM features
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| ***Consequences if not approved:*** | Specification is incomplete.  |
|  |  |
| ***Clauses affected:*** | 5.6.1, 6.2.1, 6.3.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.306 CR 0003  |
| ***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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| The First Change |

## 5.6 UE capabilities

### 5.6.1 UE capability transfer

#### 5.6.1.1 General

Editor’s Note: Targeted for completion in June 2018

5.6.1.2 Initiation

Editor’s Note: Targeted for completion in June 2018.

#### 5.6.1.3 Reception of the *UECapabilityEnquiry* by the UE

Editor’s Note: Targeted for completion in June 2018.

#### 5.6.1.4 Compilation of band combinations supported by the UE

The UE shall:

1> if includes *FreqBandList* is received:

2> compile a list of band combinations, candidate for inclusion in the *UECapabilityInformation* message, only consisting of bands included in *FreqBandList*, and prioritized in the order of *FreqBandList*, (i.e. first include remaining band combinations containing the first-listed band, then include remaining band combinations containing the second-listed band, and so on);

2> for each band combination included in the candidate list:

3> if it is regarded as a fallback band combination with the same capabilities of another band combination included in the list of candidates as specified in TS 38.306 [xx]:

4> remove the band combination from the list of candidates;

2> include all band combinations in the candidate list into *supportedBandCombination*;

1> else:

2> include all band combinations supported by the UE into *supportedBandCombination,* excluding fallback band combinations with the same capabilities of another band combination included in the list of band combinations supported by the UE;

#### 5.6.1.5 Compilation of baseband processing combinations supported by the UE

The UE shall:

1> for each band combination included in *supportedBandCombination*:

2> include the baseband processing combination supported for the band combination into *supportedBasebandProcessingCombination*, unless it is already included;

2> if there are the fallback baseband processing combinations of this baseband processing combination as specified in TS 38.306 [xx] for which supported baseband capabilities are different from this baseband processing combination:

3> include only these baseband processing combinations into *supportedBasebandProcessingCombination*;

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| The Next Change |

6.2 RRC messages

6.2.1 General message structure

*– NR-RRC-Definitions*

This ASN.1 segment is the start of the NR RRC PDU definitions.

-- ASN1START

-- TAG-NR-RRC-DEFINITIONSSTART

NR-RRC-Definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- TAG-NR-RRC-DEFINITIONS-STOP

-- ASN1STOP

*– BCCH-BCH-Message*

The *BCCH-BCH-Message* class is the set of RRC messages that may be sent from the network to the UE via BCH on the BCCH logical channel.

-- ASN1START

-- TAG-BCCH-BCH-MESSAGE-START

BCCH-BCH-Message ::= SEQUENCE {

 message BCCH-BCH-MessageType

}

BCCH-BCH-MessageType ::= CHOICE {

 mib MIB,

 messageClassExtension SEQUENCE {}

}

-- TAG-BCCH-BCH-MESSAGE-STOP

-- ASN1STOP

*– DL-DCCH-Message*

The *DL-DCCH-Message* class is the set of RRC messages that may be sent from the network to the UE on the downlink DCCH logical channel.

-- ASN1START

-- TAG-DL-DCCH-MESSAGE-START

DL-DCCH-Message ::= SEQUENCE {

 message DL-DCCH-MessageType

}

DL-DCCH-MessageType ::= CHOICE {

 c1 CHOICE {

 rrcReconfiguration RRCReconfiguration,

 spare15 NULL, spare14 NULL, spare13 NULL,

 spare12 NULL, spare11 NULL, spare10 NULL,

 spare9 NULL, spare8 NULL, spare7 NULL,

 spare6 NULL, spare5 NULL, spare4 NULL,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 messageClassExtension SEQUENCE {}

}

-- TAG-DL-DCCH-MESSAGE-STOP

-- ASN1STOP

*– UL-DCCH-Message*

The *UL-DCCH-Message* class is the set of RRC messages that may be sent from the UE to the network on the uplink DCCH logical channel.

-- ASN1START

-- TAG-UL-DCCH-MESSAGE-START

UL-DCCH-Message ::= SEQUENCE {

 message UL-DCCH-MessageType

}

UL-DCCH-MessageType ::= CHOICE {

 c1 CHOICE {

 measurementReport MeasurementReport,

 rrcReconfigurationComplete RRCReconfigurationComplete,

 spare14 NULL,

 spare13 NULL, spare12 NULL,

 spare11 NULL, spare10 NULL, spare9 NULL,

 spare8 NULL, spare7 NULL, spare6 NULL,

 spare5 NULL, spare4 NULL, spare3 NULL,

 spare2 NULL, spare1 NULL

 },

 messageClassExtension SEQUENCE {}

}

-- TAG-UL-DCCH-MESSAGE-STOP

-- ASN1STOP

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| The Next Change |

6.2.2 Message definitions

<< skip irrelevant part >>

– *UECapabilityInformation*

Editor’s note: Targeted for completion in June 2018. For EN-DC, UE capabilities are transferred in E-UTRA, see TS 36.331.

The *UECapabilityInformation* message is used to transfer of UE radio access capabilities requested by the network, and between network nodes.

Signalling radio bearer: SRB1

RLC-SAP: AM

Logical channel: DCCH

Direction: UE to NG-RAN

***UECapabilityInformation message***

-- ASN1START

-- TAG-UECAPABILITYINFORMATION-START

UECapabilityInformation ::= SEQUENCE {

 rrc-TransactionIdentifier RRC-TransactionIdentifier,

 criticalExtensions CHOICE {

 ueCapabilityInformation UECapabilityInformation-IEs,

 criticalExtensionsFuture SEQUENCE {}

 }

}

UECapabilityInformation-IEs ::= SEQUENCE {

 ue-CapabilityRAT-ContainerList UE-CapabilityRAT-ContainerList,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-UECAPABILITYINFORMATION-STOP

-- ASN1STOP

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| The Next Change |

6.3.3 UE capability information elements

*–* *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

BandCombination ::= SEQUENCE {

 bandAndDL-ParametersList BandAndDL-ParametersList,

 bandCombinationsUL BIT STRING (SIZE (1.. maxBandComb)),

 bandCombinationParametersList SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationParameters OPTIONAL

}

BandAndDL-ParametersList ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandAndDL-Parameters

BandAndDL-Parameters ::= CHOICE {

 bandAndDL-ParametersEUTRA BandAndDL-ParametersEUTRA,

 bandAndDL-ParametersNR BandAndDL-ParametersNR

}

BandCombinationParameters ::= SEQUENCE {

 ca-ParametersNR CA-ParametersNR OPTIONAL,

 mrdc-Parameters MRDC-Parameters OPTIONAL

}

CA-ParametersNR ::= SEQUENCE {

 multipleTimingAdvances ENUMERATED {supported} OPTIONAL

-- R4 2-5: Simultaneous reception and transmission for inter band CA (TDD-TDD or TDD-FDD)

 simultaneousRxTxInterBandCA ENUMERATED {supported} OPTIONAL,

-- BCS related to R4 2-1 and Updated CA BW class in R4-1803374

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

}

MRDC-Parameters ::= SEQUENCE {

 singleUL-Transmission ENUMERATED {supported} OPTIONAL,

-- R4 1-10: Support of EN-DC with LTE-NR coexistence in UL sharing from UE perspective

 ul-SharingEUTRA-NR ENUMERATED {supported} OPTIONAL,

-- R4 1-11: Switching time between LTE UL and NR UL for EN-DC with LTE-NR coexistence in UL sharing from UE perspective

 ul-SwitchingTimeEUTRA-NR ENUMERATED {type1, type2} OPTIONAL,

-- R4 2-4: Simultaneous reception and transmission for inter-band EN-DC (TDD-TDD or TDD-FDD)

 simultaneousRxTxInterBandENDC ENUMERATED {supported} OPTIONAL,

-- R4 2-6: Asynchronous FDD-FDD intra-band EN-DC

 asyncIntraBandENDC ENUMERATED {supported} OPTIONAL,

 basebandProcesingCombinationMRDC BasebandProcessingCombinationMRDC

}

BandAndDL-ParametersEUTRA ::= SEQUENCE {

 bandEUTRA FreqBandIndicatorEUTRA,

 ca-BandwidthClassDL-EUTRA CA-BandwidthClassEUTRA OPTIONAL,

 intraBandContiguousCC-InfoDL-EUTRA-List SEQUENCE (SIZE (1.. maxNrofServingCellsEUTRA)) OF IntraBandContiguousCC-InfoDL-EUTRA

