3GPP TSG-RAN WG2 #105 Tdoc R2-19xxxxx

Athens, Greece, 25th February – 1st Mars 2019

Agenda Item: x.x.x

Source: Ericsson

Title: Email discussion summary [104#66][NR] UE NR and E-UTRA capabilities for Late drop (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This document reports the following e-mail discussion:

[104#66][NR] UE NR and E-UTRA capabilities for Late drop (Ericsson)

      To progress and agree on principles (reuse on existing capabilities, request filtering, etc)

      Intended outcome: Report and agreeable draft CRs to 36.306, 38.306, 36.331, 38.331 (to be included in Running CRs at next meeting)).

      Deadline:  Thursday 2019-02-07

# 2 Discussion

## 2.1 Capability coordination

Signaling and UE behavior for MR-DC may rely on the fact that different RATs are used for MCG and SCG configurations. But in NR-DC, when reusing EN-DC framework for capability coordination, this may generate ambiguity and requires additional discussion. Namely, the FFS below can be derived from [1].

**FFS: How to signal restricted bands, in a band combination, to be used for SN in NR-DC**

In NR-DC, more information is needed into the inter node messages to indicate the share of each band combination that the SN may use. To address this issue, a field could be added with a list of the selected band entries used by the MN. This information, in combination with the *allowedBC-ListMRDC* IE, could be used by the SN to select the bands for the SCG, such that the UE capabilities are not exceeded. Below is a ASN.1 example of this option.

ConfigRestrictInfoSCG ::= SEQUENCE {

 allowedBC-ListMRDC BandCombinationInfoList OPTIONAL,

 powerCoordination-FR1 SEQUENCE {

 p-maxNR-FR1 P-Max OPTIONAL,

 p-maxEUTRA P-Max OPTIONAL,

 p-maxUE-FR1 P-Max OPTIONAL

 } OPTIONAL,

 servCellIndexRangeSCG SEQUENCE {

 lowBound ServCellIndex,

 upBound ServCellIndex

 } OPTIONAL, -- Cond SN-Addition

 maxMeasFreqsSCG-NR INTEGER(1..maxMeasFreqsMN) OPTIONAL,

 maxMeasIdentitiesSCG-NR INTEGER(1..maxMeasIdentitiesMN) OPTIONAL,

 ... ,

 [[

 selectedBandEntriesMN SEQUENCE (SIZE (1..maxSimultaneousBands)) OF BandEntryIndex

 ]]

}

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| --- |
| ***selectedBandEntiesMN***Indicates the position of a band entry selected by the MN, in the first band combination entry in *allowedBC-ListMRDC* IE. |

**Question 1: For capability coordination in NR-DC, should the MN be able to indicate a list of band entries, on top of the information provided in *allowedBC-ListMRDC* IE? Companies are also encouraged to list more solutions above and provide comments below.**

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| **Company** | **Yes/No?** | **Comments** |
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In [3], it was also raised for NR-DC an issue concerning the parameter *pdcch-BlindDetectionCA*, copied below from TS 38.306.

| **Definitions for parameters** | **Per** | **M** | **FDDTDD****DIFF** | **FR1****FR2****DIFF** |
| --- | --- | --- | --- | --- |
| ***pdcch-BlindDetectionCA***Indicates PDCCH blind decoding capabilities supported by the UE for CA with more than 4 CCs as specified in TS 38.213 [11]. The field value is from 4 to 16.  | UE | Tbd | No | Yes |

The UE is expected to monitor a total of PDCCH candidates per slot for downlink cells with SCS configuration , where stands for the capability indicated in *pdcch-BlindDetectionCA*, and is given in TS 38.213 for each . This equation can then be divided into 2 cases.

A) A UE (that indicates ) configured with downlink cells where would result in .

B) A UE (that indicates ) configured with downlink cells where would result in .

As it can be seen from the derivation above, different cell groups are not taken into account to define the maximum number of PDCCH candidates the UE can monitor, which leads to unclarity on how this capability should be handled for NR-DC case.

