**3GPP TSG-RAN WG4 Meeting #108bis R4-2317271**

**Xiamen, China, Oct. 9 – 13, 2023**

**Agenda item:** 7.4

**Source:** Moderator (Apple)

**Title:** [108bis][148] NR\_reply\_LS\_UE\_RF

**Document for:** Information

# Introduction

This email thread is focused on the following RF topics under AI 7. Note the topic “1. LS on applicability of the requirements in TS 36.101 Clause 8 and Clause 9 to IoT NTN UEs (R5-235817)” has been moved to thread [332].

1. Reply LS on newly introduced FR2 CA BW Classes (R2-2309219)
2. Power Class in UL intra band CA within an UL inter band CA (R4-2315031)
3. LS to RAN5 for measurement grid based on the assumption of 6x2 for PC3

# Topic #1: void

# Topic #2: Reply LS on newly introduced FR2 CA BW Classes (R2-2309219)

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2315441 | Xiaomi | **Proposal 1: About RAN2’s LS on the status on FR2 BW classes R, S, T, U, RAN4 would like to clarify that**  **FR2 BW classes R, S, T, U had been already captured in the RAN4 specification.** |
| R4-2315815 | vivo | **Observation:** In current RAN2 spec, the RSTU is not covered by R5~R8.  **Proposal:** RAN4 confirm that the RSUT is not need to be removed from current spec. |
| R4-2315816 | vivo | RAN4 first would like to thank RAN2 for the reply LS on newly introduced FR2 CA BW Classes and informing RAN4 on RAN2’s efforts on release independent issue of CA BW class of RSTU. As for status on FR2 BW classes R, S, T, U, RAN4 once discussed whether they could be removed since they could be covered by R5~R8 from FBG5, but to leave more flexibility for UE implementaion, RAN4 further confirm that R, S, T, U will be kept in spec. |
| R4-2315865 | Huawei, Hisilicon | New CA bandwidth classes for FR2-2 have been discussed in past RAN4 meetings. Considering the approved channel bandwidth for FR2-2 was up to 2000MHz, the new CA bandwidth classes V and W within FRG1 (4\*400MHz and 5\*400MHz) were approved to support up to 2000MHz along with the NOTE 4 in TS 38.101-2 v17.8.0 by CR R4-2220821.  Table 5.3A.4-1: CA bandwidth classes   |  |  |  |  | | --- | --- | --- | --- | | NR CA bandwidth class | Aggregated channel bandwidth | Number of contiguous CC | Fallback group | | A | BWChannel ≤ 400 MHz | 1 | 1,2,3,4,5 | | B | 400 MHz < BWChannel\_CA ≤ 800 MHz | 2 | 1 | | C | 800 MHz < BWChannel\_CA ≤ 1200 MHz | 3 |  | | V (Note 4) | 1200 MHz < BWChannel\_CA ≤ 1600 MHz | 4 |  | | W (Note 4) | 1600 MHz < BWChannel\_CA ≤ 2000 MHz | 5 |  | | NOTE 1: Maximum supported component carrier bandwidths for fallback groups 1, 2, 3, 4 and 5 are 400 MHz, 200 MHz, 100 MHz, 100 MHz and 200 MHz respectively except for CA bandwidth class A. For CA bandwidth classes of fallback group 5, requirements apply for non-interlaced 100 MHz and 200 MHz channel bandwidths (each CA bandwidth class consisting of up to two contiguous sub-blocks each with component carriers of a single channel bandwidth).  NOTE 2: It is mandatory for a UE to be able to fallback to lower order CA bandwidth class configuration within a fallback group. It is not mandatory for a UE to be able to fallback to lower order CA bandwidth class configuration that belong to a different fallback group.  NOTE 3: In this release of the specification, the minimum requirements for intra-band contiguous CA configurations apply for aggregated channel bandwidths up to 1600 MHz for FR2-1 (this note is not relevant for UE capability parsing by the network).  NOTE 4: This bandwidth class is applicable only for operating bands within FR2-2. | | | |   RAN4 respectfully ask RAN2 to take above into consideration in the UE capability signaling design. |
| R4-2316373 | Huawei, Hisilicon | RAN4 thanks RAN2 for the LS reply on new FR2 FBG2 CA BW classes R, S, T, U.  RAN4 is aware of that RAN2 confirms the above bandwidth classes can be considered to be introduced since Rel-17 and also allows early implementation since Rel-15 with the exquisite design. RAN4 would like to provide following answer to the RAN2’s inquire on RAN4 status on R, S, T, U.  **Answer from RAN4**: In RAN4#105, whether to remove the FR2 CA BW classes R, S, T, U was discussed but the corresponding CR in R4-2218823 was not pursued. Thus, in the latest version i.e. v18.2 of TS 38.101-2 the CA BW classes R, S, T, U are still embedded in Table 5.3A.4-1. |
| R4-2316690 | ZTE | **Observation 1 The FR2 CA BW classes R, S, T and U are not newly introduced CA BW classes. They have been introduced in RAN4 spec since v17.2.0.**  **Observation 2 The FR2 CA BW classes R2 ~ R12 in FBG#5 have been introduced in RAN4 spec since v17.6.0.**  **Observation 3 Up to the latest RAN4 spec, both CA BW classes R, S, T, U and R2 ~ R12 are supported in TS 38.101-2.**  **Proposal 1 It is suggested to approve the draft reply LS shown in [7].** |
| R4-2316691 | ZTE | RAN4 thanks RAN2 for the reply LS in R2-2309219 and the confirmation that RAN2 could consider to introduce the FR2 FBG#2 CA BW classes R, S, T, U starting Rel-17 but allowing earlier implementation from Rel-15.  With regard to the question about the RAN4 status on BW classes R, S, T, U, RAN4 would like to answer as follows:  RAN4 confirms that up to the latest RAN4 spec, both FR2 CA BW classes R, S, T, U and R2 ~ R12 are supported in TS 38.101-2. |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions..*