}

BandAndDL-ParametersNR ::= SEQUENCE {

 bandNR FreqBandIndicatorNR,

 ca-BandwidthClassDL CA-BandwidthClassNR OPTIONAL,

-- R4 2-3: Non-contiguous intra-band CA frequency separation class for FR2 as in the RAN4 LS R4-1803363

 intraBandFreqSeparationDL FreqSeparationClass OPTIONAL,

 intraBandContiguousCC-InfoDL-List SEQUENCE (SIZE (1.. maxNrofServingCells)) OF IntraBandContiguousCC-InfoDL

}

IntraBandContiguousCC-InfoDL ::= SEQUENCE {

-- Related to RAN4 LS R2-1804078

 maxNumberMIMO-LayersPDSCH MIMO-LayersDL OPTIONAL

}

IntraBandContiguousCC-InfoDL-EUTRA ::= SEQUENCE {

-- Related to RAN4 LS R2-1804078

 MIMO-CapabilityDL ENUMERATED {twoLayers, fourLayers, eightLayers} OPTIONAL

}

-- TAG-BANDCOMBINATIONLIST-STOP

-- ASN1STOP

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*– BandCombinationParametersUL-List*

The IE *BandCombinationParametersUL-List* is used to contain list of NR and/or E-UTRA frequency UL band parameters combination for the supported NR CA and/or MR-DC band combinations included in supportedBandCombination in RF-Parameters and/or RF-Parameters-MRDC.

-- ASN1START

-- TAG-BANDCOMBINATIONPARAMETERSULLIST-START

BandCombinationParametersUL-List ::= SEQUENCE (SIZE (1..maxBandComb)) OF BandCombinationParametersUL

BandCombinationParametersUL ::= SEQUENCE (SIZE (1.. maxSimultaneousBands)) OF BandParametersUL

BandParametersUL ::= CHOICE {

 bandParametersUL-EUTRA BandParametersUL-EUTRA,

 bandParametersUL-NR BandParametersUL-NR

}

BandParametersUL-EUTRA ::= SEQUENCE {

 ca-BandwidthClassUL-EUTRA CA-BandwidthClassEUTRA OPTIONAL,

 intraBandContiguousCC-InfoUL-EUTRA-List SEQUENCE (SIZE (1.. maxNrofServingCellsEUTRA)) OF IntraBandContiguousCC-InfoUL-EUTRA

}

BandParametersUL-NR ::= SEQUENCE {

 ca-BandwidthClassUL CA-BandwidthClassNR OPTIONAL,

-- R4 2-3: Non-contiguous intra-band CA frequency separation class for FR2 as in the RAN4 LS R4-1803363

 intraBandFreqSeparationUL FreqSeparationClass OPTIONAL,

 intraBandContiguousCC-InfoUL-List SEQUENCE (SIZE (1.. maxNrofServingCells)) OF IntraBandContiguousCC-InfoUL

}

IntraBandContiguousCC-InfoUL ::= SEQUENCE {

-- Related to RAN4 LS R2-1804078

 maxNumberMIMO-LayersCB-PUSCH MIMO-LayersUL OPTIONAL,

 maxNumberMIMO-LayersNonCB-PUSCH MIMO-LayersUL OPTIONAL

}

IntraBandContiguousCC-InfoUL-EUTRA ::= SEQUENCE {

-- Related to RAN4 LS R2-1804078

 MIMO-CapabilityUL ENUMERATED {twoLayers, fourLayers} OPTIONAL

}

-- TAG-BANDCOMBINATIONPARAMETERSULLIST-STOP

-- ASN1STOP

*– – BasebandCombinationParametersUL-List*

-- ASN1START

-- TAG-BASEBANDCOMBINATIONPARAMETERSULLIST-START

BasebandCombinationParametersUL-List ::= SEQUENCE (SIZE (1..maxBasebandProcCombUL)) OF BasebandCombinationParametersUL

BasebandCombinationParametersUL ::= SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BasebandParametersPerBandUL

BasebandParametersPerBandUL ::= SEQUENCE {

 ca-BandwidthClassUL CA-BandwidthClassNR,

 freqRange ENUMERATED {fr1, fr2},

 basebandParametersPerCC-UL SEQUENCE (SIZE (1.. maxNrofServingCells)) OF BasebandParametersPerCC-UL

}

BasebandParametersPerCC-UL ::= SEQUENCE {

-- R4 2-2: Simultaneous reception or transmission with same or different numerologies in CA

-- It is expressed by the combination of SCS whether simultaneous RxTx is supported or not.

 supportedSubcarrierSpacingUL SubcarrierSpacing,

-- Accoding to the RAN4 LS R4-1803563, maximum Bandwidth supported per CC is added in BPC

-- FFS how to work together with BCS and max BW for each CC to be defined for each CA band combination in the RAN4 spec.

 supportedBandwidthUL CHOICE {

 fr1 ENUMERATED {mhz5, mhz10, mhz15, mhz20, mhz25, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100},

 fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

 },

 -- R2-1800012. To be confirmed by RAN1

-- R1 2-14: Codebook based PUSCH MIMO transmission. Absence of this field implies that CB-based PUSCH is not supported.

 maxNumberMIMO-LayersCB-PUSCH MIMO-LayersUL OPTIONAL,

-- R1 2-15: Non-codebook based PUSCH MIMO transmission. Absence of this field implies that Non-CB-based PUSCH is not supported.

 maxNumberMIMO-LayersNonCB-PUSCH MIMO-LayersUL OPTIONAL,

-- Accoding to the RAN4 LS R4-1803563, modulation order is added per CC granularity in BPC

-- FFS whether all of modulation order specified in the spec need to be signalled.

-- FFS how to address the requirements agreed by RAN4, e.g. mandaotry w/o capabiltiy for 64QAM. mandaotry with capabiltiy for DL 256QAM in FR1.

 supportedModulationOrderUL ModulationOrder OPTIONAL,

-- R1 2-53: SRS resources

 supportedSRS-Resources SRS-Resources OPTIONAL,

-- R1 2-55: SRS Tx switch

 srs-TxSwitch SRS-TxSwitch OPTIONAL,

-- R1 2-57: Support low latency CSI feedback

 lowLatencyCSI-Feedback ENUMERATED {supported} OPTIONAL,

-- R1 5-12 & 5-12a: Up to 2/7 PUSCHs per slot for different TBs

 pusch-DifferentTB-PerSlot SEQUENCE {

 scs-15kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-30kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-60kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-120kHz ENUMERATED {upto2, upto7} OPTIONAL

 } OPTIONAL,

-- R1 6-7: Two PUCCH group

 twoPUCCH-Group ENUMERATED {supported} OPTIONAL,

-- R1 6-8: Different numerology across PUCCH groups

 diffNumerologyAcrossPUCCH-Group ENUMERATED {supported} OPTIONAL,

-- R1 6-9: Different numerologies across carriers within the same PUCCH group

 diffNumerologyWithinPUCCH-Group ENUMERATED {supported} OPTIONAL,

-- R1 6-10: Cross carrier scheduling

 crossCarrierScheduling ENUMERATED {supported} OPTIONAL,

-- R1 6-11: Number of supported TAGs

 supportedNumberTAG ENUMERATED {n2, n3, n4} OPTIONAL,

-- R1 6-18: Supplemental uplink with dynamic switch

 dynamicSwitchSUL ENUMERATED {supported} OPTIONAL,

-- R1 6-19: Simultaneous transmission of SRS on an SUL/non-SUL carrier and PUSCH/PUCCH/SRS/PRACH on the other UL carrier in the same cell