Three solutions were outlined in [3] and listed below:

**Option 1**. MN divides between MN and SN (i.e. have and ) and lets SN and UE know allowed and .

**Option 2**. MN and SN exchange the values of of each cell group for each SCS configuration .

**Option 3**. MN derives maximum allowed number of cells for each SCS configuration and informs it to SN.

Given that options above would require extra signaling and coordination between MN and SN, and that case B already implies in complex handling of *pdcch-BlindDetectionCA*, another option can be to have *pdcch-BlindDetectionCA* as a dummy parameter and limit the availability of UE capabilities retrieved by the network to case A, i.e. the UE only report capabilities for a number of CCs that can comply with .

**Option 4**. The parameter *pdcch-BlindDetectionCA* is set to a dummy value and the UE only report capabilities for a number of CCs that can comply with .

**Question 2: Which option is preferred by companies? Companies are also encouraged to list more solutions above and provide comments below.**

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| **Company** | **Option** | **Comments** |
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## 2.2 Inclusion of voice capability

In RAN2#103bis, the following was agreed:

Agreements

1 The parameters included in measAndMobParametersMRDC, measAndMobParametersMRDC-XDD-Diff and measAndMobParametersMRDC-FRX-Diff are reused for NGEN-DC and NE-DC except for sftd-MeasNR-Cell for NE-DC.

1-1 Add clarification in 38.306 sftd-MeasNR-Cell field that this is now only applied to EN-DC and NGEN-DC cases.

2: Reuse Phy-ParametersMRDC for NGEN-DC and NE-DC.

3-1: BandParameters, CA-ParametersEUTRA, CA-ParametersNR and power classes are reused for NGEN-DC and NE-DC.

3-2: FFS for MR-DC parameters and featureset until feedback from RAN1/RAN4.

4: GeneralParametersMRDC-XDD-Diff is in general reused for NGEN-DC and NE-DC except for v2x-EUTRA-v1530, and except for SRB3 for NE-DC

4-1: v2x-EUTRA-v1530 is only applied to EN-DC in Rel-15 and should be clarified in 38.306.

4-2: SRB3 is not applied to NE-DC and should be clarified in 38.306.

5: PDCP-ParametersMRDC is reused for NGEN-DC and NE-DC

6-1: limit the current ims-VoiceOverNR-PDCP-SCG-Bearer and ims-VoiceOverNR-PDCP-MCG-Bearer to EN-DC case only, and add one additional bit for NGEN-DC case for SCG bearer.

6-2: FFS: to introduce VoiceOverSCG-Bearer for NE-DC SCG bearer in either MR-DC capability or NR SA UE capability.

7: NGEN-DC-Add-UE-MRDC-Capabilities and NE-DC-Add-UE-MRDC-Capabilities can be added if RAN1/RAN4 confirms there is a need to differentiate UE capabilities for different options.

**Option 1: In MR-DC UE capability.**

In [2], it was raised that VoiceOverSCG-Bearer for NE-DC should be inserted in *UE-MRDC-Capability* IE since it is a capability related to an MR-DC option.

**Option 2: In NR SA UE capability.**

IMS parameter concerning EN-DC, for instance, is within E-UTRA capability (*IMS-VoiceOverNR-PDCP-SCG-Bearer-15*). Therefore, this capability should not need to be visible for the SN RAT. Similarly, this VoiceOverSCG-Bearer for NE-DC should not need to be visible for the SN in NE-DC case, even though it is related to the NE-DC SCG.

**Question 3: Where the capability of VoiceOverSCG-Bearer for NE-DC SCG bearer should be included?**

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| **Company** | **Option 1/2** | **Comments** |
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## 2.3 Capability request filtering

In RAN#103bis, the following was agreed:

Agreements

1 Introduce one per UE capability indication in UE-EUTRA-Capability to indicate support of option 7 and introduce one per UE capability indication in UE-NR-Capability to indicate support of option 4

2 NGEN-DC can reuse all the capabilities parameters of EN-DC.

3 Add ability to request NE-DC capabilities into NR RRC.

It should be discussed, however, details regarding how the network should request capabilities for NG-EN-DC and NE-DC. Two options are captured below, but companies are also encouraged to list more solutions and provide comments to the options below.

