3GPP TSG-RAN WG2 Meeting #110-e R2-20XXXX

Electronic meeting, 1st - 12th June, 2020

**Agenda item: 5.4.3.1**

**Source: vivo (rapporteur)**

**Title: [AT110e][019][NR15] UE cap CGI Reporting**

**Document for: Discussion and decision**

# Introduction

This is a summary document of the following email discussion:

* [AT110e][019][NR15] UE cap CGI Reporting (vivo)

Scope: Treat R2-2005618, R2-2005619, R2-2005620, R2-2005621, R2-2005622, R2-2004994, R2-2004995, R2-2004996 (proponents are responsible to explain and drive)

Part 1: Decision whether to make corrections or not, identify agreeable corrections. Deadline: June 4, 0700 UTC.

Part 2: For agreeable parts, continuation to agree CRs. Deadline: June 10, 0700 UTC

This summary focus on some remaining issues on CGI reporting in threefold:

* Additional CGI reporting UE capability
* Correction on CGI reporting UE capability
* Correction on UE capability constraints

# Additional CGI reporting capability [1]

In the RAN2#105 meeting, the agreements related to ANR reached are following:

Agreements

1: Introduce extra UE optional capabilities in EN-DC for ANR configured by LTE towards 2G/3G/4G neighbour cells when DRX configurations are different between MN and SN.

2: Existing FGIs (17/18/19) are required to be redefined to include the case of the UE is configured with EN-DC with same DRX configurations between MN and SN.

3: RAN2 confirms autonomous gap is not supported for the following cases:

• ANR (towards NR neighbour cells) configured by NR PCell in NR SA

• ANR (towards NR neighbour cells) configured by NR PSCell in EN-DC

• ANR (towards NR neighbour cells) configured by LTE PCell in EN-DC

• ANR (towards NR neighbour cells) configured by LTE PCell in LTE SA

4 RAN2 understands there would be interruption time on all NR SCG cells if UE starts autonomous gap in EN-DC and SN does not know this.

The extra UE optional capabilities in EN-DC were discussed in the RAN2#105 meeting, the background is quoted as following [1].

*During online discussion, some companies raised one issue in EN-DC. Since NR sub6 and LTE are actually quite similar, in some (especially early) UE implementation, some RF / Baseband hardware is shared in LTE and NR sub6 for early product launch. Then if DRX offsets are not aligned in MN and SN, such UEs must wait for both LTE and NR being idle (i.e. common idle period in DRX cycles in MN and SN) before measuring CGI. This is hardware specific or chip set vendor specific limitation, which requires different UE capability with EN-DC or LTE SA. Note that UE capability of per-FR and independent gap is introduced with similar reason.*

As a result, three UE optional capabilities, i.e. *utra-GERAN-CGI-Reporting-ENDC* /*eutra-CGI-Reporting-ENDC* /*reportCGI-NR-EN-DC-r15* are introduced in TS36.306 for ANR configured by LTE towards *GERAN* / *UTRA* /E-UTRA/NR neighbour cells when DRX configurations are different between MN and SN.

In the TS37.340, it states that “*In MR-DC, both the MN and the SN can configure CGI reporting. The MN can configure CGI reporting for intra-RAT and inter-RAT cells but the SN can only configure CGI reporting of intra-RAT cells”.* Hence, one UE optional capabilities, i.e. *nr-CGI-Reporting-ENDC* is introduced in TS38.306 for ANR configured by NR SN towards NR neighbour cells when EN-DC is configured.

The same issue discussed above also exists when ANR is configured by LTE SN towards E-UTRA neighbor cells in NE-DC case. To solve the issue, the rapporteur therefore proposes the following:

**Proposal 1: In TS36.306, introduce new UE optional capability (e.g. *eutra-CGI-Reporting-NEDC*) in NE-DC for ANR configured by LTE towards E-UTRA neighbour cells when DRX configurations are different between MN and SN.**