-- Details on the channel/signal combination are to be described in TS 38.306

 simultaneousTxSUL-NonSUL ENUMERATED {supported} OPTIONAL,

-- R1 6-22: UL search space sharing for CA

 searchSpaceSharingCA-UL ENUMERATED {supported}) OPTIONAL

}

-- TAG-BASEBANDCOMBINATIONPARAMETERSULLIST-STOP

-- ASN1STOP

*– BasebandProcessingCombinationMRDC*

-- ASN1START

-- TAG-BASEBANDPROCESSINGCOMBINATIONMRDC-START

BasebandProcessingCombinationMRDC ::= SEQUENCE (SIZE (1..maxBasebandProcComb)) OF BasebandProcessingCombinationLink

BasebandProcessingCombinationLink ::= SEQUENCE {

 basebandProcessingCombinationIndexMN BasebandProcessingCombinationIndex,

 basebandProcessingCombinationLinkedIndexSN SEQUENCE (SIZE (1..maxBasebandProcComb)) OF BasebandProcessingCombinationIndex

}

BasebandProcessingCombinationIndex ::= INTEGER (1..maxBasebandProcComb)

-- TAG-BASEBANDPROCESSINGCOMBINATIONMRDC-STOP

-- ASN1STOP

*– CA-BandwidthClassNR*

-- ASN1START

-- TAG-CA-BANDWIDTHCLASS-START

-- Updated based on R4-1803374

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

-- TAG-CA-BANDWIDTHCLASS-STOP

-- ASN1STOP

*– CA-BandwidthClassEUTRA*

-- ASN1START

-- TAG-CA-BANDWIDTHCLASSEUTRA-START

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

-- TAG-CA-BANDWIDTHCLASSEUTRA-STOP

-- ASN1STOP

*– – FreqBandIndicatorEUTRA*

-- ASN1START

-- TAG-FREQ-BAND-INDICATOR-EUTRA-START

FreqBandIndicatorEUTRA ::= INTEGER (1..maxBandsEUTRA)

-- TAG-FREQ-BAND-INDICATOR-EUTRA-STOP

-- ASN1STOP

*– FreqBandList*

The IE *FreqBandList* is used to contain list of NR and/or E-UTRA frequency bands for which the UE is requested to provide its supported NR CA and/or MR-DC band combinations (i.e. within the UE capability containers for NR and MR-DC, as requested by E-UTRA).

***FreqBandList* information element**

-- ASN1START

-- TAG-FREQBANDLIST-START

FreqBandList ::= SEQUENCE (SIZE (1..maxBandsMRDC)) OF FreqBandInformation

FreqBandInformation ::= CHOICE {

 bandEUTRA FreqBandIndicatorEUTRA,

 bandNR FreqBandIndicatorNR

}

-- TAG-FREQBANDLIST-STOP

-- ASN1STOP

*– FreqSeparationClass*

The IE *FreqSeparationClas*s is used for an intra-band non-contiguous CA band combination to indicate frequency separation between lower edge of lowest CC and upper edge of highest CC in a frequency band.

***FreqSeparationClass* information element**

-- ASN1START

-- TAG-FREQSEPARATIONCLASS-START

FreqSeparationClass ::= ENUMERATED {c1, c2, c3, ...}

-- TAG-FREQSEPARATIONCLASS-STOP

-- ASN1STOP

*– MIMO-Layers*

-- ASN1START

-- TAG-MIMO-Layers-START

MIMO-LayersDL ::= ENUMERATED {twoLayers, fourLayers, eightLayers}

MIMO-LayersUL ::= ENUMERATED {oneLayer, twoLayers, fourLayers}

-- TAG-MIMO-Layers-STOP

-- ASN1STOP

*– RAT-Type*

The IE *RAT-Type* is used to indicate the radio access technology (RAT), including NR, of the requested/transferred UE capabilities.

***RAT-Type* information element**

-- ASN1START

-- TAG-RAT-TYPE-START

RAT-Type ::= ENUMERATED {nr, eutra-nr, spare2, spare1, ...}

-- TAG-RAT-TYPE-STOP

-- ASN1STOP

*– SupportedBasebandProcessingCombination*

-- ASN1START

-- TAG-SUPPORTEDBASEBANDPROCESSINGCOMBINATION-START

SupportedBasebandProcessingCombination ::= SEQUENCE (SIZE (1..maxBasebandProcCombDL)) OF BasebandProcessingCombination

BasebandProcessingCombination ::= SEQUENCE {

 basebandParametersDL SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BasebandParametersPerBandDL,

 basebandParametersUL BIT STRING (SIZE (1..maxBasebandProcCombUL))}

BasebandParametersPerBandDL ::= SEQUENCE {

 ca-BandwidthClassDL CA-BandwidthClassNR,

 freqRange ENUMERATED {fr1, fr2},

 basebandParametersPerCC-DL SEQUENCE (SIZE (1..maxNrofCC)) OF BasebandParametersPerCC-DL

}

BasebandParametersPerCC-DL ::= SEQUENCE {

-- R4 2-2: Simultaneous reception or transmission with same or different numerologies in CA

-- It is expressed by the combination of SCS whether simultaneous RxTx is supported or not.

 supportedSubcarrierSpacingDL SubcarrierSpacing,

-- Accoding to the RAN4 LS R4-1803563, maximum Bandwidth supported per CC is added in BPC

-- FFS how to work together with BCS and max BW for each CC to be defined for each CA band combination in the RAN4 spec.

 supportedBandwidthDL CHOICE {

 fr1 ENUMERATED {mhz5, mhz10, mhz15, mhz20, mhz25, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100},

 fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

 },

-- R2-1800012. To be confirmed by RAN1

-- R1 2-2: PDSCH beam switching

 timeDurationForQCL SEQUENCE {

 scs-60kHz ENUMERATED {s7, s14, s28} OPTIONAL,

 sch-120kHz ENUMERATED {s14, s28} OPTIONAL

 } OPTIONAL,

-- R1 1-10: Support of SCell without SS/PBCH block

 scellWithoutSSB ENUMERATED {supported} OPTIONAL,

-- R1 1-11: Support of CSI-RS RRM measurement for SCell without SS/PBCH block

 csi-RS-MeasSCellWithoutSSB ENUMERATED {supported} OPTIONAL,

-- R1 2-3: PDSCH MIMO layers. Absence of this field implies support of one layer.

 maxNumberMIMO-LayersPDSCH MIMO-LayerDL OPTIONAL,

-- Accoding to the RAN4 LS R4-1803563, modulation order is added per CC granularity in BPC

-- FFS whether all of modulation order specified in the spec need to be signalled.