**Option 1: When responding to an *UECapabilityEnquiry* message that includes *rat-Type* set to *eutra-nr* and the UE supports EN-DC, NGEN-DC or NE-DC, the UE includes capabilities for EN-DC, NGEN-DC and NE-DC, whichever is supported.**

A capability request with *rat-Type* set to *eutra-nr* will currently result in acquiring EN-DC capabilities (if supported by the UE), in both 36.331 and 38.331. A straightforward approach that would comply with the current handling for EN-DC would be that the UE, when receiving a capability request with *rat-Type* set to *eutra-nr*, would also include capabilities for NG-EN-DC and NE-DC, whichever is supported, as in the 38.331 example below. A drawback from this approach could be that a gNB may be only interested on e.g. NE-DC capabilities, but while using a *UE-CapabilityRAT-Request* with *rat-Type* set to *eutra-nr*, it will receive also the UE EN-DC capabilities.

5.6.1.3 Reception of the *UECapabilityEnquiry* by the UE

The UE shall set the contents of *UECapabilityInformation* message as follows:

1> if the *ue-CapabilityRAT-RequestList* contains a *UE-CapabilityRAT-Request* with *rat-Type* set to *nr*:

2> include in the *ue-CapabilityRAT-ContainerList* a *UE-CapabilityRAT-Container* of the type *UE-NR-Capability* and with the *rat-Type* set to *nr*;

2> include the *supportedBandCombinationList, featureSets* and *featureSetCombinations* as specified in clause 5.6.1.4;

1> if the *ue-CapabilityRAT-RequestLis*t contains a *UE-CapabilityRAT-Request* with *rat-Type* set to *eutra-nr*:

2> if the UE supports (NG)EN-DC or NE-DC:

3> include in the *ue-CapabilityRAT-ContainerList* a *UE-CapabilityRAT-Container* of the type *UE-MRDC-Capability* and with the *rat-Type* set to *eutra-nr*;

3> include the *supportedBandCombinationList* and *featureSetCombinations* as specified in clause 5.6.1.4;

**Option 2: When responding to an *UECapabilityEnquiry* message, a new indication is used to request for the UE to include capabilities for NGEN-DC and NE-DC, whichever is supported.**

Another option would be to include new indications for the request of NGEN-DC and NE-DC capabilities. This could reduce the size of reported UE capabilities for MR-DC options, while not preventing a further combination, on the network side, of requests for different MR-DC options in a sole container with MR-DC capabilities. A drawback from this approach could be that additional signaling and more complex procedure text should be defined in this case, as in the 38.331 example below (considering that for NGEN-DC and NE-DC capability request, the field must be included).

*UE-CapabilityRequestFilterNR* information element

-- ASN1START

-- TAG-UE-CAPABILITYREQUESTFILTERNR-START

UE-CapabilityRequestFilterNR ::= SEQUENCE {

 frequencyBandList FreqBandList OPTIONAL, -- Need N

 nonCriticalExtension UE-CapabilityRequestFilterNR-v1540 OPTIONAL

}

UE-CapabilityRequestFilterNR-v1540 ::= SEQUENCE {

 srs-SwitchingTimeRequest ENUMERATED {true} OPTIONAL, -- Need N

 nonCriticalExtension UE-CapabilityRequestFilterNR-v15xy OPTIONAL

}

UE-CapabilityRequestFilterNR-v15xy ::= SEQUENCE {

 mrdc-Request MRDC-Request OPTIONAL, -- Need N

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

MRDC-Request ::= SEQUENCE {

 en-DC-Request ENUMERATED {true} OPTIONAL, -- Need N

 ne-DC-Request ENUMERATED {true} OPTIONAL, -- Need N

 ng-EN-DC-Request ENUMERATED {true} OPTIONAL, -- Need N

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

-- TAG-UE-CAPABILITYREQUESTFILTERNR-STOP

-- ASN1STOP

*UE-MRDC-Capability* information element

-- ASN1START

-- TAG-UE-MRDC-CAPABILITY-START

UE-MRDC-Capability ::= SEQUENCE {

 measAndMobParametersMRDC MeasAndMobParametersMRDC OPTIONAL,

 phy-ParametersMRDC-v1530 Phy-ParametersMRDC OPTIONAL,

 rf-ParametersMRDC RF-ParametersMRDC,

 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,

 featureSetCombinations SEQUENCE (SIZE (1..maxFeatureSetCombinations)) OF FeatureSetCombination OPTIONAL,

 pdcp-ParametersMRDC-v1530 PDCP-ParametersMRDC OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension UE-MRDC-Capability-v15xy OPTIONAL