### Sub-topic 2-1:

*Sub-topic description:*

*Open issues and candidate options before f2f meeting:*

**Issue 2-1-1: Agree to capture in the reply LS “As for status on FR2 BW classes R, S, T, U, RAN4 once discussed whether they could be removed since they could be covered by R5~R8 from FBG5, but to leave more flexibility for UE implementaion, RAN4 further confirm that R, S, T, U will be kept in spec.”**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + To be discussed

Ericsson: We knew it has been discussed in the past. We would like to know the technical reason to keep this and replace by R5 and R8, and consider the fact that RAN2 has specified the capability filter to simplify and reduce UE signalling. Maintaining R to U would lead to only fragmentation if this filter is not used.

Xiaomi: R/S/T/U has different deployment scenario from R5. R5 is mixing 100 and 200MHz. From UE side, we would like to keep flexibility for UE.

Vivo: We understand the Ericsson concern. There is no harm to keep RSTU in the spec. RAN2 has many work on RSTU for release independent.

ZTE: We share the same view as Xiaomi. Currently the RSTU have already been captured in RAN4 spec. These bandwidth classes have been introduced before R5 and R8. These bandwidth classes have deployment requirement not only for mixing bandwidth. We think for reply LS we do not need to say what is the RAN4 and how RAN4 proceed this and just clarify RAN4 situation.

Qualcomm: we do think both sides have problem. Do we have near term deployment with fallback group 2? If not we can look at this also.

Ericsson: the network is configuration bandwidths for certain bands. This can be done by looking at R5 and R8. If there is other technique difference, we can look at. There is only a risk for fragmentation.