-- FFS how to address the requirements agreed by RAN4, e.g. mandaotry w/o capabiltiy for 64QAM. mandaotry with capabiltiy for DL 256QAM in FR1.

 supportedModulationOrderDL ModulationOrder OPTIONAL,

-- R1 2-15a: Association between CSI-RS and SRS

 srs-AssocCSI-RS ENUMERATED {supported} OPTIONAL,

-- R1 3-1a: For type 1 CSS with dedicated RRC configuration and for type 3 CSS, UE specific SS, CORESET resource allocation of 6RB bit-map and duration 3 OFDM symbols for FR2

 type1-3-CSS ENUMERATED {supported} OPTIONAL,

-- R1 3-5 & 3-5a: For type 1 with dedicated RRC configuration, type 3, and UE-SS,, monitoring occasion can be any OFDM symbol(s) of a slot for Case 2 (with a DCI gap)

 pdcchMonitoringAnyOccasions ENUMERATED {withoutDCI-gap, withDCI-gap} OPTIONAL,

-- R1 5-1a: UE specific RRC configure UL/DL assignment

 ue-SpecificUL-DL-Assignment ENUMERATED {supported} OPTIONAL,

-- R1 5-11 & 5-11a: Up to 2/7 unicast PDSCHs per slot for different TBs

 pdsch-DifferentTB-PerSlot SEQUENCE {

 scs-15kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-30kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-60kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-120kHz ENUMERATED {upto2, upto7} OPTIONAL

 } OPTIONAL,

-- R1 6-10: Cross carrier scheduling

 crossCarrierScheduling ENUMERATED {supported} OPTIONAL,

-- R1 6-21: DL search space sharing for CA

 searchSpaceSharingCA-DL ENUMERATED {supported} OPTIONAL

}

-- TAG-SUPPORTEDBASEBANDPROCESSINGCOMBINATION-STOP

-- ASN1STOP

*– ModulationOrder*

-- ASN1START

-- TAG-MODULATION-ORDER-START

ModulationOrder ::= ENUMERATED {bpsk-halfpi, bpsk, qpsk, qam16, qam64, qam256}

-- TAG-MODULATION-ORDER-STOP

-- ASN1STOP

*– –* *UE-CapabilityRAT-ContainerList*

The IE *UE-CapabilityRAT-ContainerList* contains a list of containers, one for each RAT for which UE capabilities are transferred, if any.

***UE-CapabilityRAT-ContainerList* information element**

-- ASN1START

-- TAG-UE-CAPABILITY-RAT-CONTAINER-LIST-START

UE-CapabilityRAT-ContainerList ::=SEQUENCE (SIZE (0.. maxRAT-CapabilityContainers)) OF UE-CapabilityRAT-Container

UE-CapabilityRAT-Container ::= SEQUENCE {

 rat-Type RAT-Type,

 ue-CapabilityRAT-Container OCTET STRING

}

-- TAG-UE-CAPABILITY-RAT-CONTAINER-LIST-STOP

-- ASN1STOP

|  |
| --- |
| ***UE-CapabilityRAT-ContainerList field descriptions*** |
| ***ue-CapabilityRAT-Container***Container for the UE capabilities of the indicated RAT. The encoding is defined in the specification of each RAT:For NR: the encoding of UE capabilities is defined in UE-NR-Capability.For EUTRA-NR: the encoding of UE capabilities is defined in UE-MRDC-Capability |

*– UE-MRDC-Capability*

The IE *UE-MRDC-Capability* is used to convey the UE Radio Access Capability Parameters for MR-DC, see TS 38.306 [yy].

***UE-MRDC-Capability* information element**

-- ASN1START

-- TAG-UE-MRDC-CAPABILITY-START

UE-MRDC-Capability ::= SEQUENCE {

 measParametersMRDC MeasParametersMRDC OPTIONAL,

 rf-ParametersMRDC RF-ParametersMRDC,

 phy-ParametersMRDC Phy-ParametersMRDC OPTIONAL,

 generalParametersMRDC GeneralParametersMRDC-XDD-Diff OPTIONAL,

 fdd-Add-UE-MRDC-Capabilities UE-MRDC-CapabilityAddXDD-Mode OPTIONAL,

 tdd-Add-UE-MRDC-Capabilities UE-MRDC-CapabilityAddXDD-Mode OPTIONAL,

 fr1-Add-UE-MRDC-Capabilities UE-MRDC-CapabilityAddFRX-Mode OPTIONAL,

 fr2-Add-UE-MRDC-Capabilities UE-MRDC-CapabilityAddFRX-Mode OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

UE-MRDC-CapabilityAddXDD-Mode ::= SEQUENCE {

 phy-ParametersMRDC-XDD-Diff Phy-ParametersMRDC-XDD-Diff OPTIONAL,

 measParametersMRDC-XDD-Diff MeasParametersMRDC-XDD-Diff OPTIONAL,

 generalParametersMRDC-XDD-Diff GeneralParametersMRDC-XDD-Diff OPTIONAL

}

UE-MRDC-CapabilityAddFRX-Mode ::= SEQUENCE {

 phy-ParametersMRDC-FRX-Diff Phy-ParametersMRDC-FRX-Diff OPTIONAL,

 measParametersMRDC-FRX-Diff MeasParametersMRDC-FRX-Diff

}

RF-ParametersMRDC ::= SEQUENCE {

 supportedBandCombination BandCombinationList,

 bandCombinationParametersUL-List BandCombinationParametersUL-List,

}

Phy-ParametersMRDC ::= SEQUENCE {

 phy-ParametersMRDC-XDD-Diff Phy-ParametersMRDC-XDD-Diff OPTIONAL,

 phy-ParametersMRDC-FRX-Diff Phy-ParametersMRDC-FRX-Diff OPTIONAL

}

Phy-ParametersMRDC-XDD-Diff ::= SEQUENCE {

-- R1 8-1: Dynamic power sharing for LTE-NR DC

 dynamicPowerSharing ENUMERATED {supported} OPTIONAL,

-- R1 6-13 & 8-2: Case 1 Single Tx UL LTE-NR DC

 tdm-Pattern ENUMERATED {supported} OPTIONAL

}

Phy-ParametersMRDC-FRX-Diff ::= SEQUENCE {

-- R1 8-1: Dynamic power sharing for LTE-NR DC

 dynamicPowerSharing ENUMERATED {supported} OPTIONAL,

-- R1 6-13 & 8-2: Case 1 Single Tx UL LTE-NR DC

 tdm-Pattern ENUMERATED {supported} OPTIONAL

}

MeasParametersMRDC ::= SEQUENCE {

 measParametersMRDC-Common MeasParametersMRDC-Common,

 measParametersMRDC-XDD-Diff MeasParametersMRDC-XDD-Diff OPTIONAL

 measParametersMRDC-FRX-Diff MeasParametersMRDC-FRX-Diff,

}

MeasParametersMRDC-Common ::= SEQUENCE {

-- R4 3-1: Independent measurement gap configurations for FR1 and FR2

}

MeasParametersMRDC-XDD-Diff ::= SEQUENCE {

 sftd-MeasPSCell ENUMERATED {supported} OPTIONAL,

 sftd-MeasNR-Cell ENUMERATED {supported} OPTIONAL

}

MeasParameters-MRDC-FRX-Diff :: SEQUENCE {

-- R4 3-2: Simultaneous reception of data and SS block with different numerologies when UE conducts the serving cell measurement or intra-frequency measurement

 simultaneousRxDataSSB-DiffNumerology ENUMERATED {supported} OPTIONAL

}

GeneralParametersMRDCXDD-Diff ::= SEQUENCE {

 splitSRB-WithOneUL-Path ENUMERATED {supported} OPTIONAL,

 splitDRB-withUL-Both-MCG-SCG ENUMERATED {supported} OPTIONAL,

 srb3 ENUMERATED {supported} OPTIONAL

}

-- TAG-UE-MRDC-CAPABILITY-STOP

-- ASN1STOP

*– UE-NR-Capability*

The IE *UE-NR-Capability* is used to convey the NR UE Radio Access Capability Parameters, see TS 38.306 [yy].