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm Incorporated | We support the direction. We think the new UE capability should also cover the case when DRX configurations are the same between MN and SN. |
| Ericsson | We believe the purpose is very similar to that of *eutra-CGI-Reporting-ENDC* but to keep the backward compatibility, a new capability has been proposed. However, we believe the problem at hand is very similar to that of *eutra-CGI-Reporting-ENDC* (i.e., a chipset that can coordinate DRX configuration of MN and SN for NE-DC purposes will also be capable of doing so in EN-DC purposes ) and therefore there has to be some correlation. As some other UE capabilities that were introduced for EN-DC have also been made applicable for NE-DC, we think the same can be done for this as well. If we go with having two different capabilities then we believe there is a need to add that when the UE sets ***eutra-CGI-Reporting-NEDC*** it also sets *eutra-CGI-Reporting-ENDC* (vice-versa need not be true as early UEs might support only EN-DC and not NE-DC related changes). So, we prefer to reuse the existing capability for this purpose as the existing capability informs when the LTE chipset and NR chipset at the UE can coordinate for finding aligned DRX configs. |
| Huawei, HiSilicon | Ok with the intention. We share the same view with Ericsson that the requirements for EN-DC and NE-DC are the same, but not sure if the existing signaling can be reused considering backward compatibility issue. |
| Samsung | Finer information in capability signaling is generally safer approach, hence we have some sympathy on this but we also wondering whether it is that urgent to justify Release 15 change.  We prefer to introduce this in Release 16. |
| vivo | Agree with Qualcomm. Yes, we need to consider backward compatibility issue. |
| MediaTek | We support the intention and agree with Qualcomm. We could discuss whether to have this from Release 15 or Release 16. |
| OPPO | Agree the intention but we also think it is not urgent for Rel15 |
| Nokia | We think we should follow the similar approach as for EN-DC, i.e. clarify that FGIs 17/18/19 cover NE-DC with aligned DRX configurations as well. For misaligned DRX configurations, we have two options: either introduce new eutra-CGI-Reporting-NEDC capability or update description of eutra-CGI-Reporting-ENDC capability to cover NE-DC with misaligned DRX configurations as well as suggested by Ericsson. |

Similarly, the issue discussed in above also exists when ANR is configured by NR toward E-UTRA/NR neighbour cells in NE-DC and NR-DC cases. To solve the issue, the rapporteur therefore proposes the following:

**Proposal 2: In TS38.306, introduce additional UE capabilities (e.g. *eutra-CGI-Reporting- NEDC-NRDC, nr-CGI-Reporting-NEDC-NRDC*) in NE-DC/NR-DC for ANR configured by NR towards E-UTRA/NR neighbour cells when DRX configurations are different between MN and SN.**

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm Incorporated | We understand that those capabilities MN configured and SN configured CGI reporting in case of NR-DC, and MN configured CGI reporting in case of NE-DC.  We think we should differentiate between NR-DC and NE-DC because UE implementation is quite different between NR-DC (single RAT) and NE-DC (multi-RAT).  In addition, each capability parameter should cover the cases when DRX configurations are different and the same. |
| Ericsson | We are fine with introducing new capability for the case of NE-DC but we are not sure what the motivation is for NR-DC. As mentioned previously, the reason for needing a separate capability was that LTE chipset and the NR chipset might be different at the UE and they need some additional coordination to understand the common idle periods when MN and SN have configured different DRX configurations in EN-DC. This scenario is valid for NE-DC but we are not sure if the same is valid for NR-DC as both MN and SN belong to the same RAT and therefore they might use the same chipset? |
| Huawei, HiSilicon | Same view with Ericsson that we are fine with introducing new capability for NE-DC but not sure what the motivation is for NR-DC. Not sure about the assumption that some RF / Baseband hardware is shared in LTE and NR sub6 for early product launch, as the DRX can be aligned between MN and SN in NR-DC. |
| Samsung | Same as P1 (i.e. introducing the capability in R16)  However, if the majority view is to do it in Release 15, we agree with QC that having separate capability bit is required. Saving a single bit at the expense of lower flexibility cannot be justified. |
| vivo | May be differentiation between NR-DC and NE-DC can address Ericsson and Huawei concern. |
| MediaTek | We also think differentiate between NR-DC and NE-DC is necessary. |
| OPPO | For NE-DC case, yes we also agree with the motivation. For NR-DC, we just wonder then what’s the difference between this new capability and existing one i.e. ***nr-CGI-Reporting***? I would assume they are the same for HO purpose since currently MCG can be only FR1 carrier. It could not be different for the purpose of SN change because there is no difference between FR1 and FR2 for ***nr-CGI-Reporting*** either. Based on this analysis network can ready know UE’s capability for NR-DC case. |
| Nokia | We think we should clarify that nr-CGI-Reporting and eutra-CGI-Reporting is also applicable in case NR-DC is configured. For NE-DC we can update the description of nr-CGI-Reporting-ENDC to cover NE-DC as well. There is no need to differentiate for aligned and misaligned DRX, which was only intended for the case of early UE implementations related to EN-DC. |

# Correction on CGI reporting UE capability [1]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***eutra-CGI-Reporting***  Defines whether the UE supports acquisition of relevant information from a neighbouring E-UTRA cell by reading the SI of the neighbouring cell and reporting the acquired information to the network as specified in TS 38.331 [9] when the EN-DC is not configured. It is mandated if the UE supports EUTRA. | UE | CY | No | No |
| ***nr-CGI-Reporting***  Defines whether the UE supports acquisition of relevant information from a neighbouring intra-frequency or inter-frequency NR cell by reading the SI of the neighbouring cell and reporting the acquired information to the network as specified in TS 38.331 [9] when EN-DC is not configured. | UE | Yes | No | No |

