**3GPP TSG-RAN WG4 Meeting #94-e R4-202683**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 8.1.1

**Source: Moderator (**Ericsson)

**Title:** Email discussion summary for RAN4#94e\_#9\_NR\_unlic\_SysParameters

**Document for:** Information

# Introduction

*In the agenda item, systems parameters related issues for Rel-16 NR-U work item are discussed. The main topics under this AI are as follows:*

* *Wideband operation*
* *Band definition*
* *Intra-band operation and raster definitions*
* *Spectrum emission mask*

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

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

# Topic #1: Wideband operation

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000818 | Huawei, HiSilicon | Proposal 1: Alt.2 for 60kHz intra-carrier guardbands should be supported.  Proposal 2: The intra-carrier guardbands should be defined based on the common PRB grid and no shift is needed. |
| R4-2000981 | ZTE Corporation | Proposal 1: 25 PRBs for NR-U 20MHz carrier is mandatory without capability or IOT bit is needed.  Observation: slightly longer filter length seems necessary for 25PRB@20MHz, 60KHz SCS compared with 24PRB@20MHz, 60KHz SCS, however this is still much simpler compared with other SCS cases  Proposal 2: not to define RB shift for PRB grid alignment and leave up to the implementation. |
| R4-2001732 | FUTUREWEI | Observation 1: The proposed RB allocations for 20 MHz subchannels meet the minimum guard band sizes.  Observation 2: the proposed table does not provide guard band for some combinations with 40 MHz and some combinations with 60 MHz subchannels.  Analysis provided some corrections to the table.  Proposal 1: Table 4 provides sufficient minimum guard band for the various subchannels.  In general, a table is not needed because the base station provides the allocations.  Observation 3: It may not be necessary to capture subchannel bandwidths in the standards since the allocations are already specified. |
| R4-2000820 | Huawei, HiSilicon | Draft CR |
| R4-2000967 | Qualcomm Incorporated | Proposal 1: Adopt Alternative 1 in [1] for 60kHz SCS.  Alt.1 is also listed in the table in Section 2.1.  Proposal 2: RAN4 specifications should clearly state that requirements apply under the assumptions of using subbands that are multiples of 20MHz.  Proposal 3: Only the configurations in [1] should be used in 3GPP testing. |
| R4-2001319 | Ericsson | Proposal 1: a nominal channel raster for which minimum requirements apply is specified without a ±200 kHz shift (offset); increased adjacent interference rejection between NR-U and victims, if desired, can be achieved by increasing the guard within the restrictions already agreed by RAN4.  Proposal 2: changes to 38.101-1 in accordance with Section 3. |
| R4-2001320 | Ericsson | Draft CR |

## 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: Handling 60kHz SCS and guard band

*Sub-topic description:* NR-U spectral utilization and intra carrier guardbands have been extensively discussed in previous meetings. A WF on intra carrier guardbands was agreed in RAN4#93. The open issue is related to 60kHz SCs case only. Two options are available:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS** | **20MHz Channels** | **40MHz Channels** | | **60MHz Channels** | | **80MHz Channels** | |
| Alt. 1 60KHz | 24 | [23-5-23] | Max. 51 | [23-5-23-5-23] | Max. 79 | [23-5-23-5-23-5-23] | Max. 107 |
| Alt. 2 60KHz | [25] | [24-3-24] | Max. 51 | [24-3-25-3-24] | Max. 79 | [24-4-24-3-24-4-24] | Max. 107 |

*Open issues and candidate options before e-meeting:*

**Issue 1-1: Guardbands for 60kHz SCS**

* Proposals
  + Option 1: Adopt Alternative 1
  + Option 2: Alt.2 for 60kHz intra-carrier guardbands should be supported
* Recommended WF
  + TBA

### Sub-topic 1-2: Guardband grid and shift

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 1-2: Guardband grid and shift**

* Proposals
  + Option 1: The intra-carrier guardbands should be defined based on the common PRB grid and no shift is needed.
  + Option 2: not to define RB shift for PRB grid alignment and leave up to the implementation.
  + Option-3: a nominal channel raster for which minimum requirements apply is specified without a ±200 kHz shift (offset); increased adjacent interference rejection between NR-U and victims, if desired, can be achieved by increasing the guard within the restrictions already agreed by RAN4.
* Recommended WF
  + TBA

