**3GPP TSG-RAN WG2 Meeting #119bis R2-22xxxx**

**e-Meeting, 10-19 October 2022**

**Source: Apple Inc**

**Title: [DRAFT] Summary of email discussion [AT119bis-e][009][NR17] DC Location Reporting (Apple)**

**Document for: Decision**

**Agenda Item: 6.24.1**

# Introduction

This document provides a summary for the following email discussion.

* [AT119bis-e][009][NR17] DC Location Reporting (Apple)

Scope: Treat R2-2209334, R2-2210693, R2-2210694, R2-2210240, R2-2210773, R2-2210788. Determine agreeable parts, Based on agreeable parts, progress CRs

Intended outcome: Report, Agreed-in-principle CRs

Deadline: In time for CB W2 Mon (if CB is needed),

Deadline (for companies' initial feedback): Thursday 2022-10-13 1600 UTC

# Discussion

Companies providing input to this email discussion are requested to leave contact information below.

|  |  |  |
| --- | --- | --- |
| **Company** | **PoC** | **Email** |
| Ericsson | Tuomas Tirronen | [Tuomas.tirronen@ericsson.com](mailto:Tuomas.tirronen@ericsson.com) |
| Huawei, HiSilicon | Yang Zhao | zhaoyang@huawei.com |
| Qualcomm Incorporated | Masato KITAZOE | mkitazoe@qti.qualcomm.com |
| Apple | Naveen Palle | [naveen.palle@apple.com](mailto:naveen.palle@apple.com) |
| Samsung | Sangyeob Jung | sy0123.jung@samsung.com |
| MediaTek | Mutai Lin | morton.lin@mediatek.com |
| Nokia, Nokia Shanghai Bell | Tero Henttonen | [tero.henttonen@nokia.com](mailto:tero.henttonen@nokia.com) |
| OPPO | Zonda Du | duzhongda@oppo.com |
| Lenovo | Hyung-Nam Choi | hchoi5@lenovo.com |
| ZTE | Yu Liu | liu.yu3@zte.com.cn |
| CATT | Jie Shi | [shijie@catt.cn](mailto:shijie@catt.cn) |
| Intel | Candy Yiu | Candy.yiu@intel.com |
| vivo | Xiaodong Yang | Yangxiaodong5g@vivo.com |

* 1. Discussion on the RAN4 LS

**Question 1:** Do companies have any comments on the RAN4 LS [1]?

|  |  |
| --- | --- |
| **Company** | **Any comments/suggestions?** |
| Nokia, Nokia Shanghai Bell | We would note that RAN2 need not take the exact text of the RAN4 agreement in the CRs – the most important thing is that the wording is clear. |
|  |  |
|  |  |
|  |  |

* 1. Discussion on the CRs related to the RAN4 LS

Two companies provided CRs [2] [3] taking into account the clarification provided by RAN4 in [1].

Both versions of the CR suggest clarifying the definition of the “edge” of the component carrier for the purpose of using this in the mathematical centre calculation for the DC location reporting. [3] in addition suggests some additional editorial corrections.

**Question 2:** Do companies agree with either of the CRs?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **Agree to Nokia’s Version of the CR [2]?** | **Agree to Apple’s version of the CR [3]?** | **If yes to both, which one is preferred** | **Any comments/suggestions?** |
| Ericsson | Yes | Yes | [3] | [3] has some additional clarifications which makes the specification easier to read. Also some typos are fixed. |
| Huawei, HiSilicon | OK | OK | Slightly prefer [3] | [2] is simpler, while [3] corrected some other typos which are correct, so slight preference on [3]. |
| Qualcomm Incorporated | Yes | Yes | [3] |  |
| Apple | Yes | Yes | [3] – proponent |  |
| Samsung | Yes | Yes | - |  |
| MediaTek | Yes | Yes | [3] |  |
| Nokia, Nokia Shanghai Bell | Yes | Yes | - | We would prefer simpler version but don’t see big issues with the Apple CR, either. |
| OPPO | Yes | Yes | [3] |  |
| ZTE | Yes | Yes | [3] |  |
| CATT | Yes | Yes | [3] |  |
| Intel | Yes | Yes | [3] |  |
| vivo | Yes | Yes | [3] |  |

* 1. Discussion on applicable SCS and component carrier

In [4], there are two issues raised. The first one is on which component carrier is referred in the field definition of *defaultDCLocationOption.*

The second one is on which SCS is to be used if there are more than one SCS in the current component carrier. The paper suggests that RAN2 confirm on which of the three options the paper proposes.

