3GPP TSG-RAN WG4 Meeting # 104-e R4-22xxxxx

**Electronic Meeting, Aug. 15th – 26th, 2022**

**Agenda item:** 9.4.3, 9.4.4

**Source:** Moderator (vivo)

**Title:** Email discussion summary for [104-e][108] NR\_RF\_FR2\_enh2\_Part\_3

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

# Topic #1: DC location

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2212354](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212354.zip)** | Apple | Rel-17 Intra-band UL CA DC default location clarification  ***Observation 1****: In UL CA when the two edge component carriers are with the same numerology, the default DC location would be the same between the two “edge” frequency interpretations.*  ***Observation 2****: In UL CA when the two edge component carriers are with different numerologies, the default DC location would be different before rounding to the sub-carrier index between the two “edge” frequency interpretations. In some cases the default DC location after rounding could be offset by one sub-carrier.*  ***Proposal 1****: RAN4 to clarify which of the following definitions is intended for* “edge” frequency of the edge component carriers:  ***Definition 1****: Edge sub-carrier frequency*  ***Definition 2****: Edge sub-carrier boundary frequency*  ***Proposal 2****: Send an LS to RAN2 to clarify the definition of the “edge” frequency of the edge component carriers for default UL DC location calculation.* |
| **[R4-2213332](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213332.zip)** | OPPO | R17 Draft CR on introduction of FR1 CA DC location reporting |
| **[R4-2213333](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213333.zip)** | OPPO | R17 Draft CR on introduction of FR2 CA DC location reporting |
| **[R4-2214039](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2214039.zip)** | Qualcomm Incorporated | DC location reporting for different features |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1 ”Edge” Clarification

**Issue 1-1-1: Whether and how to clarify which of the following definitions is intended for “edge” frequency of the edge component carriers?**

* Proposals
  + Option 1: Edge sub-carrier frequency
  + Option 2: Edge sub-carrier boundary frequency
  + Option 3: Not need to clarify
* Recommended WF
  + TBA

**Discussions:**

OPPO: in the previous LS to RAN2 the definition of DC location is clear. Lower edge is the lowest frequency of all the component CC. It should be option 2.

ZTE: I have different proposal. For this issue, the definition of upper and lower edge for mixed SCS. We can reuse the existing spec definition in section 5.3A.2. Regarding the necessity to send LS to RAN2, there seems no need.

Qualcomm: if we use the same on the both edges, it means calculation is based on the center. Does it really matter.

Apple: From our side, either option 1 or option 2 are OK. UE definition needs be aligned with network understanding. UE needs this definition to align the LO. If all the CCs have the same SCS, different definition makes no difference. If the SCS is different, we need clarify. The common understanding is needed. We slightly prefer Option 1.

Nokia: we also think either Option works. If we send LS to RAN2 or not depends on the definition of center is written in RAN2 or RAN4. If it was written in RAN4, we do not need to send LS to RAN2.

OPPO: when the SCS is the same, the option 1 = option 2. When SCS is mixed, option 2 gives the fixed location. We think option 2 is proper way.

Vivo: we support Nokia comment for LS. For options, we prefer option 1.

**Issue 1-1-2: Whether send an LS to RAN2 to clarify the definition of “edge” frequency of the edge component carriers for default UL DC location calculation?**

* Proposals
  + Option 1: Yes
  + Option 2: No.
* Recommended WF
  + TBA

Chair => follow Nokia comment “If it was written in RAN4, we do not need to send LS to RAN2.”

### Sub-topic 1-2 Applicability

**Issue 1-2-1: Discuss which feature variants which method for DC location signalling is applicable.**

* Proposals
  + Option 1: Tentative proposal from R4-2214039:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Feature/Reporting method | | R15 | R16 | R17 |
| Single CC |  | Yes | Yes | Yes |
| DL CA, single UL CC | UL DC on UL CC | Yes | Yes | Yes |
| UL DC on DL CC | No | No | Yes |
| Contiguous UL CA up to 2 UL CCs | Single LO on UL CC | Yes, but one DC per UL CC | Yes | Yes |
| Single LO outside UL CC | No | No | Yes |
| Dual LO on UL CC | Yes, one DC per UL CC | Yes | Yes |
| Dual LO on DL CC  (N/A in RAN4 specs) | Yes | No | Yes |
| Contiguous UL CA > 2 UL CCs | Single LO, all cases | Yes, one DC per UL CC | No | Yes |
| Non-contiguous UL CA | Single LO on UL CC | Yes, but one per CC | Yes | Yes |
| Single LO outside UL CC | No | No | Yes |
| Dual LO on UL CC | Yes, one per CC | No | Yes |
| Dual LO, at least one outside UL CC | No | No | Yes |

* + Option 2: Others
* Recommended WF
  + TBA

**Discussion:**

Qualcomm: we need update RAN4 spec. We need discuss whether we should apply the Rel-17 approach to all the cases?