### Sub-topic 1-3: Testing for spectral utilization

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 1-3: Testing for spectral utilization**

* Proposals
  + Option 1:
    - Only the configurations in R4-1916160 should be used in 3GPP testing.
    - RAN4 specifications should clearly state that requirements apply under the assumptions of using subbands that are multiples of 20MHz.
* Recommended WF
  + Adopt option 1 above.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Sub topic 1.2: R4-2000981 states that filter complexity is slightly increased for higher SU. Do you expect that all UE’s should use a Hanning window for WOLA? Which requirement was checked? For example, we don’t even have agreement on ACLR yet.  R4-2001732 we think it would be simpler to limit sub-band bandwidths to be 20 MHz only. That would seem to eliminate most of the problems presented in this paper. Would that be an acceptable solution?  Sub topic 1-2: |
| Skyworks | Sub topic 1.1 issue 1.1: Skyworks supports Alt 2. based on 25RB in 20MHz for 60kHz SCS |
| Huawei | Sub-topic 1-1 issue 1.1: Huawei supports Alt 2. It have been discussed for a long time and reached the agreement on 25 RB SU (WF R4-1910388)  Sub-topic 1-2 Issue 1-2: Huawei supports Option 1 |
| ZTE | Sub-topic 1-1 issue 1.1: support Alt 2 as It has been agreed long time ago in the WF R4-1910388  Sub-topic 1-2 issue 1.2: we support not to define RB shift and regarding the common PRB grid for wide band operation is common understanding I think. The background why we mention leaving up to implementation, because point 0 can be configuredany as any value, then based on the point 0 todefine common PRB grid. |
| Nokia | Sub topic 1-2: In our view option 1 and 2 are trying to achieve the same thing. The GB RBs will for wideband operation be defined on the common PRB grid. This means there is no need for RB shift as it is the PRB grid itself which can be offset by the configuration of point A. Allowing the ±200 kHz shift (offset) of point A would enable the gNB to ensure the maximum spectral utilization. Minimization of the impact to possible adjacent victims are ensured by SEM and ACLR values. If desired, additional protection of adjacent operation can be achieved by increasing the guard within the restrictions already agreed by RAN4. Therefore, leaving the possibility of ±200 kHz shift for implementation choice would allow for the maximum spectral utilization while not compromising the possibility of protecting adjacent operation.  Sub topic 1-3: We support only testing the default GB configuration with the assumptions of using subbands that are multiples of 20MHz. |
| Futurewei | To reply to Qualcomm’s question in R4-2001732: We need to clarify how this table is used. For example, if the table were used for testing 20 MHz subchannels, it may be acceptable for establishing test conditions. However, for scheduling considerations, it is necessary to ensure sufficient intrachannel guard band on the common PRB grid for various subchannel bandwidths, not just 20 MHz. |
| Intel | Sub-topic 1-1 issue 1.1: Intel supports Alt. 2. It was agreed almost 6 month ago and by that time we believe all companies understood this issue already but reached the agreement. |
| Samsung | Sub-topic 1-1 : please note that the WF agreed on NRU spectrum utilization is in R4-1910537. And the 25PRB @60kHz SCS is conditional as below:  Spectrum utilization for single carrier operation of 20MHz case:  It is agreed to increase the number of PRBs to 25 for 20 MHZ channel bandwidth with 60 kHz SCS with the condition of relaxation on NR-U emission requirements compared with R15 NR. |
| Apple | Subtopic 1.1: We support Alternative 1 as a baseline. Alternative 2 can be contemplated further as an option because RAN4 did not agree that 25RB is a mandatory feature for the UE. As also pointed out by Samsung, relaxation of emission requirements will be needed, but it was not studied further by RAN4. Furthermore, we cannot support an approach taken by one proponent in which 25RB is mandated for band n46, and 24RB is intentionally excluded |
| ZTE2 | Wrt comment of Qualcomm on subtopic: 1-1: this is just example how GB reducation and sampling rate impacts on the window length. Here ACLR is assumed as 45dBc which could definitely meet UE ACLR. It’s expected that UE ACLR will be smaller than legacy 30dBc, then I think window length impacts will be even more reduced. We are also open to other windowing/filtering length analysis and comparsion. |

