**3GPP T****SG-RAN WG2 Meeting #111-e R2-200xxxx**

**Electronic Meeting, 17th – 28th August 2020**

**Agenda item: 6.1.3**

**Source: vivo**

**Title: Report of [AT111-e][023][NR16]** **NG-ENDC capability (vivo)**

**Document for: Discussion and Decision**

# 1 Introduction

This contribution is to report the discussion and the result of the following offline discussion in RAN2#111-e Meeting [1]:

* [AT111-e][023][NR16] NG-ENDC capability (vivo)

Scope: Treat R2-2008080, R2-2008081, R2-2008082

Deadline: Short UE cap

# 2 Discussion

In the last RAN2 meeting, whether the reported UE capabilities related to L1/L2 features for EN-DC can be also re-used for the case of NGEN-DC had been warmly discussed. In the end, it was agreed to clarify the support of NGEN-DC for UE capabilities [2].

The following contributions were submitted to clarify the support of NGEN-DC for the newly added Rel-16 LTE/NR UE capabilities and two specific Rel-15 UE capabilities (i.e. *v2x-EUTRA* and *pdcp-DuplicationSRB*) that were not discussed in the previous offline discussion.

R2-2008080 Clarification on the extended capability of NGEN-DC vivo CR Rel-16 36.306 16.1.0 1784 - F NR\_newRAT-Core

R2-2008081 Clarification on the extended capability of NGEN-DC vivo CR Rel-16 38.306 16.1.0 0402 - F NR\_newRAT-Core

R2-2008082 Clarification on the extended capability of NGEN-DC vivo CR Rel-15 38.306 15.10.0 0403 - F NR\_newRAT-Core

## 2.1 Rel-16 LTE clarification on the support of NGEN-DC

The capability *nr-HO-ToEN-DC-r16* was introduced in Rel-16. To clarify that this capability can be also re-used for the NGEN-DC scenario, the 36.306 CR in R2-2008080 [3] proposes the following revision to the description of *nr-HO-ToEN-DC-r16*.

|  |
| --- |
| *nr-HO-ToEN-DC-r16*  This field indicates whether the UE supports inter-RAT handover from NR to (NG)EN-DC while NR-DC or NE-DC is not configured as defined in TS 37.340 [38]. It is mandatory to support inter-RAT handover from NR to (NG)EN-DC if the UE supports (NG-RAN) E-UTRA NR Dual Connectivity. |

**Question 1: Do companies agree to capture the proposed clarification for NGED-DC in the description of *nr-HO-ToEN-DC-r16*?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments, if any** |
| Nokia | Yes, but | On second thoughts, agree that we probably need to double check if we are not adding new functionality. |
| MediaTek ([Felix](mailto:Chun-Fan.Tsai@mediatek.com)) | No | This is not a clarification but adding of new function.  Handover from NR to EN-DC is inter-system handover while handover from NR to NGEN-DC is in intra-system handover. There is clear different behaviour in the NAS layer and there are also some difference in AS procedure.  If the capability is not related to higher layer, we are fine to extend the capability so that it cover both EN-DC and NGEN-DC. But this is not the case. We think it is incorrect to extend this capability. |
| CATT | Yes |  |
| Lenovo | No | If we recall correctly, when this topic was discussed and agreed in RAN2#108 only the specific HO scenario from NR SA to EN-DC was considered. And in TS 37.340 the HO from NR SA to NGEN-DC is set to “NO”, see Table B-1. |
| Ericsson (Tony) | Maybe No | We tend to agree with MediaTek comment that there is some difference between inter- and intra-system handover. Therefore, this change may not be needed and also incorrect.  Before to decide these kinds of changes, it would be good to clarify this aspect. |
| Qualcomm Incorporated (Masato) | Supportive, but needs discussion | Inter-RAT handover is triggered by NR RAN based on the release-15 UE capabilities, handoverLTE-EPC and handoverLTE-5GC defined in 38.331 (so CN type is distinguished).  R2-2008080 is for EUTRA UE capability, hence processed by the target EUTRAN after handover is triggered by NR RAN. At this stage, the only thing the target E-UTRAN needs to know is if SN addition is possible as part of the inter-RAT handover. This part alone looks agnostic to CN type. |
| ZTE (LiuJing) | Prefer Yes | We tend to agree with Qualcomm that legacy capabilities handoverLTE-EPC and handoverLTE-5GC can be used for futher differentiation.  Then nr-HO-ToEN-DC-r16 is only used to determine whether SN addition is allowed during handover procedure, and this aspect is not related to CN type.  But allowing this change also means TS37.340 need update. So although we prefer to extend the use case of this capability, we are also fine if majority want to keep it as it is. |
| Apple | Needs discussion | As mentioned by companies above on this being not a straight-forward correction, we think we should not agree without discussion. |
| OPPO | No | There is no discussion / agreement for mobility from NR to NGEN-DC yet, i.e., as shown in Annex-B of 37.340. |
| Huawei, HiSilicon (Yiru Kuang) | No | Agree with Lenovo. In TS 37.340 Annex B, Table B-1 summarizes the supported handover scenarios, and it is clear that NR handover to NGEN-DC is not allowed. |