**Issue 2-1-2: Whether to send another LS to inform RAN2 of the new CA bandwidth classes V and W for FR2-2, as proposed in R4-2315865**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + To be discussed

# Topic #3: Power Class in UL intra band CA within an UL inter band CA (R4-2315031)

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2315031 | Nokia, Nokia Shanghai Bell | **Observation 1**: Thus far, TS 38.306 refers to *ue-PowerClass* in BandNR to identify power class per band in UL inter band CA state, while it is not clear if it considers UL inter band CA including UL intra band CA.  **Observation 2**: Since *ue-PowerClass* for a band in BandNR is not listed in each BandCombination in TS 38.331, referring to *ue-PowerClass* = e.g., PC2 for a band as the achievable highest power (power class) per band within UL inter band CA means that all the supported PC2 (or higher PC) UL inter band CA including the band(s) by a UE shall be able to achieve PC2 for the band(s) in all the supported UL inter band CA including the band(s) by the UE.  **Observation 3**: From Observation 2, although a way to refer to *ue-PowerClass* may impose constraints on UE development, 3GPP has lived with these constraints thus far.  **Observation 4**: Referring to *ue-PowerClass* for a band, e.g., n41, to understand power class for UL intra band contiguous CA, e.g., CA\_n41C within an UL inter band CA, e.g., CA\_n3A-n41C, may impose similar constraints mentioned in **Observation 3** on UE implementation.  **Observation 5**: Technically, in order to identify e.g., power class of CA\_n41C within UL CA\_n3A-n41C, *powerClass* for DL CA\_n3A-n41C\_UL CA\_n41C should be referred to given that that is the highest order fallback configuration with CA\_n41C as UL. UEs, however, may not explicitly report a key fallback combination like DL\_CA\_n3A-n41C\_UL CA\_n41C and a “key fallback band combination” to determine constituent UL intra band contiguous CA within an UL inter band CA is not defined in specifications. Also there is no defined rule on how to handle a case if there are multiple key fallbacks.  **Observation 6**: From Observation 4 and 5, whichever *ue-PowerClass* for n41 or *PowerClass* for DL CA\_n3A-n41C\_UL CA\_n41C is referred to, there is an issue.  **Observation 7**: It would be reasonable to discuss this topic based on Rel-17 and onwards specifications.  **Proposal 1**: Discuss how to identify power class of UL intra band contiguous CA within UL inter band CA based on Rel-17 and onward specification.  **Observation 8**: *ue-PowerClass* for a band supported by a UE is mandatorily reported by the UE if it supports.  **Observation 9**: *ue-PowerClass* for a band is always higher or equal to power class for all the fallback configurations with the band or the UL intra band contiguous CA as UL like DL\_CA\_n3A-n41\_UL\_n41 UL or UL CA\_n41C supported by the same UE.  **Proposal 2**: From Rel-17 and onwards, *ue-PowerClass* for corresponding bands within UL inter band CA is the referenced field parameter to identify power class for each band or each UL intra band contiguous CA within the UL inter band CA like CA\_nXA-nYC unless a UE indicates power class for the band(s) or the UL intra contiguous CA(s) via *ue-PowerClassPerBandPerBC-r17*. |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions..*

### Sub-topic 3-1:

*Sub-topic description:*

*Open issues and candidate options before f2f meeting:*

**Issue 3-1-1: Any questions on Observations 1-9?**

* Recommended WF
  + TBA

Qualcomm: there was discussions in previous meetings about where to clarify this and LS to RAN2. Maintence discussion is still on-going. It is not clear from which release the clarification applies. We would like apply the change from the current release. It is better to discuss this together other papers in the next meeting.

Samsung: Share the similar view as Qualcomm. In past meeting, we only consider pure inter-band UL CA. Intra-band within inter-band CA should be treated together. We suggest to discuss it as package in the next meeting. We can submit the contribution into this LS thread.

Mediatek: actually proposal 2 is different from intra-band non-contiguous.

Huawei: We share the similar views as other companies. We also have other cases with power classes. It is better to have complete solution. For this one, we have different ideas.

Ericsson: We also agree with Qualcomm. We can discuss it next timing. For intra-band combination, the power class per CC is the same as for per band.

Apple: We are not sure if the single CC power class and for the same band with intra-band CA power class can be always the same. From signalling design point of view, we should design them separately. But the current signalling is miss. The fall back is the intra-band CA, there is not power class.