### 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** |
| R4-2001320 | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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:*   * *Most companies support option 2, thus we propose to adopt option 2.*   *Candidate options:*   * *Alt.2 for 60kHz SCS intra-carrier guardbands should be supported*   *Recommendations for 2nd round:*   * Agree on the above proposal. |
| **Sub-topic#1-2** | *Tentative agreements:*   * *There is no clear agreement on this sub-topic.*   *Candidate options:*  *All three candidate options remain:*   * + Option 1: The intra-carrier guardbands should be defined based on the common PRB grid and no shift is needed.   + Option 2: not to define RB shift for PRB grid alignment and leave up to the implementation.   + Option-3: a nominal channel raster for which minimum requirements apply is specified without a ±200 kHz shift (offset); increased adjacent interference rejection between NR-U and victims, if desired, can be achieved by increasing the guard within the restrictions already agreed by RAN4.   *Recommendations for 2nd round:*   * *Continue discussions on these options.* |
| **Sub-topic#1-3** | *Tentative agreements:*   * *There were input from few companies on this sub-topic.*   *Candidate options:*  *The candidate option remains:*   * + - *Only the configurations in R4-1916160 should be used in 3GPP testing.*     - *RAN4 specifications should clearly state that requirements apply under the assumptions of using subbands that are multiples of 20MHz.*   *Recommendations for 2nd round:*   * *If there are no opposing opinions, then we can agree on above options.* |
|  |  |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2001320 | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”*  *Discussion continues on this [note that this is a draft CR] CR, since topics related to guardband and intra-band CA BW class is still open.* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: Band definition

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001958 | Ericsson | draftCR to 38.104 on NR-U band paln in 5GHz |
| R4-2001959 | Ericsson | draftCR to 38.101-1 on introduction of band n46 |

## 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 2-1: CR for inclusion of band n46 in TS 38.104

*Sub-topic description: In the previous meetings, we have agreed on refarming band 46 for NR-U, as band n46. So, it is technically agreed, and now the relevant CR needs to be agreed for TS 38.104.*

*Open issues and candidate options before e-meeting:*

**Issue 2-1: CR for inclusion of band n46 in TS 38.104**

* Proposals
  + Based on the proposals available in R4-2001958
    - Section 5.2

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* + - Section 5.3.5







* Recommended WF
  + Propose to agree on the changes as proposed in the CR

### Sub-topic 2-2: CR for inclusion of band n46 in TS 38.101-1

*Sub-topic description: Similar to previous CR proposal, the band definition need to be introduced to the spec.*