**Issue 1-2-2: Whether change RAN4 specifications to allow exceptions for carrier leakage and IQ image only if UE declares support for an appropriate method for signalling the DC location?**

* Proposals
  + Option 1: Yes.
  + Option 2: No.
  + Option 3: Others
* Recommended WF
  + [Option 1]

**Discussion**:

Apple: before reaching agreement, we would like to clarify this exception is only for carrier without RB allocated or including carrier with RB allocated.

OPPO: for issue 1-2-2, does it mean carrier leakage and LO image allowed for UE when DC location is reported. If yes, we are fine.

Nokia: we have similar comment. There is an exception for mask for FR2 only. There is difference between FR1 and FR2. What exception does Qualcomm mention?

Qualcomm: Our intention is that we have such exception. There is unclear part for this exception. Our proposal is exception is applied where UE reports.

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1 ”Edge” Clarification

|  |  |
| --- | --- |
| **Issues** | **Company & Comments:** |
| **Issue 1-1-1:** | Company A: |
| Apple: Option 1 |
| vivo: we prefer option 1 |
| Nokia(HU): Option 1 or 2  We think as far as we specify clear definition, proposal 1 or proposal 2 works.  TO: Apple  Does Apple have a specific reason to select Option 1? |
| OPPO:  Option 2: Edge sub-carrier boundary frequency  This is our understanding from the day 1 of this discussion. The benefit is that there will be only one default DC location for a CA combination regardless of which scs used in each CC (not considering rounded to SCS case). This is simple way. |
|  |
| **Issue 1-1-2:** | Apple: Option 1 |
| vivo: we are open for this issue. From our perspective, this clarification has no impact on signalling design. |
| Nokia(HU): Option 1 if the definition of the center is captured in RAN2 spec. |
| OPPO: Maybe Option 2. We don’t see the confusion up to now, but no strong view on this. |
|  |
|  |