Skyworks: How is all the case PC1.5 supported in one band but PC1.5 cannot supported for intra-band CA?

Nokia: We have no problem together with others. With high power limit, power class for higher power class may be waved. There are options to resolve this. Most simple option is with power class band combination.

**Issue 3-1-2: Proposal 1: Discuss how to identify power class of UL intra band contiguous CA within UL inter band CA based on Rel-17 and onward specification.**

* Proposals
  + Option 1: agreeable
  + Option 2: not agreeable
* Recommended WF
  + TBA

**Issue 3-1-3: Proposal 2: From Rel-17 and onwards, ue-PowerClass for corresponding bands within UL inter band CA is the referenced field parameter to identify power class for each band or each UL intra band contiguous CA within the UL inter band CA like CA\_nXA-nYC unless a UE indicates power class for the band(s) or the UL intra contiguous CA(s) via ue-PowerClassPerBandPerBC-r17.**

* Proposals
  + Option 1: agreeable
  + Option 2: not agreeable
* Recommended WF
  + TBA

# Topic #4: LS to RAN5 for measurement grid based on the assumption of 6x2 for PC3

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

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2315385 | Apple, Samsung | **1. Overall Description:**  During the Rel-17 Study on enhanced test methods for FR2, RAN4 had concluded that FR2 test time can be reduced based on the optional measurement grid associated with the 4x2 array assumption, as documented in TS38.884, Clause 8.2 [1].  It is the RAN4 understanding that the PC3 measurement grids based on the 8 × 2 worst-case configuration are applied by default unless the device manufacturer explicitly declares that all antenna arrays with M × N (M ≥ N) comply with M ≤ 4 and N ≤ 2; in that case, measurement grids based on the 4 × 2 configuration can be applied to testing.  RAN4 has discussed the need to accommodate devices with antenna configurations up to M = 6 in light of the current understanding that for such devices only the worst-case (8 × 2) grid configuration is applicable. In an effort to enable test time reduction, RAN4 kindly asks RAN5 to consider defining an additional vendor declaration in 38.502-2 and measurement grids based on the 6 × 2 antenna configuration in 38.521-2 as part of the ongoing NR RF FR2 Enhanced Test Methods work in RAN5 [2].  **2. Action**  **To RAN5 group.**  ACTION: RAN4 kindly asks RAN5 to consider defining an additional vendor declaration in 38.508-2 and the measurement grids based on the 6 × 2 antenna configuration in 38.521-2. |
| R4-2316322 | Keysight Technologies, Apple | Observation 1: Augmenting the measurement grids for PC3 UEs by introducing new measurement grids for devices that, per vendor declaration, have a maximum antenna configuration of 4<*M*≤6 and *N*≤2, supports test time reductions for commonly used antenna configurations.  Proposal 1: Send an LS to RAN5 with a request for RAN5 to augment the measurement grids for PC3 UEs by introducing new measurement grids for devices that, per vendor declaration, have a maximum antenna configuration of 4<*M*≤6 and *N*≤2 |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions..*

### Sub-topic 4-1:

*Sub-topic description:*

*Open issues and candidate options before f2f meeting:*

**Issue 4-1-1: Observation 1: Augmenting the measurement grids for PC3 UEs by introducing new measurement grids for devices that, per vendor declaration, have a maximum antenna configuration of 4<M≤6 and N≤2, supports test time reductions for commonly used antenna configurations.**

* Proposals
  + Option 1: agreeable
  + Option 2: not agreeable
* Recommended WF
  + TBA

Apple: this was discussed last meeting. The agreement is to go offline and more carefully scroll out. There is also discussion paper prepared by Keysight and supported by Apple. LS is just to trigger the work in RAN5. This is necessary to have shorter test time.

Samsung: We can confirm we support this.

Qualcomm: Support it.

**Issue 4-1-2: If Observation 1 is agreeable, any comments on the LS R4-2315385**

* Proposals
  + Option 1: agreeable
  + Option 2: not agreeable
* Recommended WF
  + TBA