*Open issues and candidate options before e-meeting:*

**Issue 2-2: CR for inclusion of band n46 in TS 38.101-1**

* Proposals
  + Table 5.2-1





* + Option 2: Table 5.3.5





* Recommended WF
  + Propose to agree on the changes as proposed in the CR

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Sub topic 2.2: It is premature and difficult to manage these partial draft CR’s. These draft CR’s are missing large sections of the specification needed to NR-U. Even the sub-sections within these CR’s are incomplete or incorrect. For example, this CR only introduces Band n46, but there was also an agreement to introduce 6 GHz band, at least band numbering, which is not included here. Also, these CR’s include 100 MHz channel bandwidth which has not yet been agreed to be included for Rel-16 NR-U; i.e., we don’t have SEM definition of it.  Sub topic 2-2:  ….  Others: |
| Skyworks | Sub topic 2.2: 100MHz is not agreed and requirement are missing for this channel bandwidth. For band definition should a note explicitly exclude 5350 to 5470MHz? |
| Huawei | Sub topic 2.2: 100 MHz is not agreed yet. We are ok not to introduce 6 GHz band number since the requirements cannot be finalized for Rel-16. Hence we would like to propose to capture the agreements somewhere other than the TS. |
| ZTE | Sub topic 2.2: 100MHz is not agreed yet and i think it is just mentioned in reasons and not implemented in the actual CR. |
| Ericsson | Sub topic 2.2: In the current CR drafts, we have not included 100MHz CBW, since there is no agreement yet. We have mistakenly added 100MHz in the cover sheet, this need to be corrected. The band plan definition tables do not include 100MHz CBW.  Wrt Qualcomm’s comment: We provided the CR since there are no place to initiate discussions related capturing the normative texts when an agreement is made on NR-U.  Regarding band number for 6GHz spectrum, since no requirements are in place, we do not prefer to introduce this band number in the spec yet. If needed, any such agreements can be captured in the TR.  Regarding the range 5350 to 5470MHz, we can exclude this part of the spectrum from the conformance testing. This note can be specified in RAN5 spec. At some point, we can send an LS to RAN5 to inform about this exclusion zone within the spectrum for band n46. |
| Nokia | Sub topic 2-1: As such band 46 refarming to band n46 was agreed some time ago. All agreements should be capture in one big CR according workplan and split agreed in WF R4-1902504. Draft CRs that tried to capture NR-U implementation were submitted for comments during last RAN4#92bis and RAN4#93 meetings also included this part. One of the main issues with many separate CRs/draft CRs that introduces NR-U is to have similar approach with naming (NR-U, band n46, share spectrum access etc.)  Sub topic 2-2: Similar to comments as to 38.104 specification. No need to agree separate draft CR, this should be implemented in big CR to UE 38.101-1 specification. |
| Charter Communications | Sub topic 2-1: Charter also agrees that B46 refarming to n46 was agreed some time ago. We should captured all the agreements in a big CR  Sub topic 2.2: Given Ericsson’s clarification regarding channel BW, we agree on CR to include n46 to 38.101-01 |
| Apple | 2.2: The CRs is a good starting point for adding band n46 definition into our specifications and we do not have any critical comments for its initial content. Referring to the comments from other companies, we do also agree that 100MHz channel size was not agreed, but we cannot see 100MHz channel added into the tables either. As explained by Ericsson, the CR title page (unintentionally?) mentions 100MHz.  As for 6GHz band, the corresponding RAN plenary SI was extended till December 2020 due to delays in the regulatory domain, so there is no need to add anything concerning 6GHz band at this point. It is not even clear for us why 6GHz band was raised in the scope of this discussion. |
| Nokia | Sub topic 2-1 and 2-2  We would like to note that draftCRs (bigCRs to 38.104) have already been provided from our side at RAN4#92bis and RAN#93 R4-1912331, R4-1914284, R4-1914285 and R4-1914286. The only discussion still open is the alignment of adding this to 38.104 and 38.101-1 together with the naming (NR-U, band n46, share spectrum access etc.) |
| CableLabs | Sub topic 2-2: We agree with Charter and Ericsson to include band n46 to 38.101-01.  We agree with Qualcomm to introduce a band number or numbers for the 6-GHz unlicensed band. FCC may open up the 6-GHz band as soon as March. If the band number(s) could be defined in RAN4 #94, the progress may speed up in the April meeting. The following band numbers are provisionally suggested subject to further update from FCC and ETSI/BRAN:   * n*a*: the entire 6-GHz band from 5925 to 7125 MHz * n*b*: U-NII-5 band from 5925 to 6425 MHz (Europe focus) * n*c*: U-NII-6 band from 6425 to 6525 MHz * n*d*: U-NII-7 band from 6525 to 6875 MHz * n*e*: U-NII-8 band from 6875 to 7125 MHz   where *a*, *b*, *c*, *d* and *e* are numbers to be defined. |

### 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** |
| R4-2001958 | Company A |
| Company B |
|  |
| R4-2001959 | Company A |
| Company B |
|  |

## 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:*   * *Many companies provided input indicating support for inclusion of band n46 in the spec. So, Band n46 can be included in the BS spec at this stage.*   *Candidate options:*  *For BS spec TS 38.104, there are two options:*   1. *Use Nokia’s big CR for 38.104 and include the band definitions as it is described in R4-2001958*   *Ericsson to update R4-2001958 by correcting the coversheet (removing mention of 100MHz from coverpage)Recommendations for 2nd round:*   * Discuss that “RAN4 needs a placeholder for normative text against the specifications with agreed text”. * *Discuss above two options and finalize on one of the options.* * RAN4 also need to agree how we designate this, either   + -- for operations with shared spectrum access (used in RAN1/RAN2)   + -- for operations in n46 (then with a note in the operating band table that restricts this to “operation with shared spectrum access”) |
| **Sub-topic#2-2** | *Tentative agreements:*   * *Many companies provided input indicating support for inclusion of band n46 in the spec. So, Band n46 can be included in the UE spec at this stage.*   *Candidate options:*   * *For UE spec TS 38.101-1, Ericsson to provide an updated version removing all mention of 100MHz CBW.*   *Recommendations for 2nd round:*   * *Discuss Ericsson’s updated CR* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### 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** |
| R4-2001958 | If agreed to use this draft CR, then revise it. (Alternative is to include the content in big CR for 38.104) |
| R4-2001959 | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”*  *To be revised. Note that, this is a draft CR.* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: Intra-band operation and raster definitions