|  |
| --- |
| In the description of *defaultDCLocationOption*, it is stated that ‘The default Tx Direct Current is located at the mathematical center of the UE bandwidth, ..., rounded to the subcarrier grid defined for the component carrier on which the Tx Direct Current is located’.  It is unclear what ‘the component carrier’ refers to, UL or DL carrier, configured or active carrier? It is also unclear whether ‘the Tx Direct Current’ refers to the default DC location or the actual DC location? We think here refers to the default DC location since the actual DC location has not been obtained in the current step. In addition, when there are more SCSs in the current component carrier, it is unclear to use which SCS to determine the subcarrier grid. So we give the following three modification options about this sentence:  Option 1: ‘rounded to the subcarrier grid of the lowest SCS defined for the component carrier on which the default Tx Direct Current is located, where the component carrier only refers to the UL CC.’  Option 2: ‘rounded to the subcarrier grid of the lowest SCS defined for the component carrier on which the default Tx Direct Current is located, where the component carrier refers to the UL CC when the default DC location is located on both UL and DL CC for TDD, and refers to the located CC (may be UL CC or DL CC) for other cases.’  Option 3: Others. |

**Question 3:** Companies are requested to provide views on the below:

Which definition is to be used for the component carrier for *defaultDCLocationOption:*

**Option 1:** ‘rounded to the subcarrier grid of the lowest SCS defined for the component carrier on which the default Tx Direct Current is located, where the component carrier only refers to the UL CC.’

**Option 2:** ‘rounded to the subcarrier grid of the lowest SCS defined for the component carrier on which the default Tx Direct Current is located, where the component carrier refers to the UL CC when the default DC location is located on both UL and DL CC for TDD, and refers to the located CC (may be UL CC or DL CC) for other cases.’

**Option 3: Others?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **Option 1** | **Option 2** | **Option 3 (pls provide suggestion in this case)** | **Any other comments/suggestions?** |
| Huawei, HiSilicon |  |  | See comments | We understand the component carrier is meant to be the carrier where the Direct Current is located and RAN4 has requested RAN2 to indicate the default DC location option, which could be UL and/or DL. So not sure why there is a need to have the differentiation between option 1 and option 2, we understand the current mechanism it is already clear? |
| Qualcomm Incorporated |  |  | See comment | It is our understanding that in the current RAN2 text below, “Tx Direct Current” was meant to indicate the default DC location.   * “rounded to the subcarrier grid defined for the component carrier on which the Tx Direct Current is located”   The original text in the corresponding RAN4 LS (R4-2119965) is as follows, and “the DC” in that context was default DC location.   * The DC is located at the mathematical center of the UE bandwidth rounded to the subcarrier grid defined for the component carrier on which the DC is located.   Since it is clear which component carrier the default DC location lands on, there is no need of option 1 or option 2. We still need to clarify that it is subcarrier grid of lowest SCS.   * “rounded to the subcarrier grid of the lowest SCS defined for the component carrier on which the ~~Tx Direct Current~~ the default DC is located” |
| Apple |  |  | See comment | While we have very similar views as Huawei, we are ok with clarification on “which” SCS, as Qualcomm has pointed out (this is related to the next question). Regarding which carrier, we think it is already clear. |
| Samsung |  |  | See comment | Same view as Qualcomm and good to clarify “the subcarrier grid of the lowest SCG”. |
| MediaTek |  |  | No need to change? | 1. We think what matters for the default DC location calculation is the outmost frequency. 2. It had been clarified in the definition of *OffsetToDefault* in 38.331: The lowest SCS in the CC group is used as the offset granularity. 3. No matter what ‘the component carrier’ refers to, UE needs to report them in the IE *defaultDC-Location*.   We can follow the majority to avoid ambiguity. |
| Nokia, Nokia Shanghai Bell |  |  | See comments | We agree with QC and would be fine with their proposed clarification |
| OPPO |  |  |  | We think the clarification from Qualcomm is good. But we think the “lowest SCS in the CC group” and the “lowest SCS defined for the component carrier on which the default DC is located” could be different and the previous one is the correct one. |
| ZTE |  |  | See comments | When the *defaultDC-Location-r17* is set to ‘ulAndDL’, the default DC location may be located on both UL and DL component carrier for TDD. Considering that BWP ID/number and SCS(s) are same for UL and DL component carrier for TDD, we agree not to clarify the “component carrier”, and only to clarify the “SCS” and the “Tx Direct Current”, then the change is as below (similar as the one specified by QC).  ‘rounded to the subcarrier grid of the lowest SCS defined for the component carrier on which the default Tx Direct Current is located.’  If companies agree, we can provide draft CR for phase2 discussion.  In addition, the “lowest SCS in the CC group” is only used for *OffsetToDefault*, not used for *defaultDCLocationOption*. |
| CATT |  |  | See comments | Agree with QC’s comment, we need to clarify it is subcarrier grid of lowest SCS. Follow the majority view to use the default Tx Direct Current or default DC-Location. |
| vivo |  |  |  | OK with QC’s comments for clarification on subcarrier grid of lowest SCS. |

