3GPP TSG-RAN WG2 #114 Tdoc R2-21xxxxx

Electronic meeting, May 19th – 27th, 2021

Agenda Item: 6.5.2

Source: Ericsson (rapporteur)

Title: [AT114-e][221][DCCA] Cell grouping CR

Document for: Discussion, Decision

# 1 Introduction

This document is to kick off the following email discussion:

* [AT114-e][221][DCCA] Cell grouping CR (Ericsson)

Scope:

* + - Discuss CRs for R16 NR-DC cell grouping based on online agreements.

Intended outcome:

* + - Discussion summary in [R2-2106493](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_114-e/Docs/R2-2106493.zip) (by email rapporteur).
    - Agreeable CRs. Intermediate status of discussion will be checked during 2nd week Monday session.

Deadline for providing comments, for rapporteur inputs, conclusions and CR finalization:

* + - Deadline for CR finalization: 2nd week Wed, UTC 1000

In the online session Wednesday 1st week, the following was agreed:

* Work offline to provide CRs for the NW-filtering solution.
* Email discussion [221] (Ericsson)
* Checkpoint Monday 2nd week. If several possibilities, can have show of hands to see which direction has most support.

This discussion document is to gather comments from participating companies on the CRs for introducing cell grouping for NR-DC.

# 2 Discussion

To make it easier to find the correct contact delegate in each company for potential follow-up questions, the rapporteur encourages the delegates who provide input to provide their contact information in this table:

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| --- | --- |
| Company | Delegate contact |

|  |  |
| --- | --- |
| Ericsson | stefan.wager@ericsson.com |
| Qualcomm Incorporated (Masato) | mkitazoe@qti.qualcomm.com |
| Apple Inc | naveen.palle@apple.com |
| MediaTek | Chun-fan.tsai@mediatek.com |
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Companies are requested to add their comments for each of the treated CRs of this email discussion in the boxes below.

## 2.1 Network based cell group filtering

Network based cell group filtering is described in:

[R2-2106017](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_114-e/Docs/R2-2106017.zip) Cell grouping for NR-DC Ericsson discussion LTE\_NR\_DC\_CA\_enh-Core

Based on the text proposal in Annex A, draft CRs for 38.331 and 38.306 introducing cell group filtering have been created and uploaded to the drafts folder (link).

### 2.1.1 General questions and comments

Companies are requested to provide their questions and comments on the CRs in the table below. Detailed comments can also be provided in the CRs themselves, if more feasible.

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| --- | --- |
| Company | Questions/Comments |
| Qualcomm Incorporated | We should clarify the behaviour when requestedCellGrouping is not included in UE Capability Enquiry. The UE should report only FR1-FR2 NR-DC in that case. |
| Apple Inc | Agree with Qualcomm’s comments. We do not want UE implementations to handle the high/flexible cell-grouping combinations for the case where the NW does not provide the cell grouping filtering. The UE would assume that NW supports only FR1-MCG and FR2-SCG DC.  In addition, we have some more comments:  In the proposed CR example, MCG=[n1, n7, n41, n66] and SCG=[n78, n261], we wonder on the NW flexibility or practical deployment options keeping in mind the future extensions. We can always have a DC combination just with n1, n7, n41 and n66. Does this mean that NW does not support this? We are also not sure if NWs have deployments where certain bands are always not considered as PCells ( n78/n261 in this case). What if the NW intends to support PCell on every band? What would be put into SCG group?  Also, can NW have the same band in both MCG and SCG..(we assume for the future intra-band DC case). In which case, the savings would be diminished.  Also, in the above example, how should the UE assume about the support of sync/async on the provided filtering bands..? Should the UE reports both async and sync DC, even when the NW can only support one of async/sync (it is our view that NW has deployed a config of timing across/within bands, and it cannot change the timing for different UEs). So it would be very useful to provide this info.  If we understand correctly, the proposed CR allows NW to provide more than one such MCG/SCG grouping? If so, will the bands from each of the group will not overlap? If they do, how does the UE interpret the overlap? If the NW provide atleast some bands that are the samea cross the diff MCG/SCG sets, then we think that the saving might not be practical.  It is our view that the future-proof signaling should be able to allow the NW to provide this filtering info for every capability enquiry message.  Maybe, instead of providing bands for MCG and SCG, NW can provide bands that operate with time-sync and bands without any time sync and UE can build DC combinations for sync/async based on this. This allows the flexibility on the NW to assign P(S)Cell to diff bands.  We also have other UE reporting options that can reduce the signaling size if UE has relations between bands (if band X in a CG, band Y cannot be in the same CG, band A can only be in the same CG as band X), and this sort of signaling can avoid comprehensive signaling (if UE can signal such relation for applicable DC combinations, based on the bands). |
| MediaTek | The major issue to the size of *maxCellGroupings*, which actually provide another kind limitation on the number of bands in NR-DC. We will discuss more in next question.  Several other comments.  <1> The UE behavior while the filter is not provided should be clarified. QC proposal is okay for us.  <2> The aspect on sync and async NR-DC is missing. We probably need more capability bit to indicate the NW that the UE support cell group #X with sync or async NR-DC operation (or both support).  <3> Does the “fallback” principle apply the requested cell group. Using example 1 - MCG=[n1, n7, n41, n66] and SCG=[n78, n261], does this implies that MCG=[n1, n7, n41, ~~n66~~] and SCG=[n78, n261] is supported (and requested) by the network ? In other words, Is the UE requested to report the cell grouping that result in removing one or more bands in MCG or SCG of this cell grouping?  <4> We assume that intra-band NR-DC is not within this scope. So, the bands in MCG will be different from the bands in SCG. (Otherwise, it would be super complicate) |
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*Rapporteur summary: tbd.*