***UE-NR-Capability* information element**

-- ASN1START

-- TAG-UE-NR-CAPABILITY-START

UE-NR-Capability ::= SEQUENCE {

 pdcp-Parameters PDCP-Parameters,

 rlc-Parameters RLC-Parameters OPTIONAL,

 mac-Parameters MAC-Parameters OPTIONAL,

 phy-Parameters Phy-Parameters,

 rf-Parameters RF-Parameters,

 measParameters MeasParameters OPTIONAL,

 fdd-Add-UE-NR-Capabilities XDD-UE-NR-CapabilityAddXDD-Mode OPTIONAL,

 tdd-Add-UE-NR-Capabilities XDD-UE-NR-CapabilityAddXDD-Mode OPTIONAL,

 fr1-Add-UE-NR-Capabilities UE-NR-CapabilityAddFRX-Mode OPTIONAL,

 fr2-Add-UE-NR-Capabilities UE-NR-CapabilityAddFRX-Mode OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

UE-NR-CapabilityAddXDD-Mode ::= SEQUENCE {

 phy-ParametersXDD-Diff Phy-ParametersXDD-Diff OPTIONAL,

 mac-ParametersXDD-Diff MAC-ParametersXDD-Diff OPTIONAL,

 measParametersXDD-Diff MeasParametersXDD-Diff OPTIONAL

}

UE-NR-CapabilityAddFRX-Mode ::= SEQUENCE {

 phy-ParametersFRX-Diff Phy-ParametersFRX-Diff OPTIONAL,

 measParametersFRX-Diff MeasParametersFRX-Diff OPTIONAL

}

Phy-Parameters ::= SEQUENCE {

 phy-ParametersCommon Phy-ParametersCommon OPTIONAL,

 phy-ParametersXDD-Diff Phy-ParametersXDD-Diff OPTIONAL,

 phy-ParametersFRX-Diff Phy-ParametersFRX-Diff OPTIONAL,

 phy-ParametersFR1 Phy-ParametersFR1 OPTIONAL,

 phy-ParametersFR2 Phy-ParametersFR2 OPTIONAL,

 supportedBasebandProcessingCombination SupportedBasebandProcessingCombination,

 basebandCombinationParametersUL-List BasebandCombinationParametersUL-List

}

Phy-ParametersCommon ::= SEQUENCE {

-- R1 1-9: CSI-RS based CFRA for HO

 csi-RS-CFRA-ForHO ENUMERATED {supported} OPTIONAL,

-- R1 2-11: Downlink dynamic PRB bundling (DL)

 dynamicPRB-BundlingDL ENUMERATED {supported} OPTIONAL,

-- R1 2-32a: Semi-persistent CSI report on PUCCH

 sp-CSI-ReportPUCCH ENUMERATED {supported} OPTIONAL,

-- R1 2-32b: Semi-persistent CSI report on PUSCH

 sp-CSI-ReportPUSCH ENUMERATED {supported} OPTIONAL,

-- R1 2-34: NZP-CSI-RS based interference measurement

 nzp-CSI-RS-IntefMgmt ENUMERATED {supported} OPTIONAL,

-- R1 2-42: Support Type II SP-CSI feedback on long PUCCH

 type2-SP-CSI-Feedback-LongPUCCH ENUMERATED {supported} OPTIONAL,

-- R1 3-3: More than one CORESET per BWP (in addition to CORESET #0)

 multipleCORESET ENUMERATED {supported} OPTIONAL,

-- R1 3-6: Dynamic SFI monitoring and dynamic UL/DL determination

 dynamicSFI ENUMERATED {supported} OPTIONAL,

-- R1 3-7: Precoder-granularity of CORESET size

 precoderGranularityCORESET ENUMERATED {supported} OPTIONAL,

-- R1 4-10: Dynamic HARQ-ACK codebook

 dynamicHARQ-ACK-Codebook ENUMERATED {supported} OPTIONAL,

-- R1 4-11: Semi-static HARQ-ACK codebook

 semiStaticHARQ-ACK-Codebook ENUMERATED {supported} OPTIONAL,

-- R1 4-12: HARQ-ACK spatial bundling for PUCCH or PUSCH per PUCCH group

 spatialBundlingHARQ-ACK ENUMERATED {supported} OPTIONAL,

-- R1 4-21: Dynamic beta-offset configuration and indication for HARQ-ACK and/or CSI

 dynamicBetaOffsetInd-HARQ-ACK-CSI ENUMERATED {supported} OPTIONAL,

-- R1 4-23: Repetitions for PUCCH format 1, 3,and 4 over multiple slots with K = 1, 2, 4, 8

 pucch-Repetition-F1-3-4 ENUMERATED {supported} OPTIONAL,

-- R1 5-2: RA type 0 for PUSCH

 ra-Type0-PUSCH ENUMERATED {supported} OPTIONAL,

-- R1 5-3: Dynamic switching between RA type 0 and RA type 1 for PDSCH

 dynamicSwitchRA-Type0-1-PDSCH ENUMERATED {supported} OPTIONAL,

-- R1 5-4: Dynamic switching between RA type 0 andRA type 1 for PUSCH

 dynamicSwitchRA-Type0-1-PUSCH ENUMERATED {supported} OPTIONAL,

-- R1 5-6: PDSCH mapping type A with less than 7 OFDM symbols

 pdsch-MappingTypeA ENUMERATED {supported} OPTIONAL,

-- R1 5-6a: PDSCH mapping type B

 pdsch-MappingTypeB ENUMERATED {supported} OPTIONAL,

-- R1 5-7: Interleaving for VRB-to-PRB mapping for PDSCH

 interleavingVRB-ToPRB-PDSCH ENUMERATED {supported} OPTIONAL,

-- R1 5-8: Interleaving for VRB-to-PRB mapping for PUSCH

 interleavingVRB-ToPRB-PUSCH ENUMERATED {supported} OPTIONAL,

-- R1 5-10: Inter-slot frequency hopping for PUSCH

 interSlotFreqHopping-PUSCH ENUMERATED {supported} OPTIONAL,

-- R1 5-13: Type 1 configured PUSCH repetitions within a slot

 type1-PUSCH-RepetitionOneSlot ENUMERATED {supported} OPTIONAL,

-- R1 5-14: Type 1 configured PUSCH repetitions over multiple slots

 type1-PUSCH-RepettitionMultiSlots ENUMERATED {supported} OPTIONAL,

-- R1 5-15: Type 2 configured PUSCH repetitions within a slot

 type2-PUSCH-RepetitionOneSlot ENUMERATED {supported} OPTIONAL,

-- R1 5-16: Type 2 configured PUSCH repetitions over multiple slots

 type1-PUSCH-RepettitionMultiSlots ENUMERATED {supported} OPTIONAL,

-- R1 5-17: PUSCH repetitions over multiple slots

 pusch-RepetitionMultiSlots ENUMERATED {supported} OPTIONAL,

-- R1 5-17a: PDSCH repetitions over multiple slots

 pdsch-RepetitionMultiSlots ENUMERATED {supported} OPTIONAL,

-- R1 5-18: DL SPS

 downlinkSPS ENUMERATED {supported} OPTIONAL,

-- R1 5-19: Type 1 Configured UL grant

 configuredUL-GrantType1 ENUMERATED {supported} OPTIONAL,

-- R1 5-20: Type 2 Configured UL grant

 configuredUL-GrantType2 ENUMERATED {supported} OPTIONAL,

-- R1 5-21: Pre-emption indication for DL

 pre-EmptIndication-DL ENUMERATED {supported} OPTIONAL,

-- R1 5-22 & 5-25: CBG-based re-transmission for DL/UL using CBGTI

 cbg-TransIndication BIT STRING (SIZE (2)) OPTIONAL,

-- R1 5-23: CBGFI for CBG-based re-transmission for DL

 cbg-FlushIndication-DL ENUMERATED {supported} OPTIONAL,

-- R1 5-24: Dynamic HARQ-ACK codebook using sub-codebooks for CBG-based re-transmission for DL