Sub topic 1-2 Applicability

|  |  |
| --- | --- |
| **Issues** | **Company & Comments:** |
| **Issue 1-2-1:** | Company A: |
| Apple:  1. We are not sure if Rel-15 signaling can support more than one UL carriers and dual LO on DL CC.  2. Contiguous UL CA (up to two CCs) with single LO outside UL CC should be supported by Rel-16 signalling. That is, it can be reported as 3300 or 3301.  3. All the non-contiguous UL CA with up to two CCs should be supported by Rel-16 signalling. |
| vivo: Thanks to QC for the elaborate summary. For the LO outside the UL CC case, 3300/3301 can be used in R16 scheme and R16 scheme can cover both contiguous and non-contiguous case when CC number is not greater than 2. |
| Nokia(HU):  R17: Contiguous UL CA up to 2 UL CCs 🡪 Single LO outside UL CC  R17: Non-contiguous UL CA🡪 Single LO outside UL CC  Yes (only when UL DC is in a gap between available outermost frequency components per CC-group) for both above cases.  R17: Non-contiguous UL CA🡪 Dual LO, at least one outside UL CC  The situation may change if non-contiguous CA including UL cont and/or non-cont UL CAs. |
| Company A: OPPO:   1. Regarding the “No” within the table, we need to align the understanding on what does it mean.   Does “3300/3301” can be considered as “Yes” or “No”, even the exact DC location might not be able to be indicated?  If it is “Yes”, then some of the “No” cases in R15 and R16 column need to be changed to “Yes”.   1. Regarding Rel-15 scheme, it can report the DC in each CC in theory, however, when in CA cases, the reported DC location may be incorrect.   The reason is that for one UL CC when it is combined with other UL CCs the DC location will be different (this is the reason why R16 scheme was introduced), but Rel-15 scheme can only report one DC for each UL CC. This means the R15 reported DC location is not the real DC location in UL CA.  Propose not to use Rel-15 scheme in UL CA cases at least when UE support Rel-16 or Rel-17 scheme.   1. Regarding Rel-16 scheme, in our understanding, it can only be applied to UL CA cases according to 38331 definition (see below figure). Therefore, some of single UL CC cases in R16 column should be changed to “No”       The changes for each case can be found in below table.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Feature/Reporting method | | R15 | R16 | R17 | | Single CC |  | Yes | Yes  -> No (Rel-16 scheme only apply to 2UL CA case) | Yes | | DL CA, single UL CC | UL DC on UL CC | Yes | Yes  -> No (Rel-16 scheme only apply to 2UL CA case) | Yes | | UL DC on DL CC | No  -> Yes (3300 reported) | No | Yes | | Contiguous UL CA up to 2 UL CCs | Single LO on UL CC | Yes, but one DC per UL CC  -> No (R15 DC location indicated in CA case may be incorrect) | Yes | Yes | | Single LO outside UL CC | No  (R15 DC location indicated in CA case may be incorrect) | No  -> Yes (3300 reported) | Yes | | Dual LO on UL CC | Yes, one DC per UL CC  -> No (R15 DC location indicated in CA case may be incorrect) | Yes | Yes | | Dual LO on DL CC  (N/A in RAN4 specs) | Yes  -> No (R15 DC location indicated in CA case may be incorrect) | No  -> Yes (3300 reported) | Yes | | Contiguous UL CA > 2 UL CCs | Single LO, all cases | Yes, one DC per UL CC  -> No (R15 DC location indicated in CA case may be incorrect) | No | Yes | | Non-contiguous UL CA | Single LO on UL CC | Yes, one DC per UL CC  -> No (R15 DC location indicated in CA case may be incorrect) | Yes | Yes | | Single LO outside UL CC | No  (R15 DC location indicated in CA case may be incorrect) | No  -> Yes (3300 reported) | Yes | | Dual LO on UL CC | Yes, one DC per UL CC  -> No (R15 DC location indicated in CA case may be incorrect) | No  -> Yes | Yes | | Dual LO, at least one outside UL CC | No  (R15 DC location indicated in CA case may be incorrect) | No  -> Yes (3300 reported for the outside UL CC) | Yes | |
|  |
| **Issue 1-2-2:** | Company A: |
| Apple: Are the exceptions discussed in this issue only applicable to non-allocated carrier or they are also applicable to allocated carriers? It is also unclear why IQ image can be allowed for exception? |
| Nokia: Clarification is needed. There are several exceptions in 38.101-1 and 38.101-2 and the exception are inconsistent across -1 and -2….  Does QC propose that only when DC is reported, spectrum emission is waived, and carrier leakage and IQ image requirements apply for 38.101-2 for spectrum emission mask for non-contiguous UL CA? |
| OPPO: Option 3 for now as the question itself is not crystal clear.  For clarification of the question itself, does it mean carrier leakage/IQ image exception only be allowed when UE indicate its exact DC location? If it is, then Option 1. And the supported reporting scheme is UE capability, further requested by NW. |
|  |
|  |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| **[R4-2213332](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213332.zip)** | Company A |
| Company B |
| Apple: We understand that the Rel-17 DC signaling parameter(s) at some point may need to be incorporated into RAN4 specifications to address certain DC associated RF requirements. However, RAN4 may not have sufficient information at this point in time to clearly specify how the signaling parameters are introduced in RAN4 spec. For example, Rel-17 DC signaling includes two fields, one is related to how default DC location is determined, the other is the offset to the default DC location in unit of number of sub-carriers. Neither of these two parameters can be used to indicate 3300 or 3301. Therefore, we suggest to wait till RAN2 completes the Rel-17 signaling design before introducing the corresponding parameters into RAN4 specifications. |
|  | vivo: In previous LS to RAN2, we indicated that “the exact DC location must be known”. In our understanding, this imply 3300/3301 should not be used in R17 scheme. We also agree with apple, it would be better to wait for RAN2 to complete the whole signaling design. |
|  | Nokia: Clarification is needed. There are several exceptions in 38.101-1 and 38.101-2 and the exception are inconsistent across -1 and -2….  Does QC propose that only when DC is reported, spectrum emission is waived, and carrier leakage and IQ image requirements apply for 38.101-2 for spectrum emission mask for non-contiguous UL CA? |
|  | OPPO: This is our paper, and some further clarification here fore better understanding the changes:   1. Regarding 3300/3301 for Rel-17 DC location report.   This has not been discussed specifically in Rel-17 but need some discussion here. As we all know that 3300 can be reported in Rel-15/16 to indicate the DC location is “out of the carrier”, and 3301 can be reported to indicate the DC location is “Undetermined position within the carrier”.  The reason behind probably is that when DC location is out of carrier, there is no need for NW to know that since it doesn’t help UL performance improvement anymore, so can be signaled with one value for all. This case hasn’t been changed in Rel-17, thus probably can still be needed especially for FR1.  And similar for 3301, UE can choose to not indicate the exact DC location to NW, for example when UE carrier leakage is small and linearity is good. Therefore, 3301 can still be allowed in Rel-17 though the reporting value range defined in Rel-17 is large.  So, DC location is “out of the carrier” and “Undetermined position within the carrier” probably is still needed which may not be the value of 3300/3301. If this is agreeable, RAN2 should be informed about these two scenarios since now they are discussing about the values in the signaling and LS maybe needed.  Regarding vivo comment on the LS to RAN2 “the exact DC location must be known”, it is correct if UE would like to get some exceptions for carrier leakage/IQ image, otherwise the exact DC location is not needed.   1. Regarding the scenarios that carrier leakage is waived, it is proposed to define “*the DC location indicated in [txDirectCurrentLocation-r17] is outside of the active UL carriers*”, since for FR1 the carrier leakage requirement and IQ image requirement only apply when they are in the UL CCs. |
| **[R4-2213333](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213333.zip)** | Company A |
| Company B |
| Apple: Same comments as in R4-2213332  OPPO: Some clarifications below for better understanding.   1. For FR2, similar changes are made as FR1, and the “waived” scenario is out of UL and DL carriers since in FR2 the carrier leakage and IQ image are defined in both UL and DL CCs. 2. The use of “xxx requirements are waived” is changed to “xxx requirements are not applied due to the exact DC location is unknown”.   The reason is that when “waived” is translated to some other languages it could mean “relaxed”, and people may interpret it as the UE can apply carrier leakage allowance/relaxation in any DC location as long as it reports 3300 or 3301 and this has caused misunderstanding of the specification inside and outside of 3GPP today. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #2: FR2 CA BW classes