## 2.2 Rel-16 NR clarification on the support of NGEN-DC

Same as the motivation described in section 2.1, the 38.306 CR in R2-2008081 [4] proposes to clarify the description of the following capabilities:

* *ULTxSwitchingBandPair-r16*
* *uplinkTxSwitching-OptionSupport-r16*
* *handoverInterF*
* *nr-HO-ToEN-DC-r16*
* *measurementEnhancement-r16*
* *demodulationEnhancement-r16*

The corresponding changes are given below:

***BandCombinationList* parameters:**

| **Definitions for parameters** | **Per** | **M** | **FDD-TDD**  **DIFF** | **FR1-FR2**  **DIFF** |
| --- | --- | --- | --- | --- |
| ***ULTxSwitchingBandPair-r16***  Indicates UE supports dynamic UL Tx switching in case of inter-band CA, SUL, and (NG)EN-DC as defined in TS 38.214 [12], TS 38.101-1 [2] and TS 38.101-3 [4]. The capability signalling comprises of the following parameters:  - *bandIndexUL1-r16* and *bandIndexUL2-r16* indicate the band pair on which UE supports dynamic UL Tx switching. *bandindexUL1*/*bandindexUL2* xx refers to the xxth band entry in the band combination. UE shall indicate support for 2-layer UL MIMO capabilities at least on one of the indicated two bands for UL Tx switching, and only the band where UE supports 2-layer UL MIMO capability can work as carrier2 as defined in TS 38.101-1 [2] and TS 38.101-3 [4].  - *uplinkTxSwitchingPeriod-r16* indicates the length of UL Tx switching period per pair of UL bands per band combination when dynamic UL Tx switching is configured, as specified in TS 38.101-1 [2] and TS 38.101-3 [4]. UE shall not report the value n210us for EN-DC band combinations. n35us represents 35 us, n140us represents 140us, and so on, as specified in TS 38.101-1 [2] and TS 38.101-3 [4].  - *uplinkTxSwitching-DL-Interruption-r16* indicates that DL interruption on the band will occur during UL Tx switching, as specified in TS 38.133 [5] and in TS 36.133 [27]. UE is not allowed to set this field for the band combination of SUL band+TDD band, for which no DL interruption is allowed.  Field encoded as a bit map, where bit N is set to "1" if DL interruption on band N will occur during uplink Tx switching as specified in TS 38.133 [5] and in TS 36.133 [27]. The leading / leftmost bit (bit 0) corresponds to the first band of this band combination, the next bit corresponds to the second band of this band combination and so on. The capability is not applicable to the following band combinations, in which DL reception interruption is not allowed:  - TDD+TDD CA with the same UL-DL pattern  - TDD+TDD EN-DC with the same UL-DL pattern | BC | FD | N/A | FR1 only |
| ***uplinkTxSwitching-OptionSupport-r16***  Indicates which option is supported for dynamic UL Tx switching for inter-band UL CA and (NG)EN-DC. *switchedUL* represents option 1 as specified in TS 38.214 [12], *dualUL* represents option 2 as specified in TS 38.214 [12], *both* represents both option 1 and option2 as specified in TS 38.214 [12]. UE shall not report the value *both* for (NG)EN-DC case. The field is mandatory for inter-band UL CA and (NG)EN-DC case where UE supports dynamic UL Tx switching. | BC | CY | N/A | FR1 only |