 dynamicHARQ-ACK-CodeB-CBG-Retx-DL ENUMERATED {supported} OPTIONAL,

-- R1 5-26: Semi-static rate-matching resource set configuration for DL

 rateMatchingResrcSetSemi-Static ENUMERATED {supported} OPTIONAL,

-- R1 5-27: Dynamic rate-matching resource set configuration for DL

 rateMatchingResrcSetDynamic ENUMERATED {supported} OPTIONAL,

-- R1 5-28: Rate-matching around LTE CRS

 rateMatchingLTE-CRS ENUMERATED {supported} OPTIONAL,

-- R4 1-8: BWP switching delay

 bwp-SwitchingDelay ENUMERATED {type1, type2} OPTIONAL

}

Phy-ParametersXDD-Diff ::= SEQUENCE {

-- R1 4-2: 2 PUCCH of format 0 or 2 in consecutive symbols

 twoPUCCH-F0-2-ConsecSymbols ENUMERATED {supported} OPTIONAL,

-- R1 8-7: UL power control with 2 PUSCH closed loops

 twoDifferentTPC-Loop-PUSCH ENUMERATED {supported} OPTIONAL,

-- R1 8-8: UL power control with 2 PUCCH closed loops

 twoDifferentTPC-Loop-PUCCH ENUMERATED {supported} OPTIONAL

}

Phy-ParametersFRX-Diff ::= SEQUENCE {

-- R1 2-6 & 2-16b: Support 1+2 DMRS (DL/UL)

 oneFL-DMRS-TwoAdditionalDMRS BIT STRING (SIZE (2)) OPTIONAL,

-- R1 2-7 & 2-18: Supported 2 symbols front-loaded DMRS(DL/UL)

 twoFL-DMRS BIT STRING (SIZE (2)) OPTIONAL,

-- R1 2-8 & 2-18a: Supported 2 symbols front-loaded +2 symbols additional DMRS(DL/UL)

 twoFL-DMRS-TwoAdditionalDMRS BIT STRING (SIZE (2)) OPTIONAL,

-- R1 2-9 & 2-19: Support 1+3 DMRS (DL/UL)

 oneFL-DMRS-ThreeAdditionalDMRS BIT STRING (SIZE (2)) OPTIONAL,

-- R1 2-10: Support DMRS type (DL)

 supportedDMRS-TypeDL ENUMERATED {type1, type2} OPTIONAL,

-- R1 2-17: Support DMRS type (UL)

 supportedDMRS-TypeUL ENUMERATED {type1, type2} OPTIONAL,

-- R1 2-37: Support Semi-open loop CSI

 semiOpenLoopCSI ENUMERATED {supported} OPTIONAL,

-- R1 2-38: CSI report without PMI

 csi-ReportWithoutPMI ENUMERATED {supported} OPTIONAL,

-- R1 2-39: CSI report with CRI

 csi-ReportWithCRI ENUMERATED {supported} OPTIONAL,

-- R1 2-39a: CSI report without CQI

 csi-ReportWithoutCQI ENUMERATED {supported} OPTIONAL,

-- R1 2-44 & 2-47: 1 port of DL/UL PTRS

 onePortsPTRS BIT STRING (SIZE (2)) OPTIONAL,

-- R1 4-2: 2 PUCCH of format 0 or 2 in consecutive symbols

 twoPUCCH-F0-2-ConsecSymbols ENUMERATED {supported} OPTIONAL,

-- R1 4-3: PUCCH format 2 over 1 – 2 OFDM symbols once per slot with FH

 pucch-F2-WithFH ENUMERATED {supported} OPTIONAL,

-- R1 4-4: PUCCH format 3 over 4 – 14 OFDM symbols once per slot with FH

 pucch-F3-WithFH ENUMERATED {supported} OPTIONAL,

-- R1 4-5: PUCCH format 4 over 4 – 14 OFDM symbols once per slot with FH

 pucch-F4-WithFH ENUMERATED {supported} OPTIONAL,

-- R1 4-6: Non-frequency hopping for PUCCH formats 0 and 2

 freqHoppingPUCCH-F0-2 ENUMERATED {notSupported} OPTIONAL,

-- R1 4-7: Non-frequency hopping for PUCCH format 1, 3, and 4

 freqHoppingPUCCH-F1-3-4 ENUMERATED {notSupported} OPTIONAL,

-- R1 4-19: SR/HARQ-ACK/CSI multiplexing once per slot using a PUCCH (or piggybacked on a PUSCH)

 mux-SR-HARQ-ACK-CSI-PUCCH ENUMERATED {supported} OPTIONAL,

-- R1 4-20: UCI code-block segmentation

 uci-CodeBlockSegmentation ENUMERATED {supported} OPTIONAL,

-- R1 4-22: 1 long PUCCH format and 1 short PUCCH format in the same slot

 onePUCCH-LongAndShortFormat ENUMERATED {supported} OPTIONAL,

-- R1 4-22a: 2 PUCCH transmissions in the same slot which are not covered by 4-22 and 4-2

 twoPUCCH-AnyOthersInSlot ENUMERATED {supported} OPTIONAL,

-- R1 5-9: Intra-slot frequency-hopping for PUSCH except for PUSCH scheduled by Type 1 before RRC connection

 intraSlotFreqHopping-PUSCH ENUMERATED {supported} OPTIONAL,

-- R1 5-29: LBRM for PUSCH

 pusch-LBRM ENUMERATED {supported} OPTIONAL,

-- R1 6-5a: PDCCH blind detection capability for CA

 pdcch-BlindDetectionCA ENUMERATED {supported} OPTIONAL,

-- R1 8-3: TPC-PUSCH-RNTI

 tpc-PUSCH-RNTI ENUMERATED {supported} OPTIONAL,

-- R1 8-4: TPC-PUCCH-RNTI

 tpc-PUCCH-RNTI ENUMERATED {supported} OPTIONAL,

-- R1 8-5: TPC-SRS-RNTI

 tpc-SRS-RNTI ENUMERATED {supported} OPTIONAL,

-- R1 8-6: Absolute TPC command mode

 absoluteTPC-Command ENUMERATED {supported} OPTIONAL

-- R1 8-7: UL power control with 2 PUSCH closed loops

 twoDifferentTPC-Loop-PUSCH ENUMERATED {supported} OPTIONAL,

-- R1 8-8: UL power control with 2 PUCCH closed loops

 twoDifferentTPC-Loop-PUCCH ENUMERATED {supported} OPTIONAL,

-- R4 1-6: pi/2-BPSK for PUSCH

 pusch-HalfPi-BPSK ENUMERATED {supported} OPTIONAL,

-- R4 1-7: pi/2-BPSK for PUCCH format 3/4

 pucch-F3-4-HalfPi-BPSK ENUMERATED {supported} OPTIONAL,

-- R4 1-9: 1-symbol GP in unpaired spectrum

 oneSymbolGP-TDD ENUMERATED {supported} OPTIONAL,

-- R4 2-7: Almost contiguous UL CP-OFDM

 almostContiguousCP-OFDM-UL ENUMERATED {supported} OPTIONAL

}

Phy-ParametersFR1 ::= SEQUENCE {

-- R1 3-2: Unicast PDCCH monitoring following Case 1-2

 pdcchMonitoringSingleOccasion ENUMERATED {supported} OPTIONAL,

-- R4 1-1: 60kHz of subcarrier spacing for FR1

 scs-60kHz ENUMERATED {supported} OPTIONAL,

-- R4 1-4: 256QAM for PDSCH in FR1

 pdsch-256QAM-FR1 ENUMERATED {supported} OPTIONAL

}

Phy-ParametersFR2 ::= SEQUENCE {

-- R4 2-8: PA calibration gap

 calibrationGapPA ENUMERATED {supported} OPTIONAL

}

RF-Parameters ::= SEQUENCE {

 supportedBandListNR SupportedBandListNR,

 supportedBandCombination BandCombinationList,

 bandCombinationParametersUL-List BandCombinationParametersUL-List

}

SupportedBandListNR ::= SEQUENCE (SIZE (1..maxBands)) OF BandNR

BandNR ::= SEQUENCE {

 bandNR FreqBandIndicatorNR,

-- Modified MPR behaviour as in RAN4 LS R2-1804077, which is needed for NSA as well as SA

 modifiedMPR-Behaviour BIT STRING (SIZE (8)) OPTIONAL,

-- R4 2-1: Maximum channel bandwidth supported in each band for DL and UL separately and for each SCS that UE supports within a single CC