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001318 | Ericsson | Proposal 1: define three new NR CA bandwidth classes to allow intra-band contiguous CA in Band n46 for all component carrier bandwidths as follows   * + - class “M”: 50 MHz ≤ BWChannel\_CA ≤ [240] MHz (3 CC)     - class “N”: 80 MHz ≤ BWChannel\_CA ≤ [320] MHz (4 CC)     - class “O”: 100 MHz ≤ BWChannel\_CA ≤ [400] MHz (5 CC)   belonging to the same fall-back group.  Proposal 2: define CA nominal channel spacings based on the agreed channel raster for all bandwidths supported in Band n46. |
| R4-20001731 | Futurewei | Proposal 1: a 38.104 CR can be based on the endorsed CR (R4-1915982) and the addition of “[Case C]” for the “SS block pattern” column in band n46.  Proposal 2: a 38.101-1 CR for the sync raster for 30 kHz SCS can be based on the TP below. |

## 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 3-1: New intra-band BW classes

*Sub-topic description: The existing bandwidth classes only allow aggregation of two 20 MHz carriers, that is, class B with an aggregated bandwidth of 20 MHz ≤ BWChannel\_CA ≤ 100 MHz, the bandwidth classes with three or more carriers are defined for larger aggregated bandwidth with component carrier bandwidth larger than 20 MHz, typically 50 MHz channel bandwidth for bands in the 3 GHz range. So, new bandwidth classes are needed to support aggregation of multiple 20MHz carriers in NR-U band.*

*Open issues and candidate options before e-meeting:*

**Issue 3-1: New intra-band BW classes**

* Proposals
  + Option 1:
    - Define three new classes as listed below:
      * class “M”: 50 MHz ≤ BWChannel\_CA ≤ [240] MHz (3 CC)
      * class “N”: 80 MHz ≤ BWChannel\_CA ≤ [320] MHz (4 CC)
      * class “O”: 100 MHz ≤ BWChannel\_CA ≤ [400] MHz (5 CC)
    - define CA nominal channel spacings based on the agreed channel raster for all bandwidths supported in Band n46.
* Recommended WF
  + Agree on these new BW classes
  + Agree on the proposal to define nominal channel spacing based on agreed channel rasters

### Sub-topic 3-2: CR for Sync raster

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 3-2:**  **CR for Sync raster**