***MeasAndMobParameters*:**

| **Definitions for parameters** | **Per** | **M** | **FDD-TDD DIFF** | **FR1-FR2 DIFF** |
| --- | --- | --- | --- | --- |
| ***handoverInterF***  Indicates whether the UE supports inter-frequency HO. It indicates the support for inter-frequency HO from the corresponding duplex mode if this capability is included in *fdd-Add-UE-NR-Capabilities* or *tdd-Add-UE-NR-Capabilities*. It indicates the support for inter-frequency HO from the corresponding frequency range if this capability is included in *fr1-Add-UE-NR-Capabilities* or *fr2-Add-UE-NR-Capabilities*. This field only applies to NR SA/NR-DC/NE-DC (e.g. PCell handover). For PSCell change when (NG)EN-DC/NR-DC is configured, this feature is mandatory supported. | UE | Yes | Yes | Yes |

**Inter-RAT parameters:**

| **Definitions for parameters** | **Per** | **M** | **FDD-TDD DIFF** |
| --- | --- | --- | --- |
| ***nr-HO-ToEN-DC-r16***  Indicates whether the UE supports inter-RAT handover from NR to (NG)EN-DC while NR-DC or NE-DC is not configured as defined in TS 36.306 [15]. It is mandated if the UE supports (NG)EN-DC. | UE | CY | No |

**High speed parameters:**

| **Definitions for parameters** | **Per** | **M** | **FDD-TDD**  **DIFF** | **FR1-FR2**  **DIFF** |
| --- | --- | --- | --- | --- |
| ***measurementEnhancement-r16***  Indicates whether the UE supports the enhanced intra-NR and inter-RAT E-UTRAN measurement requirements to support high speed up to 500 km/h as specified in TS 38.133 [5]. This field applies to MN configured measurement enhancement when MR-DC is not configured and SN configured measurement enhancement when (NG)EN-DC is configured. | UE | TBD | No | FR1 only |
| ***demodulationEnhancement-r16***  Indicates whether the UE supports the enhanced demodulation processing for HST-SFN joint transmission scheme with velocity up to 500km/h as specified in TS 38.101-4 [18]. This field applies to MN configured demodulation enhancement when MR-DC is not configured and SN configured demodulation enhancement when (NG)EN-DC is configured. | UE | TBD | No | FR1 only |

**Question 2: Do companies agree to capture the proposed clarification for NGED-DC in the descriptions of *ULTxSwitchingBandPair-r16*, *uplinkTxSwitching-OptionSupport-r16*, *handoverInterF*, *nr-HO-ToEN-DC-r16, measurementEnhancement-r16,* and *demodulationEnhancement-r16*?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments, if any** |
| Nokia | Yes, but | On second thoughts, agree that we probably need to double check if we are not adding new functionality. |
| MediaTek ([Felix](mailto:Chun-Fan.Tsai@mediatek.com)) | No for nr-HO-ToEN-DC-r16 | Similar comment as Q1. |
| CATT | Yes |  |
| Lenovo | No for nr-HO-ToEN-DC-r16 | See our comment to Q1 above. |
| Ericsson (Tony) | Maybe No | Similar comment to Q1 |
| Qualcomm Incorporated (Masato) | Needs discussion | Basic question, how is the UE capability on handover from NR to EN-DC (*nr-HO-ToEN-DC-r16*) used by NR RAN? It should at least be considered together with other UE capabilities; handoverLTE-EPC and handoverLTE-5GC.  Other capabilities are fine. |
| ZTE (LiuJing) | Prefer Yes for nr-HO-ToEN-DC-r16,  Ok for others. | Same comments as Q1.  Regarding the question from Qualcomm, we understand a UE supports “NR to EN-DC” will also report the support of handoverLTE-EPC.  If in case nr-HO-ToEN-DC-r16 is modified to cover both EN-DC and NGEN-DC, then network can use “handoverLTE-EPC” and “handoverLTE-5GC” to further determine the scenario that actually supported. |
| Intel (Seau Sian) | No for nr-HO-ToEN-DC in the current form | Other capabilities are fine.  For nr-HO-ToEN-DC, similar to ZTE and QC, it needs to link to “handoverLTE-EPC” and “handoverLTE-5GC”. Maybe just add some further text in the field description to describe the relations with the 2 capabilities? |
| Apple | Needs discussion | Same comment as above for handover, for others we are ok, same view as Intel. |
| OPPO |  | Same comment for ***nr-HO-ToEN-DC-r16*** as replied in Q1.  handoverInterF should be for Rel-15.  Others are fine. |
| Huawei, HiSilicon (Yiru Kuang) | No for nr-HO-ToEN-DC-r16 | Similar comment as Q1. |