### 2.1.2 Size of *maxCellGroupings*

One open issue that needs to be solved is to decide a suitable value for *maxCellGroupings* in the CR, i.e. what should be the maximum number of cell groupings that the network can filter for. The size affects the size of *supportedCellGrouping*, which is signalled as part of UE capability for each supported band combination. The target should be to not exceed the overhead per BC created by the LTE-DC cell group signalling approach, for which the cap of 5 bands created a bitmap of max 30 bits. Note that

Companies are requested to provide their input on the size of *maxCellGroupings* in the table below.

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| Company | Size | Motivation |
| Ericsson | 4 or 8 | Given that the UE does not need to support all bands in *requestedCellGroupngs,* we expect not many cell groupings will be needed. We added some examples in the field description to illustrate this. Mostly a single cell grouping should be sufficient, but the list could have max size of 4 or 8. |
| Qualcomm Incorporated |  | It is indeed important we have good visibility on the value of ” maxCellGroupings-r16”. This essentially tells if the network filtering scheme is more efficient than explicit signalling of Cell Grouping combinations by the UE.  We would like to rely on network vendors and operators on the exact value. But the principle should be that it is advisable that network includes Cell Grouping combinations used in the entire operators network rather than Cell Grouping used in the gNB. |
| Apple |  | Pls see our comments to Q2.1.1 |
| MediaTek |  | We are not sure if small number of cell groups does work as it will translate to deployment limitation. This is just another kind of 5-band limitation.  For a **single** band combination with 6 bands (e.g. {n1, n7, n41, n66, n78, n261}), there is 62 possible way of grouping. Example 1 is just one of them. And we have much more combinations from other BC with 6 bands, or with 7 bands, etc. In theory, the size *maxCellGroupings* could be large. But large number implies that the capability size does not really reduced.  It could only work if operator/network vendors confirm that extremely few combinations will be used in the field. |
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*Rapporteur summary: tbd.*

### 2.1.3 *supportedCellGrouping* as list or bitmap

Another open issue may be whether *supportedCellGrouping* should be encoded as list or bitmap in ASN.1. In the current draft CR it is encoded as list, which means the size will be variable depending on the number of *requestedCellGroupings* supported by the UE:

CA-ParametersNRDC-v16xy ::= SEQUENCE {

supportedCellGrouping SEQUENCE (SIZE (1..maxCellGroupings)) OF INTEGER(0..maxCellGroupings-1) OPTIONAL

Alternatively, it could be encoded as a bitmap, where each bit position points to a certain entry in the *requestedCellGroupings* list, e.g.:

CA-ParametersNRDC-v16xy ::= SEQUENCE {

supportedCellGrouping BIT STRING (SIZE(maxCellGroupings)) OPTIONAL

The benefit with the bitmap format is the more compact size through the bitmap representation, but the drawback it that the size is constant, i.e. it is the same regardless of the number of *requestedCellGroupings* provided by the network. Assuming though that network and UE vendors are aligned in what cell groupings that are supported, it can be expected that the UE normally supports all (or at least most of) requestedCellGroupings, and then bitmap could be more efficient.

Companies are requested to provide their input on the encoding of supportedCellGrouping in the table below.

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| Company | List or bitmap | Motivation |
| Ericsson | bitmap? | We originally had the list, but assuming UEs support all or most of cell groupings requested by the network the bitmap may be more efficient. |
| Qualcomm Incorporated |  | Depends on the value of maxCellGroupings-r16. Bitmap looks fine if it is in the range of 10 combinations. |
| Apple | Depends | we think this can be resolved once the open items are addressed in Q2.1.1. |
| MediaTek | Depends | We should design the size of *supportedCellGrouping* first. |
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*Rapporteur summary: tbd.*

# Conclusion

Tbd