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2211990](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2211990.zip)** | Samsung | Discussion on FR2 CA BW class remaining issues  **Observation 1: it is no harm to specify CA BW class R S T U in FBG2 in later stage when indeed necessary**  **Proposal 1: it is better to remove R S T U for now and to add it back when there are industry needs**  **Observation 2: the new IE to limit the maximum aggregated bandwidth seems not helpful for most legacy FBGs whose aggregated bandwidth range has no overlap among different order of CA BW classes**  **Observation 3: it is necessary to further clarify the new IE to limit the maximum aggregated bandwidth is per-Band or per-FS capability. If it is per-FS, it further weakens the benefits of the new IE to save signalling. And the relationship between the new IE(s) and feature set(s) need more clarification.**  **Proposal 2: NBC issue should be addressed before introducing the new IE to limit the maximum aggregated bandwidth. The CA BW classes of FBG5 would be difficult to be release independent to earlier release if the new IE would be introduced.** |
| **[R4-2212329](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212329.zip)** | Qualcomm Incorporated | On new contiguous BW classes for legacy networks  **Proposal 1: RAN4 requests RAN2 to consider a new IE that, for intra-band scenarios:**   1. **communicates to the network that the UE has independent constraints on number of CCs and max. aggregated bandwidth.** 2. **communicates the actual value of the max. aggregated BW.** 3. **The max. aggregated bandwidth is expected to change as a function of the set of baseband attributes captured in FeatureSetListPerUplink(Downlink)CC.**   **Proposal 2: The new IE is allowed to be implemented by UEs from Rel-15.**  **Proposal 3: R2-R12 are allowed to be implemented by UEs from Rel-15.** |
| **[R4-2212355](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212355.zip)** | Apple | Signaling enhancement for FR2 new CA BW classes  ***Proposal 1****: Introduce a new IE maxaggregatedBW to indicate UE’s maximum aggregated BW capability when UE’s maximum aggregated BW is less than the CA BW class upper BW limit.*  ***Proposal 2****: The signalling solution is down-selected from the following three alternatives (using R12 in FBG5 and maximum aggregated BW = 1600 MHz as an example):*  ***Alternative 1****: The following parameters are signalled,*  *CA BW Class: R12*  *maxaggregatedBW = 1600 MHz*  *{CC1, CC2, CC3, CC4, CC5, CC6, CC7, CC8, CC9, CC10, CC11, CC12} =*  *{200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200} (FeatureSet)*  ***Alternative 2****: The following parameters are signalled,*  *CA BW Class: R12*  *maxaggregatedBW = 1600 MHz*  *Note: The default assumption is that the maxaggregatedBW is also supported by the UE for all the lower order CA BW classes where their aggregated BW upper limit is higher than or equal to maxaggregatedBW.*  ***Alternative 3****: The following parameters are signalled,*  *CA BW Class: R12*  *maxaggregatedBW = 1600 MHz*  *CA BW Class: U* |
| **[R4-2212588](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212588.zip)** | Xiaomi | Discussion on the remain issues for FR2 new CA BW classes  **Observation 1: New IE limiting the maximum aggregated bandwidth can’t resolve the issue that the UE need additionally indicate the lower order BW classes (R5-R11) beyond the R12 fallback range in FBG5.**  **Observation 2: It is not necessary to additionally indicate support for the lower BW classes (R5-R11) with 1600MHz aggregated BW.** |
| **[R4-2212589](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212589.zip)** | Xiaomi | Draft CR for Rel-17 38.101-2 to correct the notation for FBG5 CA BW class |
| **[R4-2212776](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212776.zip)** | Ericsson | Draft LS to RAN2 on FR2 bandwidth classes covering up to 2400 MHz aggregated bandwidth with mixed carrier bandwidths  **Proposal 1: remove the CA BW classes R-U since superseded by the new R5-R8 classes (no NBC problem since R-U are not included in a published version of 38.331).**  **Observation 1: there is no need to introduce any additional fall-back rules.**  **Proposal 2: introduce a new parameter indicating the maximum aggregated bandwidth supported (in MHz) by the UE as a per-band capability for each transmission direction. This parameter should apply for operating bands in both FR1 and FR2 to reduce required capability transfer of feature sets in feature-set combinations. If a general specification is not feasible, the parameter should at least cover FBG5 > 800 MHz.**  **Proposal 3: ask RAN2 to introduce FBG5 and the new parameter into 38.331.** |
| **[R4-2212777](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212777.zip)** | Ericsson | Removal of the CA bandwidth classes R-U |
| **[R4-2213592](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213592.zip)** | ZTE Corporation | Considerations on FR2 CA BW classes  **Observation 1: The compatibility issue of introduction new CA BW classes R~U has already been solved from RAN2 signalling aspects.**  **Proposal 1: It is suggested to keep the CA BW classes R, S, T and U in FBG#2 so that the operators can choose the 200MHz channel bandwidths or the 100MHz/200MHz hybrid channel bandwidths independently.**  **Proposal 2: It is suggested to introduce a new CA BW class V for aggregated BW 1200 MHz < BWChannel\_CA ≤ 1600 MHz with 4CCs in FBG#1.** |
| **[R4-2213593](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213593.zip)** | ZTE Corporation | CR for TS 38.101-2 on corrections to FR2 CA BW classes |