In TS38.306, the description of *eutra-CGI-Reporting* and *nr-CGI-Reporting states that the two capabilities are applied when EN-DC is not configured.* In Rel-15, when discussing these two capabilities, they were just for SA scenario. But with the introduction of later drop, new additional MR-DC cases should be excluded. The descriptions of the two capabilities needs to be updated accordingly, i.e. they are applied when MR-DC is not configured. Therefore,

**Proposal 3: In TS38.306, update the description of eutra-CGI-Reporting and nr-CGI-Reporting to make it clear that they are applied when MR-DC is not configured.**

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| **Company** | **Comments** |
| Qualcomm Incorporated | Agree. |
| Ericsson | Agree. |
| Huawei, HiSilicon | As we explain above, we don’t think additional capability signaling for NR-DC is needed, so not the MR-DC, the NR-DC should be excluded. |
| Samsung | Agree |
| vivo | Agree. |
| MediaTek | Agree |
| OPPO | If we can agree both can be applied for NR-DC, then maybe we can make it clear that they are applied for both SA and NR-DC. |
| Nokia | MR-DC covers NR-DC as well, so we think we should rather say: “when (NG)EN-DC or NE-DC is not configured.” |

# Correction on UE capability constraints [2]

For CGI reporting configuration, it is only allowed to configure CGI reporting for one neighbor cell at one time

ReportCGI-EUTRA ::= SEQUENCE {

cellForWhichToReportCGI EUTRA-PhysCellId,

...,

[[

useAutonomousGaps-r16 ENUMERATED {setup} OPTIONAL -- Need R

]]

}

ReportCGI ::= SEQUENCE {

cellForWhichToReportCGI PhysCellId,

...,

[[

useAutonomousGaps-r16 ENUMERATED {setup} OPTIONAL -- Need R

]]

}

But in TS 38306, a number of neighbor cells “#cell for CGI reporting”, as shown below, is use for CGI reporting for neighbor cell. This description is not aligned with TS3x.331 CGI reporting configuration procedure and the meaning is not very clear:

| Parameter | Description | Value |
| --- | --- | --- |
| #DRBs | The number of DRBs that a UE shall support. | 16 per UE.  NOTE: 8 per MAC entity with duplication. |
| #minCellperMeasObjectNR | The minimum number of neighbour cells (excluding black list cells) that a UE shall be able to store associated with a MeasObjectNR. | 32 |
| #minBlackCellRangesperMeasObjectNR | The minimum number of blacklist cell PCI ranges that a UE shall be able to store associated with a MeasObjectNR. | 8 |
| #minCellperMeasObjectEUTRA | The minimum number of neighbour cells that a UE shall be able to store associated with a MeasObjectEUTRA. | 32 |
| #minCellTotal | The minimum number of neighbour cells (excluding black list cells) that UE shall be able to store in total from all measurement objects configured. | 256 with counting CSI-RS and SSB as 2. |
| #cell for CGI reporting | the limit regarding the cells NR can configure includes the cell for which the UE is requested to report CGI. | (# minCellperMeasObjectRAT - 1), where RAT represents NR and EUTRA. |
| #maxDeprioritisationFreq | The UE shall be able to store a depriotisation request for up to 8 frequencies (applicable when receiving another frequency specific deprioritisation request via *RRCRelease* before T325 expiry). | 8 |

This description is confusing as it may give the impression that the” cell for CGI reporting” can be more than one at once. Further this description does not express that the configuration is per frequency. In contrast, the UE capability constraints for CGI reporting is described in TS 36331 as highlighted below:

| Parameter | Description | Value | NB-IoT |
| --- | --- | --- | --- |
| #DRBs | The number of DRBs that a UE shall support | 8, 15 | (0, 1, 2)  NOTE1 |
| #RLC-AM | The number of RLC AM entities that a UE shall support | 10, 17 | (2, 3)  NOTE1 |
| #minCellperMeasObjectEUTRA | The minimum number of neighbour cells (excluding black list cells) that a UE shall be able to store within a MeasObjectEUTRA. NOTE. | 32 | N/A |
| #minBlackCellRangesperMeasObjectEUTRA | The minimum number of blacklist cell PCI ranges that a UE shall be able to store within a MeasObjectEUTRA | 32 | N/A |
| #minCellperMeasObjectUTRA | The minimum number of neighbour cells that a UE shall be able to store within a MeasObjectUTRA. NOTE. | 32 | N/A |
| #minCellperMeasObjectGERAN | The minimum number of neighbour cells that a UE shall be able to store within a measObjectGERAN. NOTE. | 32 | N/A |
| #minCellperMeasObjectCDMA2000 | The minimum number of neighbour cells that a UE shall be able to store within a measObjectCDMA2000. NOTE. | 32 | N/A |
| #minCellTotal | The minimum number of neighbour cells (excluding black list cells) that UE shall be able to store in total in all measurement objects configured | 256 | N/A |
| NOTE: In case of CGI reporting, the limit regarding the cells E-UTRAN can configure includes the cell for which the UE is requested to report CGI i.e. the amount of neighbour cells that can be included is at most (# minCellperMeasObjectRAT - 1), where RAT represents EUTRA/UTRA/GERAN/CDMA2000 respectively. | | | |
| NOTE1: #DRBs based on UE capability, #RLC-AM =#DRBs + 2. | | | |

This description clearly highlights that there is only one *cellForWhichToReportCGI* in the *MeasObject*. Therefore, it is proposed as:

**Proposal 4: Align UE capability Constraint for CGI reporting in TS38.306 with the corresponding description in TS36331.**

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm Incorporated | Agree. In the CR, the note should be numbered and the pointer to the note should put in the rows of minCellperMeasObjectNR and minCellperMeasObjectEUTRA. |
| Ericsson | In LTE, it also includes information about the neighbor cells whereas in NR, the current explanation is only about the ‘cell for which the UE is performing SIB1 reading’. So, the proposal is to clarify both that ‘only one cell can be configured for CGI reporting’ and the ‘number of neighbor cells that can be included is at most (#minCellPerMeasOBjectRAT-1)’. Is this correct understanding?  [vivo]: As expressed by Ericsson, the intention is to clarify both that ‘only one cell can be configured for CGI reporting’ and the ‘number of neighbor cells that can be included is at most (#minCellPerMeasOBjectRAT-1)’. |
| Huawei, HiSilicon | Not quite understand why only one cellForWhichToReportCGI can be expressed if NOTE is used. If we remember correctly, at the beginning of discussion for this table, companies preferred to add it in the table instead of using NOTE.  [vivo] If we remember, during “[AH 1807#16] Email discussion report of UE capability constraints” [ R2-1812561], there were quite an agreement as follows:   |  |  | | --- | --- | | NOTE: In case of CGI reporting, the limit regarding the cells NR can configure includes the cell for which the UE is requested to report CGI i.e. the amount of neighbour cells that can be included is at most (# minCellperMeasObjectRAT - 1), where RAT represents NR and EUTRA. | Huawei: ok.  DOCOMO: O.K. However, it should be noted in the corresponding field description.  [Samsung] Ok  [MediaTek] ok, but should we insert another row for this? | |
| Samsung | Agree. |
| vivo | The table was discussed in P2 of [R2-1812561]:   * #CGI reporting   + Most companies agree to add “the limit regarding the cells NR can configure includes the cell for which the UE is requested to report CGI i.e. the amount of neighbour cells that can be included is at most (# minCellperMeasObjectRAT - 1), where RAT represents NR and EUTRA”   And companies preferred to add it in the table instead of using NOTE.  But we do not know why we end up with the current description in 38,306 which is confusing. Take the #minCellperMeasObjectEUTRA as an example. The original intention is to say the minimum number of neighbour cells that a UE shall be able to store within a MeasObjectEUTRA is #minCellperMeasObjectEUTRA - 1, when CGI reporting is configured, because the target cell for CGI reporting also needs to be stored.  Hence, the value for #cell for CGI reporting should be 1, rather than # minCellperMeasObjectRAT – 1. |
| MediaTek | Agree |
| OPPO | Agree. But the notes itself is difficult to read. I guess the intention is to say  NOTE: In case of CGI reporting, the amount of neighbour cells that can be included , apart from cell for which the UE is requested to report CGI, is at most (# minCellperMeasObjectRAT - 1), where RAT represents EUTRA/UTRA/GERAN/CDMA2000 respectively. |
| Nokia | We agree with the approach proposed by QCM and understanding from Ericsson. |

# Conclusions

To be added.

# References

[1] [R2-2005618](file:///D:\Documents\3GPP\tsg_ran\WG2\RAN2\2005_R2_110-e\Docs\R2-2005618.zip) Introduction of CGI reporting capabilities, vivo

[2] [R2-2004994](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_110-e\Docs\R2-2004994.zip), Correction on UE capability constraints, vivo

[3] R2-181256, [AH 1807#16] Email discussion report of UE capability constraints, Huawei, Hisilicon