-- RAN4 agreed that 400 MHz is optional for FR2. The other values defined for FR1/fR2 in TS 38.101 are mandatory w/o capability bit.

 maxChannelBW-PerCC ENUMERATED {mhz400} OPTIONAL,

 mimo-ParametersPerBand MIMO-ParametersPerBand OPTIONAL,

-- R1 0-10: Extended CP

 extendedCP ENUMERATED {supported} OPTIONAL,

-- R1 0-13: Phase coherence across non-contiguous UL symbols in slot in the transmission of one channel

 phaseCoherenceUL ENUMERATED {supported} OPTIONAL,

-- R1 1-10: Support of SCell without SS/PBCH block

 scellWithoutSSB ENUMERATED {supported} OPTIONAL,

-- R1 1-11: Support of CSI-RS RRM measurement for SCell without SS/PBCH block

 csi-RS-MeasSCellWithoutSSB ENUMERATED {supported} OPTIONAL,

-- R1 2-15a: Association between CSI-RS and SRS

 srs-AssocCSI-RS ENUMERATED {supported} OPTIONAL,

-- R1 3-1a: For type 1 CSS with dedicated RRC configuration and for type 3 CSS, UE specific SS, CORESET resource allocation of 6RB bit-map and duration 3 OFDM symbols for FR2

 type1-3-CSS ENUMERATED {supported} OPTIONAL,

-- R1 3-4: More than one TCI state configurations per CORESET

 multipleTCI ENUMERATED {supported} OPTIONAL,

-- R1 3-5 & 3-5a: For type 1 with dedicated RRC configuration, type 3, and UE-SS,, monitoring occasion can be any OFDM symbol(s) of a slot for Case 2 (with a DCI gap)

 pdcchMonitoringAnyOccasions ENUMERATED {withoutDCI-gap, withDCI-gap} OPTIONAL,

-- R1 5-1a: UE specific RRC configure UL/DL assignment

 ue-SpecificUL-DL-Assignment ENUMERATED {supported} OPTIONAL,

-- R1 5-11 & 5-11a: Up to 2/7 unicast PDSCHs per slot for different TBs

 pdsch-DifferentTB-PerSlot SEQUENCE {

 scs-15kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-30kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-60kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-120kHz ENUMERATED {upto2, upto7} OPTIONAL,

 }, OPTIONAL,

-- R1 5-12 & 5-12a: Up to 2/7 PUSCHs per slot for different TBs

 pusch-DifferentTB-PerSlot SEQUENCE {

 scs-15kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-30kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-60kHz ENUMERATED {upto2, upto7} OPTIONAL,

 scs-120kHz ENUMERATED {upto2, upto7} OPTIONAL,

 }, OPTIONAL,

-- R1 6-2 & 6-3: Type A/B BWP adaptation (up to 2/4 BWPs) with same numerology

 bwp-SameNumerology ENUMERATED {upto2, upto4} OPTIONAL,

-- R1 6-4: BWP adaptation (up to 4 BWPs) with different numerologies

 bwp-DiffNumerology ENUMERATED {upto4} OPTIONAL,

-- R1 6-7: Two PUCCH group

 twoPUCCH-Group ENUMERATED {supported} OPTIONAL,

-- R1 6-8: Different numerology across PUCCH groups

 diffNumerologyAcrossPUCCH-Group ENUMERATED {supported} OPTIONAL,

-- R1 6-9: Different numerologies across carriers within the same PUCCH group

 diffNumerologyWithinPUCCH-Group ENUMERATED {supported} OPTIONAL,

-- R1 6-10: Cross carrier scheduling

 crossCarrierScheduling ENUMERATED {supported} OPTIONAL,

-- R1 6-11: Number of supported TAGs

 supportedNumberTAG ENUMERATED {n2, n3, n4} OPTIONAL,

-- R1 6-19: Simultaneous transmission of SRS on an SUL/non-SUL carrier and PUSCH/PUCCH/SRS/PRACH on the other UL carrier in the same cell

-- Details on the channel/signal combination are to be described in TS 38.306

 simultaneousTxSUL-NonSUL ENUMERATED {supported} OPTIONAL,

-- R1 6-21: DL search space sharing for CA

 searchSpaceSharingCA-DL ENUMERATED {supported} OPTIONAL

-- R1 6-22: UL search space sharing for CA

 searchSpaceSharingCA-UL ENUMERATED {supported} OPTIONAL

-- R4 1-4: 256QAM for PDSCH in FR2

 pdsch-256QAM-FR2 ENUMERATED {supported} OPTIONAL,

-- R4 1-5: 256QAM for PUSCH

 pusch-256QAM ENUMERATED {supported} OPTIONAL

}

MIMO-ParametersPerBand ::= SEQUENCE {

-- R1 2-2: PDSCH beam switching

 timeDurationForQCL SEQUENCE {

 scs-60kHz ENUMERATED {s7, s14, s28} OPTIONAL,

 sch-120kHz ENUMERATED {s14, s28} OPTIONAL

 } OPTIONAL,

-- R1 2-3: PDSCH MIMO layers. Absence of this field implies support of one layer.

 maxNumberMIMO-LayersPDSCH MIMO-LayersDL OPTIONAL,

-- R1 2-14: Codebook based PUSCH MIMO transmission. Absence of this field implies that CB-based PUSCH is not supported.

 maxNumberMIMO-LayersCB-PUSCH MIMO-LayersUL OPTIONAL,

-- R1 2-15: Non-codebook based PUSCH MIMO transmission. Absence of this field implies that Non-CB-based PUSCH is not supported.

 maxNumberMIMO-LayersNonCB-PUSCH MIMO-LayersUL OPTIONAL,

-- R1 2-4: TCI states for PDSCH

 maxNumberConfiguredTCIstates ENUMERATED {n4, n8, n16, n32, n64} OPTIONAL,

 maxNumberActiveTCI-PerCC ENUMERATED {n1, n2, n4, n8} OPTIONAL,

-- R1 2-13: PUSCH transmission coherence

 pusch-TransCoherence ENUMERATED {nonCoherent, partialNonCoherent, fullCoherent} OPTIONAL,

-- R1 2-20: Beam correspondence

 beamCorrespondence ENUMERATED {supported} OPTIONAL,

-- R1 2-21: Periodic beam report on PUCCH

 periodicBeamReport ENUMERATED {supported} OPTIONAL,

-- R1 2-22: Aperiodic beam report on PUSCH

 apeioricBeamReport ENUMERATED {supported} OPTIONAL,

-- R1 2-23: Semi-persistent beam report on PUCCH

 sp-BeamReportPUCCH ENUMERATED {supported} OPTIONAL,

-- R1 2-23a: Semi-persistent beam report on PUSCH

 sp-BeamReportPUSCH ENUMERATED {supported} OPTIONAL,

-- R1 2-24: SSB/CSI-RS for beam management

 beamManagementSSB-CSI-RS BeamManagementSSB-CSI-RS OPTIONAL,

-- R1 2-26: Receiving beam selection using CSI-RS resource repetition “ON”

 maxNumberRxBeam INTEGER (2..8) OPTIONAL,

-- R1 2-27: Beam switching (including SSB and CSI-RS)

 maxNumberRxTxBeamSwitchDL SEQUENCE {

 scs-15kHz ENUMERATED {n4, n7, n14} OPTIONAL,

 scs-30kHz ENUMERATED {n4, n7, n14} OPTIONAL,

 scs-60kHz ENUMERATED {n4, n7, n14} OPTIONAL,

 scs-120kHz ENUMERATED {n4, n7, n14} OPTIONAL,

 scs-240kHz ENUMERATED {n4, n7, n14} OPTIONAL

 } OPTIONAL,

-- R1 2-29: Non-group based beam reporting

 maxNumberNonGroupBeamReporting ENUMERATED {n1, n2, n4} OPTIONAL,

-- R1 2-29a: Group based beam reporting

 groupBeamReporting ENUMERATED {supported} OPTIONAL,

-- R1 2-30: UL beam management

 uplinkBeamManagement SEQUENCE {

 maxNumberSRS-ResourcePerSet ENUMERATED {n8, n16, n32},

 maxNumberSRS-ResourceSet INTEGER (1..8)