## Open issues summary

### Sub-topic 2-1 non-FBG5 issue

**Issue 2-1-1: Introduce a new CA BW class V for aggregated BW 1200 MHz < BWChannel\_CA ≤ 1600 MHz with 4CCs in FBG#1. (ZTE R4-2213593)**

|  |  |  |  |
| --- | --- | --- | --- |
| NR CA bandwidth class | Aggregated channel bandwidth | Number of contiguous CC | Fallback group |
| A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4 |
| B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 |
| C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |  |
| V | 1200 MHz < BWChannel\_CA ≤ 1600 MHz | 4 |  |

* Proposals
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* Recommended WF
  + TBA

**Discussion:**

Ericsson: we propose not to introduce it from this point of time.

Verizon: we do not prefer to introduce the new bandwidth class.

Xiaomi: we prefer to introduce the new class, which was agreed in previous RAN4 meeting considering the backward compatibility.

Samsung: we agree with Ericsson and Verizon. We should introduce the new bandwidth class based on real demand.

Apple: In general, we do not object this new class according to demand from operators and vendors. It is better to introduce this in later release.

ZTE: We support to introduce 400MHz. We want to keep all the bandwidth class to have their own roadmap. This is the previous RAN4 agreement, like what Xiaomi commented.

Moderator: to Xiaomi, we check the previous document. We have agreement to introduce such 400MHz as the agreement. But with discussion continuing, companies have different understanding.

Huawei: have similar understanding as Xiaomi and ZTE. Keeping 400MHz is still valid.

Samsung: Could Xiaomi clarify the agreement? I did not see the agreement.

Xiaomi: captured in R4-2107859.

OPPO: in future, we can ask companies to update to clearly capture the agreement.

**Agreement:**

* Further discuss the bandwidth class V in the future release depending on the demand from operators.

**Issue 2-1-2: Remove R S T U for now and can be added back when there are industry needs**

* Proposals
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* Recommended WF
  + [Option 1]

**Discussion:**

Xiaomi: we disagree with it. FBG2 we should keep them considering the backward compatibility. FBG5 also covers FBG3. Does it mean FBG3 is obsolete?

Huawei: It is not necessary to remove RSTU from now. The development of RSTU and FBG5 are not contradictive.

Ericsson: we would like to understand why there is backward computability issue for the bandwidth class which is not introduced yet. From deployment, R~U have been covered by R5~R8 and they are redundant. The other capability covers them. The FBG3 may be obsolete but UE still need to report to network that does not understand the new FBG. There is no need to introduce the class which has been covered by RAN2 signaling.