## 2.3 Rel-15 NR clarification on the support of NGEN-DC

In the 38.306 CR in R2-2008082 [5], it clarifies that two capabilities, *v2x-EUTRA* and *pdcp-DuplicationSR*,are also applicable for the case of NGEN-DC, see below:

**General parameters:**

| **Definitions for parameters** | **Per** | **M** | **FDD-TDD DIFF** | **FR1-FR2**  **DIFF** |
| --- | --- | --- | --- | --- |
| ***v2x-EUTRA***  Indicates whether the UE supports EUTRA V2X according to *UE-EUTRA-Capability* as defined in TS 36.331 [17], independent of the configured EN-DC band combination. This field is only applied to (NG)EN-DC. In UE-NR-Capability, this field is not used, and UE does not include the field. | UE | No | Yes | No |

**PDCP Parameters:**

| **Definitions for parameters** | **Per** | **M** | **FDD-TDD DIFF** |
| --- | --- | --- | --- |
| ***pdcp-DuplicationSRB***  Indicates whether the UE supports CA-based PDCP duplication over SRB1/2 and/or, if (NG)EN-DC is supported, SRB3 as specified in TS 38.323 [16]. | UE | No | No |

**Question 3: Do companies agree to capture the proposed clarification for NGED-DC in the descriptions of *v2x-EUTRA* and *pdcp-DuplicationSRB*?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments, if any** |
| Nokia | Yes, but | On second thoughts, agree that we probably need to double check if we are not adding new functionality. |
| MediaTek ([Felix](mailto:Chun-Fan.Tsai@mediatek.com)) | Yes |  |
| CATT | Yes |  |
| Ericsson (Tony) | Yes |  |
| Qualcomm Incorporated (Masato) | Needs discussion | Don’t we need a separate capability for V2X via 5GC? |
| ZTE(LiuJing) | Yes |  |
| Intel (Seau Sian) | Yes | Our understanding is that V2X support is not affected by whether the eNB is connected to 5GC or EPC |
| Apple | No | We need to be very cautious to extend v2x-EUTRA to (NG)EN-DC. The reason is SA2/RAN2 have never discussed and agreed on the mix of 5GC + LTE air interface. For example, for QoS flow mapping to SL RB, a new NR V2X SIB might be required for UE to support.  This requires discussions before making decision. We have similar view as Qualcomm. |
| OPPO | No | V2x-EUTRA is not a forward compatible capability that should be extended. On the one hand, we have the following agreement from RAN2#130, i.e., the 1-bit per-UE signalling is just a quick-hack..  R2-1811136 [Q019] V2X capabilities in EN-DC Qualcomm Incorporated discussion Rel-15 NR\_newRAT-Core  => Add a single bit to indicate that UE supports V2X according to the LTE band combination independent of the configuration of EN-DC.  => RAN2 has the intention to support V2X in combination with EN-DC configuration considering also the NR band combination. Further discussion is required to conclude how the capability signalling can be defined.  => Draft CR in R2-1813307 to introduce the single bit capability. (Offline discussion 60)  On the other hand, the discussion on V2X UE capability in MR-DC scenario is on-going in V2X session. We suggest to handle this issue in V2X session.  The change on ***pdcp-DuplicationSRB*** is OK. |
| Huawei, HiSilicon (Yiru Kuang) |  | For v2x-EUTRA, we also suggest to handle it in V2X session, there is an ongoing discussion on whether/how to support joint Uu+PC5 BC in MR-DC cases, maybe related to that.  For pdcp-DuplicationSRB, it is OK. |

# 3 Conclusion

The proposals captured are the following:

# 4 References

[1] R2-111e Chair Notes 2020-08-17 1500 UTC.

[2] Draft\_RAN2\_110-e\_Meeting\_Report\_v2.

[3] R2-2008080 Clarification on the extended capability of NGEN-DC, vivo.

[4] R2-2008081 Clarification on the extended capability of NGEN-DC, vivo.

[5] R2-2008082 Clarification on the extended capability of NGEN-DC, vivo.