}

UE-MRDC-Capability-v15xy ::= SEQUENCE {

 appliedMRDC-Request MRDC-Request OPTIONAL,

 lateNonCriticalExtension OCTET STRING OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

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

 measAndMobParametersMRDC-XDD-Diff MeasAndMobParametersMRDC-XDD-Diff OPTIONAL,

 generalParametersMRDC-XDD-Diff GeneralParametersMRDC-XDD-Diff OPTIONAL

}

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

 measAndMobParametersMRDC-FRX-Diff MeasAndMobParametersMRDC-FRX-Diff

}

GeneralParametersMRDC-XDD-Diff ::= SEQUENCE {

 splitSRB-WithOneUL-Path ENUMERATED {supported} OPTIONAL,

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

 srb3 ENUMERATED {supported} OPTIONAL,

 v2x-EUTRA-v1530 ENUMERATED {supported} OPTIONAL,

 ...

}

-- TAG-UE-MRDC-CAPABILITY-STOP

-- ASN1STOP

5.6.1.3 Reception of the *UECapabilityEnquiry* by the UE

The UE shall set the contents of *UECapabilityInformation* message as follows:

1> if the *ue-CapabilityRAT-RequestList* contains a *UE-CapabilityRAT-Request* with *rat-Type* set to *nr*:

2> include in the *ue-CapabilityRAT-ContainerList* a *UE-CapabilityRAT-Container* of the type *UE-NR-Capability* and with the *rat-Type* set to *nr*;

2> include the *supportedBandCombinationList, featureSets* and *featureSetCombinations* as specified in clause 5.6.1.4;

1> if the *ue-CapabilityRAT-RequestLis*t contains a *UE-CapabilityRAT-Request* with *rat-Type* set to *eutra-nr*:

2> if the UE supports EN-DC and *mrdc-Request* is not received:

3> include in the ue-CapabilityRAT-ContainerList a UE-CapabilityRAT-Container of the type UE-MRDC-Capability and with the rat-Type set to eutra-nr;

3> include the *supportedBandCombinationList* and *featureSetCombinations* as specified in clause 5.6.1.4;

2> else if the UE supports (NG)EN-DC or NE-DC:

3> create a *UE-CapabilityRAT-Container* of the type *UE-MRDC-Capability* and with the *rat-Type* set to *eutra-nr*;

3> include, in the created *UE-CapabilityRAT-Container*, the *supportedBandCombinationList* and *featureSetCombinations* as specified in clause 5.6.1.4;

3> if the UE supports EN-DC and *en-DC-Request* is included in *mrdc-Request*:

4> include EN-DC capabilities in the created *UE-CapabilityRAT-Container*;

3> if the UE supports NE-DC and *ne-DC-Request* is included in *mrdc-Request*:

4> include, in the created *UE-CapabilityRAT-Container*, any remaining capabilities needed for NE-DC;

3> if the UE supports NGEN-DC and *ng-EN-DC-Request* is included in *mrdc-Request*:

4> include, in the created *UE-CapabilityRAT-Container*, any remaining capabilities needed for NGEN-DC;

3> include the received *mrdc-Request* in the field *appliedMRDC-Request*;

3> include in the *ue-CapabilityRAT-ContainerList* the created *UE-CapabilityRAT-Container*;

**Question 5: Which option is preferred by companies? It is also encouraged to list more solutions above and provide comments below.**

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| **Company** | **Option 1/2...** | **Comments** |
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## 2.4 Other

Companies are welcome to add further FFS:

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| Issue | Company | Comment |
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# 3 Conclusion

# 4 References

1. R2-1818404, Capability coordination for NR-DC, Ericsson, 3GPP TSG-RAN WG2#104, Spokane, USA, 12th – 17th November 2018.
2. R2-1818001 Email discussion report on 103bis#26NR Late drop NE-DC, Huawei, 3GPP TSG-RAN WG2#104, Spokane, USA, 12th – 17th November 2018.
3. R2-1818302, PDCCH blind decoding capability coordination in NR-DC, Samsung, 3GPP TSG-RAN WG2#104, Spokane, USA, 12th – 17th November 2018.