* Proposals
  + Option 1:
    - Proposal 1: a 38.104 CR can be based on the endorsed CR (R4-1915982) and the addition of “[Case C]” for the “SS block pattern” column in band n46.
    - Proposal 2: a 38.101-1 CR for the sync raster for 30 kHz SCS can be based on the TP below.
* Recommended WF
  + For CR to TS 38.104, case C can be added in brackets.
  + Similar changes proposed for 38.101-1, can be agreed also.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Sub topic 3. 1: General requirements do not exist yet for these new bandwidth classes. Adding all of these new bandwidth classes would greatly increase the size of the bandwidth class table that applies not only to NR-U but also NR. We would prefer not to introduce all of these new bandwidth classes if another way can be found instead.  Sub topic 3-2:  ….  Others: |
| Skyworks | Sub topic 3.2.1issue 2-1: 400MHz 5CC BW class seems premature at this point (remember we have only 200MHz BW class C only for UL NR today and Wifi limits to 320MHz) also 400MHz@5.15GHz is 8% BW for UL, 320MHz is>6% |
| Huawei | Sub topic 3.2.1: when 100 MHz CBW is defined, the existing classes might be ok. |
| ZTE | Sub topic 3.2.1: it’s late to introduce BW class at this stage as requirements should be also defined. |
| Ericsson | Sub topic 3-1: These new BW classes are required to support wideband operation by carrier aggregation of 20MHz channels as per the scope of the WID. There is no risk that we will run out of letters in RAN2 for capability signaling. Also, it is not possible to modify the existing BW classes.  Regarding comment from Skyworks: we are aware that, the upper limits of the proposed BW classes are sometimes greater than the subbands. Maximum subband bandwidth is 380MHz in most regions. We can define different BCS with different aggregated CA bandwidths, to avoid defining many new BW classes.  Wrt ZTE comments: Its not too late to introduce new BW classes in an open WI since this is proposed for Rel-16. |
| Nokia | Sub topic 3-1: If we are to add these new BW classes should it not be captured in a note that these are only intended for NR-U operation.  We are not sure if this part of text from proposal 2 is needed. Channel raster points are fixed for NR-U, present in specification (agreed draftCR R4-1916167) thus this text may be redundant. To our understanding the problem which is tried solved by adding freedom to the nominal channel spacing is the alignment with other channelizations in same spectrum. This optimization of alignment is exactly what the ±200 kHz freedom to configure Point A addresses. In other words, the alignment of carriers, as in Rel.15, can already be achieved by configuration of the gNb by shifting the carrier center from the nominal position.  Sub topic 3-2: This could be included in big CR to 38.104 and does not need to be endorsed at this meeting. |
| Charter Communications | Sub topic 3-1: We agree with Ericsson that new BW classes are required to support wideband operation. Having said this, I believe Nokia’s comment of needing a note to highlight that this is for NR-U operation might be prudent. |
| Intel | Sub topic 3-1: R4-2001318 indicated 10 MHz is being considered in only 3CC, i.e., class M, and not for others. Does this mean 10 MHz will be used only for 3CC case?  It would be better to make it clear to have a note that those new BW classes are intended for NR-U and not applicable to NR. |
| Apple | Subtopic 3-1: In general, we support this intention to be able to configure 3-5 20MHz component carriers for NR-U. Before NR-U there was no strong motivation to support such a configuration because an operator would most likely consider a single CC of a larger size. With NR-U, we have no option but to be compliant with 20MHz LBT chunks. Furthermore, since we cannot assume that the wideband operation will be mandatory (for the UE and/or network), there should be a way for the operator to configure e.g. 1-5 20MHz component carriers. We are open to discuss further we add new bandwidth classes, as proposed by Ericsson, or we enable it by other means. |
| CableLabs | Sub topic 3-1: Concerning the wideband operation: the UE power is only 23 dBm or 20 dBm, therefore the power spectrum density should be as low as -3 dBm/MHz for 400MHz bandwidth. Since the coverage will be very limited, is this a realistic use case?  Concerning BW=50MHz:   * How the punctured channel algorithm would be applied to this BW (particularly concerning the 10 MHz channel)? Do we need to re-examine the SEM? * Since 802.11ax support only 20 MHz channels, as part of the bonded channels scheme, a 10 MHz channel NR-U will occupy a 20 MHz Wi-Fi channel. How is this be supported by the fairness coexistence criterion? The same applies to the coexistence with LTE LAA (20 MHz channels).   We are reluctant to support the M class (50MHz) unless further analysis is done. |

### 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** |
| R4-20001731 | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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#3-1** | *Tentative agreements:*  *Judging the companies input, the understanding is that:*   1. *The new BW classes are required to support wideband operation using 20MHz CBW carrier aggregation* 2. *These new BW classes are only applicable for NR-U operation (not for general NR operations)*   *Candidate options:*   * *Update the proposals in R4-2001318 to reflect the above comments.*   *Recommendations for 2nd round:*   * *Ericsson to draft a way forward reflecting the above comments.* |
| **Sub-topic#3-2** | *Tentative agreements:*   * *There are no opposing comments on HW CR R4-20001731*   *Candidate options:*   * *Only option is R4-20001731*   *Recommendations for 2nd round:*   * *Approve HW CR in R4-20001731* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Way forward on new intra-band CA BW classes for NR-U | Ericsson |