Similar suggestions were provided for which subcarrier grid is to be used in case of the calculation of the mathematical centre.

**Question 4:** Companies are requested to provide views on the below:

Which definition is to be used for the SCS of the component carrier for *defaultDCLocationOption:*

**Option 1:** ‘the subcarrier grid of the lowest SCS of the nearest lower frequency component carrier shall be extended to cover the frequency of the mathematical default Direct Current location, where the component carrier only refers to the UL CC.’

**Option 2:** ‘the subcarrier grid of the lowest SCS of the nearest lower frequency component carrier shall be extended to cover the frequency of the mathematical default Direct Current location, where the component carrier refers to the UL CC when both UL CC and DL CC meet the requirement (i.e. the nearest lower frequency) for TDD, and refers to the nearest lower frequency CC (may be UL CC or DL CC) for other cases.’

**Option 3:** Others.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company** | **Option 1** | **Option 2** | **Option 3 (pls provide suggestion in this case)** | **Any other comments/suggestions?** |
| Huawei, HiSilicon |  |  | See comments | As long as the definition of component carrier is clear, there seems no need to differentiate the above two options. |
| Apple |  |  | See Comments | We think the suggestion made by Qualcomm for Q3 can be taken in, if majority prefers it. |
| Nokia, Nokia Shanghai Bell |  |  | See comments | We are fine with the QC proposal in Q3 |
| OPPO |  |  |  | Please refer to answer to Q3 |
| ZTE |  |  | See comments | We agree only to clarify the “SCS”, then the change is as below.  ‘the subcarrier grid of the lowest SCS of the nearest lower frequency component carrier shall be extended to cover the frequency of the mathematical default Direct Current location.’  If companies agree, we can provide draft CR for phase2 discussion. |
| CATT |  |  | See comments | Refer to the answer to Q3. |

* 1. Discussion correction of the field name

In [5], there is a suggestion to change the field name of *defaultDCLocationOption.* To *defaultDC-Location.* [5] also has an editorial correction.

**Question 5:** Do companies agree with the CR?

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Agree** | **Do not agree** | **Any comments/suggestions?** |
| Ericsson |  | X | This is not wrong, but seems only editorial on our mind. The chair indicated:   1. No editorial corrections for this meeting   We think the RRC rapporteur could sort this out by taking it in to account in the rapporteur CR next meeting cycle. |
| Huawei, HiSilicon |  |  | True that “-” is missing, but we prefer to keep “option” in the field name, in previous RAN4 LS this was indeed indicating different options. Perhaps these editorial corrections can be covered by CR in [3] or [2] once chosen. |
| Apple |  |  | No strong preference, prefer to go with majority. |
| Samsung | - | - | Purely editorial corrections so not urgent to be fixed in this meeting. |
| MediaTek | (Y) |  | Seems everyone knew to which ASN.1 IE it refers but it is still a naming misalignment between field description and ASN.1 definition. |
| Nokia, Nokia Shanghai Bell | Yes |  | We agree with Ericsson that editorial corrections were not allowed for the meeting, but understood this was meant to discourage only purely editorial CRs to be submitted. Since we have a CR correcting the DC default location, it’s fine to align the naming to match ASN.1 naming conventions (to avoid forgetting to do it the next time!). |
| OPPO |  |  | It sounds CR in this meeting is any way needed, we are fine to align this name in the field description |
| Lenovo |  |  | Agree that the change as such is editorial. But it should be clarified in which direction we want to go, i.e. to stick with current ASN.1 name “defaultDC-Location-r17” or change it to “defaultDC-LocationOption-r17”. |
| ZTE | Yes |  | As shown below, the field name is *defaultDC-Location-r17*, not *defaultDCLocationOption*, and the IE name is DefaultDC-Location-r17, not *DefaultDCLocationOption*. Actually we forgot to modify the field description, and only modified the ASN.1 in the last meeting, so misalignment occurred.  So we think the CR is needed.  CC-Group-r17 ::= SEQUENCE {  servCellIndexLower-r17 ServCellIndex,  servCellIndexHigher-r17 ServCellIndex OPTIONAL,  defaultDC-Location-r17 DefaultDC-Location-r17,  offsetToDefault-r17 CHOICE{  offsetValue OffsetValue-r17,  offsetlist SEQUENCE (SIZE(1..maxNrofReqComDC-Location-r17)) OF OffsetValue-r17  } OPTIONAL  }  ------ |
| CATT | Yes |  | To align the field description and modified the ASN.1. |
| Intel |  |  | Agree “-“ is missing. |