Verizon: we fully agree with Ericsson comment. We do not understand why we should discuss something does not exist.

ZTE: we disagree with removing RSTU. FBG2 is not obsolete. FBG2 has been introduced from Rel-15. If we think FBG5 can include all the requirements, how to handle CC with 400MHz? Should we define the new hybrid groups?

Samsung: we support moderator proposal. The background to introduce RSTU is that at that time we just discuss fallback group 1,2,3 but later we agree on fallback group 5 and then fall back group 2 is obsolete. In the future we are open to introduce this.

Qualcomm: It is good for proponent to come up with the concrete proposal where RSTU is useful. It would not be useful for legacy network. FBG5 can work. FBG5 is constructive and can support the future demand.

Ericsson: Agree with Qualcomm. It is beneficial to get clear clarification on the problem of backward compatibility.

Apple: FBG5 has issue on the signalling compatibility. It may need complicated feature set. RSTU can provide the advantage to indicate UE capability of number of 200MHz carriers.

Verizon: There is no legacy issue for this particular bandwidth class. The discussion here is mainly focusing on what we are going to deploy in the system. In the future, we have no clear view. At the current stage, we do not think these requirements are needed.

Xiaomi: have similar view as Apple. It seems FBG 5 covers FBG2. FBG5 have differences for legacy bandwidth class. RAN2 needs further check if UE report its support R12 with limited 1600MHz, the network cannot configure 8 carriers with 200MHz bandwidth.

Qualcomm: I do not believe FBG5 brings any new fall back rules.

Samsung: to Apple, FBG5, RSTU can be helpful for capability. We wonder if UE reports for FBG5 and FBG2 simulatenously.

Ericsson: FBG5 indeed follows the fall back rule. The introduction of new information is to reduce the signalling of capability.

Apple: I have different understanding. CA bandwidth class definition is mixed with configuration of network. UE does not know what the network configuration is when reporting capability. UE needs to indicate the different bandwidth class with different fall back group.

Moderator: in case that we cannot reach agreement, we can also keep them in the spec.

Chair => Encourage experts to further discuss if there is fall-back issue. If there is no fall back issue, it is suggested to further discuss RSTU in the future release depending on the operator demands.

### Sub-topic 2-2 FBG5 related issue

**Issue 2-2-1: How to enable the blue-but-not-red region in following figure?**

Chart, line chart

Description automatically generated

* Proposals
  + Option 1: Use additional FeatureSets
  + Option 2: Introduce MaxAggregatedBW only.
  + Option 3: Introduce MaxAggregatedBW and signal corresponding FBG2 class to indicate the number of individual CC that can support 200MHz. (Apple R4-2212344, Alt3)
* Recommended WF
  + TBA

**Discussion:**

Moderator: Most companies support to introduce the MaxAggregatedBW.

Huawei: We do not need to introduce this IE. For the next issue, whether it is per BC or per FS needs further discussion.

Qualcomm: we have example where the signaling can help. We have side by side comparison. This aggregated BW is the baseband capability. It has to be per FS.

Ericsson: The concern from UE vendors is that they can only support a certain aggregated bandwidth. To avoid the heavy signaling load, we introduce this to allow UE to report the maximum aggregated BW. Whether it is per band or per FS is up to RAN2. It could be beneficial to reduce the signaling by introduce this capability. That should be done for FBG5 at least. In the field, the issues were identified. Last time around, there is no fall-back issue for FBG5 but the signaling load is the concern. We can ask RAN2 what is possible. RAN2 can tell signaling design rather than RAN4.

Xiaomi: according to current fall-back rule, if UE report to support higher class, UE needs to support lower class. UE will report the highest bandwidth class. UE does not need to indicate all the lower order classes.

Verizon: we agree to introduce the new IE to avoid the signaling overload. That is useful.

Huawei: This capability has pre-condition. Baseband capability should be the same. Baseband is limited by this new IE. We only see the applicability for intra-band contiguous CA. We wonder how the new IE is applied for intra-band NC CA. To Ericsson, we can list the problem and options in LS to ask RAN2 opinion. RAN4 cannot conclude on the introduction of IE from now.

Qualcomm: We agree that RAN2 can decide the signaling. We agree with Huawei. This is limited to intra-band contiguous. It is applied to intra-band contiguous CA. To comment that the IE is not useful enough since it does not cover the situation where baseband capability is different, this comment would be true…. To Xiaomi, picture of blue is purely FBG5.

Apple: we support the new IE. Many companies have commented. In order to support 2400MHz deployment, it has used 12 CC. But there will be some limitation, that UE cannot support 12 by 200MHz. This number should be supported by R12, 11 and 10. Without it, UE need to indicate multiple feature sets, which is really complicated and even complicated for FR1+FR2. We see the merit of this IE.

Ericsson: Our position is IE should be applicable to FBG5. It may be difficult to introduce for other group.

Samsung: this issue should not totally reply on RAN2. RAN2 may not have RAN4 knowledge. RAN4 needs to have consensus on introduction of such signaling.

ZTE: The current RAN2 signaling design work when we introduce the new fallback group. We can see the potential reduction of signaling load. We cannot judge how much signaling load can be saved. We can leave the judgement to RAN2. They can decide how much we can save. Introduction of such signaling will break the rule of RAN2.

Qualcomm: We should first align on the view. We can add and delete to the framework in our LS proposal.

**Issue 2-2-2: If introduced, the new IE MaxAggregatedBW is applicable for all FBG or only FBG5?**

* Proposals
  + Option 1: FBG5 only.
  + Option 2: All FBG
  + Option 3: Others.
* Recommended WF
  + [Option 1]

**Issue 2-2-3: If introduced, the new IE is per-band or** **per-FS?**

* Proposals
  + Option 1: per-band (Apple R4-2212344, Alt2)
  + Option 2: per-FS. (Qualcomm R4-2212329)
  + Option 3: Others.
* Recommended WF
  + TBA

**Issue 2-2-4: If introduced, whether the new IE and FBG5 can be release independent from R15?**

* Proposals
  + Option 1: Yes
  + Option 2: No.
  + Option 3: Others.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1 non-FBG5 issue

|  |  |
| --- | --- |
| **Issues** | **Company & Comments:** |
| Issue 2-1-1: | Company A: |
| Ericsson: Option 2. Modifications of the FBG2 require further studies considering the support of 400 MHz and operation with this channel bandwidth. |
| Apple: Option 3  The new CA BW class as proposed can be considered in a later release when the infra-structure is ready to support 400MHz carrier per cell. |
| Xiaomi: support Option 1, it has been agreed in the WF R4-2107859 |
| Samsung: option 2.  We don’t think it necessary to introduce CA BW class V (4x400MHz) as of now. It is too far away from practical deployment. The first stage is to enable 200MHz CC BW on top of existing 100MHz CC BW in the CA BW class. |
|  |
| Issue 2-1-2: | Company A: |
| Ericsson: Option 1, the R-U classes are superseded by R5-R8, R-U are redundant. No need to introduce later. |
| Apple: Option 3  It depends on whether R, S, T, U would be used as UE capability signaling to complement FBG5 on maximum aggregated BW indication without the use of complicated FeatureSet signaling as discussed in R4-2212355. |
| Xiaomi: Option 2, it’s necessary and safe to keep R, S, T, U in FBG2. It seems FBG 5 already cover the aggregated BW of R,S,T,U, actually, according to current signaling logic, the network can never configure 8\*200MHz for the UE, if the UE indicate support R12 with the limitation of max aggregated BW 1600MHz. Whether allowing the UE additionally indicate lower order classes with the max aggregated BW 1600MHz need RAN2 further check, since if allowed, it will break the current fallback rule. |
| Samsung: option 1.  In our view business driven is the most important. RAN4 should be careful to introduce new CA BW classes when there is no deployment demand. |
|  |

Sub topic 2-2 FBG5 Related

|  |  |
| --- | --- |
| **Issues** | **Company & Comments:** |
| Issue 2-2-1: | Company A: |
| Sub-topic 2-2  Ericsson: option 2, this would address the concern of extending the maximum aggregated BW of the new FBG from 1600 MHz to 2400 MHz without increased capability signaling. In case fallbacks support different capabilities, the standard procedures in 38.331 apply. |
| Issue 2-2-1  Apple: Option 2 is our preference.  Option 3 is also proposed by us and can be considered in case the default assumption on the support of maximum aggregated BW for lower order CA BW classes in FBG5 is not accepted. |
| Xiaomi: could support Option3.  Option 1 will break the current fallback rule, if the UE report supporting the highest order class, the UE will be mandatory to support the lower order classes in ther same FBG, why the classes in FBG5 need further indicate support the lower order classes by FS additionally.  Option 2 introducing new IE to limit max aggregated BW 1600MHz with highest class R12 can’t represent the UE support the lower order classes with max aggregated BW 1600MHz. |
| Samsung:  Option 1 (FeatureSets) is feasible as it is existing scheme.  Option 2 (new IE) depends on the discussion of other detailed issues  Option 3 seems having feasibility issue since CA BW class signaling is an enumerated reporting and thus the UE could not signal FBG5 class and FBG2 class at the same time. |
|  |
| Issue 2-2-2: | Company A: |
| Ericsson: Option 3 (other), the new parameter/IE max aggregated BW should at least apply for the new class FBG5. It would be beneficial could this parameter also be used for intra-band CA (contiguous and non-contiguous) both for FR1 and FR2 as an envelope capability of the aggregated BW to reduce capability signaling. |
| Apple: Option 3. We share the similar view Ericsson. But we should aim to resolve the FBG5 signaling issue first before taking the next step to see if the same parameter can be appliable to other FBGs in FR2 and FR1. |
| Xiaomi: Option 3:others, as our contribution R4-2212588 analysis, new IE limiting the maximum aggregated bandwidth can’t resolve the issue in FBG5. If introduce it as general method for all FBGs in both FR1 and FR2, I’m not sure the new IE just indicates RF resource or includes baseband capability. In addition, if it just indicate RF resource, how to distinguish the baseband capability need be confirmed by RAN2 before RAN4 agree to introduce the new IE. Propose to merge this issue into BCS4 to further discuss. |
| Samsung:  For the FBGs which have no frequency overlap among different orders of CA BW classes, we wonder how the new IE works. So far, most FBGs has no frequency overlap. |
|  |
| Issue 2-2-3: | Company A: |
| Ericsson: Option 3 (other), RAN4 should inform RAN2 on the proposed BW limitation and our concerns on signaling, the possible application/scope of the new parameter and ask whether this could reduce capability signaling. RAN2 will decide about the signaling details and consider any feasibility and NBC issues. The proposed draft LS in R4-2212776 or R4-2212329 can be used as a baseline. |
| Apple: Option 1 is our preference. |
| Xiaomi: Option3, no matter per feature set or per band can’t resolve the issue in FBG5. If introduce it as general method for all FBGs for both FR1 and FR2, I’m not sure the new IE just indicates RF resource or includes baseband capability. In addition, if it just indicate RF resource, how to distinguish the baseband capability need be confirmed by RAN2 before RAN4 agree to introduce the new IE. Propose to merge this issue into BCS4 to further discuss, since companies also propose to introduce similar IE for BCS5 in FR1 to save signaling overhead. |
| Samsung:  In terms of signaling saving, it seems the original intention is to define the new IE as per-Band. It would be rather complicated to be per-FS and it deteriorates the benefits of signaling saving.  In addition, there is also new MaxAggregatedBW IE discussion in FR1, it would be better to be aligned. |
|  |
| Issue 2-2-4: | Company A: |
| Ericsson: Option 3 (other), FBG5 and the new IE can be implemented by a Rel-15 UE, but the 38.331 Rel-15 would not be changed. The FBG5 and the extended Rel-17 field would be listed in 38.331 Annex C “early implementable features” so that it can be tested according to the Rel-17 CR. |
| Apple: Option 3. We share the similar view with Ericsson. |
| Xiaomi: FBG5 can release independent from R15, but the backwards compatible issue for FBG5 need consider. If legacy network can’t identify the classes in FBG5, how does the network configure the intra-band class for the UE? |
| Samsung:  Release independence of a new IE should be rarely used except for very special case. As an optional enhancement, not sure if it is proper to do so here for new IE.  Besides, in FR1 MaxAggregatedBW discussion which is supposed to be applicable for BCS5 while BCS5 is only applicable in Rel-17, in such case the new IE could not be release independence to Rel-15. |
|  |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| **[R4-2212589](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212589.zip)** (Xiaomi) | Company A |
| Ericsson: the R2-R12 can be given other value names, but the redundant R-U should be removed. |
| Apple: If R, S, T, U would be retained, renaming R2-R12 can avoid the clashing with class R. |
| **[R4-2212777](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2212777.zip)**  （Ericsson） | Company A |
| Apple: If R, S, T, U would not be used as UE capability signaling to complement FBG5 on maximum aggregated BW indication without the use of complicated FeatureSet signaling as discussed in R4-2212355 and where if Alt 2 can be accepted, then R, S, T, U can be removed as they are also covered by FBG5. |
| Xiaomi: disagree the CR, it’s necessary to keep R,S,T,U in FBG2. |
| **[R4-2213593](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104-e/Docs/R4-2213593.zip)**  (ZTE) | Company A |
| Ericsson: not agreed, see comments to 2-1-1. |
| Apple: The BW class A definition does not seem to be falling apart without the proposed change. The new CA BW class as proposed can be considered in a later release when the infra-structure is ready to support 400MHz carrier per cell. |
| Xiaomi: agree, since it has been agreed in previous RAN4 meeting |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#2-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#2-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)