### 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** |
| R4-20001731 | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”*  *Agreeable as draft CR. All CRs will be approved at the completion of all parts]* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #4: Spectrum emission mask

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001306 | Nokia, Nokia Shanghai Bell | This contribution presents the agreements for the SEM as stands after the RAN#93 meeting and compares that to the basis for discussion in ETSI BRAN. As the RAN#94 meeting will be an E-meeting and no draft CRs are accepted for this topic it is suggested that how to capture the agreements presented in this document in TS are discussed and aligned such that a CR either can be issued during RAN#94-e or prepared for RAN#94bis. |
| R4-2000709 | Skyworks Solutions Inc. | Proposal on spectrum mask: the 802.11ax test procedure is adopted for 3GPP measurements and should be reflected in BRAN.  Proposal on image exception: exception at 28 dBr is confirmed to have acceptable impact to power capability [Discussed in AI 8.1.2]  Proposal on carrier leakage exception: with NRU mask measurement procedure proposed in [3] that uses 100 kHz resolution bandwidth, the exception bandwidth is reduced to 200 kHz  MPR definition of PC5: [Discussed in AI 8.1.2]   * For DFT-s-OFDM QPSK waveforms 0.5 dB additional MPR compared to single carrier operation * For CP-OFDM QPSK waveforms 1 dB additional MPR compared to single carrier operation * TBC wideband operation with interlace waveforms (the design of these should be clarified)   MPR definition for PC3: given that PC3 has 3 dB better ACLR by default, no additional MPR is needed for the wideband operation compared to single CC case [Discussed in AI 8.1.2] |

## 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 4-1: SEM measurement procedure

*Sub-topic description: Its been discussed for some time to coordinate the mask measurement procedures between 3GPP and ETSI BRAN.*

*Open issues and candidate options before e-meeting:*

**Issue 4-1: SEM measurement procedure**

* Proposals
  + Option 1: Proposal on spectrum mask: the 802.11ax test procedure is adopted for 3GPP measurements and should be reflected in BRAN.
* Recommended WF
  + Agree on the above proposal.

### Sub-topic 4-2: Capturing SEM in spec

*Sub-topic description: Many aspects of the SEM for NR-U has been agreed in RAN4#93. Now all these agreements need to be captured in the specs.*

*Open issues and candidate options before e-meeting:*

**Issue 4-2: Capturing SEM in spec**

* Proposals
  + Option 1:
  + In TS 38.104 the addition of the SEM applicable for NR-U and band n46 is proposed to be done as a subclause of *6.6.4.2.4 Basic limits for Local Area BS (Category A and B)* and additional requirements for Band n46 as subclause *6.6.4.2.5.4 Additional operating band unwanted emissions limits for Band n46*.
  + In TS 38.101-1 the addition of the SEM applicable for NR-U is proposed to be done either as a subclause to *6.5.2.3 Additional spectrum emission mask* or by adding a suffix (e.g. E) section to *6.5 Output RF spectrum emissions*.
* Recommended WF
  + [Nokia to draft a CR for 38.104 and 38.101-1 to include the SEM related requirements.]

### Sub-topic 4-3: LO leakage exception

*Sub-topic description: It was agreed in RAN4#93 [R4-1915979] that, LO leakage exception will be accommodated.*