 } OPTIONAL,

-- R1 2-31: Beam failure recovery

 maxNumberCSI-RS-BFR INTEGER (1..64) OPTIONAL,

 maxNumberSSB-BFR INTEGER (1..64) OPTIONAL,

 maxNumberCSI-RS-SSB-BFR INTEGER (1..256) OPTIONAL,

-- R1 2-45 & 2-48: 2 ports of DL/UL PTRS

 twoPortsPTRS BIT STRING (SIZE (2)) OPTIONAL,

-- R1 2-53: SRS resources

 supportedSRS-Resources SRS-Resources OPTIONAL,

-- R1 2-55: SRS Tx switch

 srs-TxSwitch SRS-TxSwitch OPTIONAL,

-- R1 2-54a: Simultaneous SRS Tx

 maxNumberSimultaneousSRS-PerCC INTEGER (1..4) OPTIONAL,

-- R1 2-57: Support low latency CSI feedback

 lowLatencyCSI-Feedback ENUMERATED {supported} OPTIONAL

}

-- R1 2-24: SSB/CSI-RS for beam management

BeamManagementSSB-CSI-RS ::= SEQUENCE {

 maxNumberSSB-CSI-RS-ResourceOneTx ENUMERATED {n8, n16, n32, n64},

 maxNumberSSB-CSI-RS-ResourceTwoTx ENUMERATED {n0, n4, n8, n16, n32, n64},

 supportedCSI-RS-Density ENUMERATED {one, three, oneAndThree}

}

-- R1 2-53: SRS resources

SRS-Resources ::= SEQUENCE {

 maxNumberAperiodicSRS-PerBWP ENUMERATED {n1, n2, n4, n8, n16},

 maxNumberAperiodicSRS-PerBWP-PerSlot INTEGER (1..6),

 maxNumberPeriodicSRS-PerBWP ENUMERATED {n1, n2, n4, n8, n16},

 maxNumberPeriodicSRS-PerBWP-PerSlot INTEGER (1..6),

 maxNumberSemiPersitentSRS-PerBWP ENUMERATED {n0, n1, n2, n4, n8, n16},

 maxNumberSP-SRS-PerBWP-PerSlot INTEGER (0..6),

 maxNumberSRS-Ports-PerResource ENUMERATED {n1, n2, n4}

}

-- R1 2-55: SRS Tx switch

SRS-TxSwitch ::= SEQUENCE {

 supportedSRS-TxPortSwitch ENUMERATED {t1r2, t1r4, t2r4, t1r4-t2r4},

 txSwitchImpactToRx ENUMERATED {true} OPTIONAL

}

PDCP-Parameters ::= SEQUENCE {

 supportedROHC-Profiles SEQUENCE {

 profile0x0000 BOOLEAN,

 profile0x0001 BOOLEAN,

 profile0x0002 BOOLEAN,

 profile0x0003 BOOLEAN,

 profile0x0004 BOOLEAN,

 profile0x0006 BOOLEAN,

 profile0x0101 BOOLEAN,

 profile0x0102 BOOLEAN,

 profile0x0103 BOOLEAN,

 profile0x0104 BOOLEAN

 },

 maxNumberROHC-ContextSessions ENUMERATED {cs2, cs4, cs8, cs12, cs16, cs24, cs32, cs48, cs64, cs128, cs256, cs512, cs1024, cs16384, spare2, spare1},

 uplinkOnlyROHC-Profiles ENUMERATED {supported} OPTIONAL,

 continueROHC-Context ENUMERATED {supported} OPTIONAL,

 outOfOrderDelivery ENUMERATED {supported} OPTIONAL,

 shortSN ENUMERATED {supported} OPTIONAL

}

RLC-Parameters ::= SEQUENCE {

 am-WithShortSN ENUMERATED {supported} OPTIONAL,

 um-WithShortSN ENUMERATED {supported} OPTIONAL,

 um-WIthLongSN ENUMERATED {supported} OPTIONAL

}

MAC-Parameters ::= SEQUENCE {

 mac-ParametersCommon MAC-ParametersCommon, OPTIONAL,

 mac-ParametersXDD-Diff MAC-ParametersXDD-Diff OPTIONAL

}

MAC-ParametersCommon ::= SEQUENCE {

 lcp-Restriction ENUMERATED {supported} OPTIONAL,

-- R1 4-24: PUCCH-spatialrelationinfo indication by a MAC CE per PUCCH resource

 pucch-SpatialRelInfoMAC-CE ENUMERATED {supported} OPTIONAL

}

MAC-ParametersXDD-Diff ::= SEQUENCE {

 skipUplinkTxDynamic ENUMERATED {supported} OPTIONAL,

 logicalChannelSR-DelayTimer ENUMERATED {supported} OPTIONAL,

 longDRX-Cycle ENUMERATED {supported} OPTIONAL,

 shortDRX-Cycle ENUMERATED {supported} OPTIONAL,

 multipleSR-Configurations ENUMERATED {supported} OPTIONAL,

 -- If supported UE supports 8 SR configurations, otherwise 1 SR config is supported.

 -- Confirmation is needed whether to align the number to what the configuration signalling can support.

 multipleConfiguredGrantConfigurations ENUMERATED {supported} OPTIONAL

 -- If supported UE supports 16 configured grant configurations, otherwise 1 ConfiguredGrant config is supported.

 -- Confirmation is needed whether to align the number to what the configuration signalling can support, and to consider whether the 16 refers

 -- to the configurations or the active ones only (as they are within the BWP).

}

MeasParameters ::= SEQUENCE {

 measParametersCommon MeasParametersCommon OPTIONAL,

 measParametersXDD-Diff MeasParametersXDD-Diff OPTIONAL,

 measParametersFRX-Diff MeasParametersFRX-Diff OPTIONAL

}

MeasParametersXDD-Diff ::= SEQUENCE {

 intraAndInterF-MeasAndReport ENUMERATED {supported} OPTIONAL,

 eventA-MeasAndReport ENUMERATED {supported} OPTIONAL

 -- Confirmation is needed on the need of capability/IOT signaling in LTE for support of the additional measurement gap configurations.

}

MeasParametersFRX-Diff ::= SEQUENCE {

-- R1 1-3: SSB based SINR measurement

 ss-SINR-Meas ENUMERATED {supported} OPTIONAL,

-- R1 1-5: CSI-RS based RRM measurement with associated SS-block

 csi-RSRP-AndRSRQ-MeasWithSSB ENUMERATED {supported} OPTIONAL,

-- R1 1-5a: CSI-RS based RRM measurement without associated SS-block

 csi-RSRP-AndRSRQ-MeasWithoutSSB ENUMERATED {supported} OPTIONAL,

-- R1 1-6: CSI-RS based SINR measurement

 csi-SINR-Meas ENUMERATED {supported} OPTIONAL,

-- R1 1-7: CSI-RS based RLM

 csi-RS-RLM ENUMERATED {supported} OPTIONAL

}

-- TAG-UE-NR-CAPABILITY-STOP

-- ASN1STOP