* 1. Discussion addition of missing need codes

In [6], it is suggested to add the missing need codes for the optional fields dlCarrier-r17 and ulCarrier-r17 in IE CC-State-r17 and to fix some editorial issues.

**Question 6:** Do companies agree with the CR?

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Agree** | **Do not agree** | **Any comments/suggestions?** |
| Ericsson | Yes |  | The need code needs fixing and need N seems appropriate. |
| Huawei, HiSilicon |  |  | reportUplinkTxDirectCurrentMoreCarrier-r17 is already NEED N, so not sure whether the Ies inside it need to have NEED N. The other editorial changes are OK and perhaps can be merged into [3] or [2] once chosen.  [Lenovo] In general, we don’t omit Need codes for optional child fields, even if the parent field is “Need N”, e.g. see pagingRecordList-v1700. So, for consistency reasons, Need codes should be specified. |
| Qualcomm Incorporated | yes |  |  |
| Apple | Ok |  |  |
| Samsung | Yes |  |  |
| MediaTek | Yes |  |  |
| Nokia, Nokia Shanghai Bell | Yes |  | As Huawei points out, the parent IE is already Need N so here is no perfect need code for this case. But we think Need N is at least giving the correct intent since this is something that network requests (once) and then UE responds. |
| OPPO |  |  | Agree with Huawei technically, but also fine to go with majority |
| Lenovo | Yes |  | Proponent |
| ZTE | Yes |  |  |
| CATT | Yes |  | Agree with Nokia’s view. |
| Intel | Yes |  |  |
| vivo | Yes |  |  |

# Conclusion

To be filled

# References

[1] R2-2209334 LS on intra-band UL CA DC default location clarification

[2] R2-2210240 Clarification to intra-band UL CA DC default location clarification Nokia, Nokia Shanghai Bell CR

[3] R2-2210788 Clarification to intra-band UL CA DC default location clarification. Apple Inc

[4] R2-2210693 Discussion on default DC location ZTE Corporation, Sanechips discussion

[5] R2-2210694 38331\_CR\_Correction on DC location ZTE Corporation, Sanechips

[6] R2-2210773 Addition of missing need codes in CC-State-r17 and other corrections Lenovo

# Annex: Main body of RAN4 LS [1]

The Rel-17 intra-band UL CA DC reporting framework has mostly been concluded in RAN4 #101e meeting and communicated to RAN2 via the LS R4-2119965. Unlike the Rel-15 and Rel-16 DC reporting mechanisms where UE would directly signal its UL DC location to the network, the Rel-17 method is composed of a default UL DC location in conjunction with a frequency offset relative to the default DC location chosen by the UE which can be communicated to the network.

The default UL DC location is defined as the “mathematical center of the UE bandwidth rounded to the subcarrier grid defined for the component carrier on which the DC is located”. If the mathematical center of the UE bandwidth lands on a frequency where there is no subcarrier grid defined, the subcarrier grid of the nearest lower frequency component carrier shall be extended to cover the frequency of the mathematical DC location. On the other hand, the UE bandwidth has been defined as the “frequencies between lower edge of lowest frequency component and upper edge of highest frequency component”. However, it remains unclear on the definition of “edge” of the component carrier which could be interpreted as the frequency at the edge sub-carrier, or the frequency at the edge sub-carrier boundary, as illustrated in Case (a) and Case (b) respectively in the figure below.



As the two interpretations for the “edge” of the component carrier may result in different default DC location when the two edge component carriers are with different numerologies, it is necessary to unify the definition to ensure that there is no ambiguity between UE and gNB when calculating the default UL DC location.

RAN4 has discussed and concluded that the “edge” of the component carrier shall be defined as the “edge sub-carrier boundary frequency” which is the Case (b) in the figure above.