*Open issues and candidate options before e-meeting:*

**Issue 4-3: LO leakage exception**

* Proposals
  + Option 1:
    - Proposal on image exception: exception at 28 dBr is confirmed to have acceptable impact to power capability
    - Proposal on carrier leakage exception: with NRU mask measurement procedure proposed in [3] that uses 100 kHz resolution bandwidth, the exception bandwidth is reduced to 200 kHz
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Sub topic 4.1: It is not clear what is meant by “802.11ax test procedure”. It would be more clear to state exactly what is the proposed 3GPP test procedure rather than refer to another test defined elsewhere. It is of course not possible for 3GPP to define what gets reflected by BRAN so that cannot be agreed here either.  Sub topic 4-2: R4-2001306 states that different masks might apply “for application where some of the sub-channels in a multi-channel configuration fails LBT and therefor becomes unavailable (punctured)”. In general, we need to be aware of the timing requirement for LBT and the fact that filters even digital may not be either available or may not be able to be switched quickly enough to accommodate different mask requirements. Masks should only apply to configured or scheduled allocations and even for these, there may be limitations. We don’t have a strong view on where SEM is captured, either as a separate suffix or as part of the main, but the details of the SEM requirement itself when/how ie applies may need further discussion.  Sub topic 4-3: What does “confirmed to have acceptable impact to power capability” mean? We haven’t even agreed on power class definition or MPR, so I don’t know how to interpret acceptable impact. For 200 kHz exception, we have not yet agreed to 100 kHz RBW. My understanding is that 100 kHz RBW is only applied in the 1 MHz transition from 0 to -20 dBr and everywhere else is 1 MHz. Even the 100 kHz in the 1 MHz transition was tentative.  ….  Others: |
| Skyworks | Sub topic 4.1: It is recognized that test procedure may require a more detailed and formal description. Still the method is described in the paper [3] R4-2000708. The 0dBr level is reffered to the in-band peak power in 1MHz. then the mask is applied as is with 100kHz resolution bandwidth  and a video bandwidth of 7.5 kHz  Agree that 3GPP cannot anticipate what will be decided in BRAN but it would still be of interest that test procedure is similar.  Sub topic 4-3: acceptable is described in the observations above proposal: 1dB extra MPR with worst case 28dBc image, 0.3dB for more typical 30dB image. No impact if transmitter upport image leackage compatible with 256QAM. This is obviously open for discussion if such additional MPR is acceptable to all |
| Huawei | Sub topic 4.1:  “802.11ax test procedure” is not clear  Sub topic 4.3:  What is the clarification of the exception bandwidth is reduced to 200 kHz? |
| Ericsson | Its possible to measure in 100kHz steps with integrating steps up to 1MHz. |
| Nokia | Sub topic 4-1: We agree that alignment between 3GPP and ETSI BRAN is beneficial and that same test procedure in principal should be applicable for 802.11ax and NR-U. However, we are reluctant to simply adopt a test procedure without having discussed this within 3GPP.  Sub topic 4-2: We are okay to provide draftCRs for 38.104 and 38.101-1 for discussion at the next meeting following the discussion outcome on the approach for capturing the SEM during this meeting. |
| Charter Communications | Sub topic 4.1: Charter supports option 1 and the procedure should be written in 3gpp to reflect the test procedures adopted by 802.11ax. Furthermore, we agree with the description of the method highlighted by Skyworks in R4-2000708  Sub topic 4.2: Charter is in agreement with Nokia and the draft CR’s should be written in accordance with the SEM agreements made ( including general mask agreements and special cases like lbt failures for wideband operation)  Sub topic 4.3: Charter is in agreement with option 1 proposal. |
| Skyworks | Clarification for Huawei on carrier leakage exception: if resolution bandwidth is used for the measurement like we propose, rather than needing an exception for 2MHz for the carrier leakage the exception is contained in 200kHz. The test procedure is explained in R4-2000708 |

### 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** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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#4-1** | *Tentative agreements:*  *The probable agreement is that, there is a need for alignment between 3GPP and ETSI BRAN. Probably, we can formulate the proposal as below. Besides, details of this test procedure also need to be discussed.*  *Candidate options:*   * *3GPP should have same test procedure as ETSI BRAN wrt SEM.*   *Recommendations for 2nd round:*   * *Discuss the above proposal, discuss more details on the test procedures so that all related conditions are well understood by the companies.* |
| **Sub-topic#4-2** | *Tentative agreements:*   * *Nokia tdoc R4-2001306 describes the agreements related to SEM.*   *Candidate options:*   * *Include all the options in a draft CR*   *Recommendations for 2nd round:*   * *Nokia to draft a CR for 38.104 and 38.101-1 to include the SEM related requirements.* |
| **Sub-topic#4-3** | *Tentative agreements:*   * *The discussions are still open on this.*   *Candidate options:*   * + - Proposal on image exception: exception at 28 dBr is confirmed to have acceptable impact to power capability     - Proposal on carrier leakage exception: with NRU mask measurement procedure proposed in [3] that uses 100 kHz resolution bandwidth, the exception bandwidth is reduced to 200 kHz   *Recommendations for 2nd round:*   * *Continue discussions on the above option.* |

*Suggestion on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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| **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)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |