**3GPP TSG-RAN WG4 Meeting # 104-e R4-2214107**

**Electronic Meeting, 15– 26 August 2022**

**Agenda item:** 11.1.3

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [104-e][129] FS\_NR\_eff\_BW\_util

**Document for:** Information

# Introduction

This email discussion is for FS\_NR\_eff\_BW\_util study item. The main objective of the study is on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidth. The following is the agreed agenda:

* Study on Efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths
  + General and work plan
  + Evaluation of use of larger channel bandwidths than operator licensed bandwidth
  + Evaluation of use of overlapping UE channel bandwidths
  + Overall Method Comparison

The following topics are discussed in this email thread:

Topic #1: General and TR

Topic #2: SIB1 signalling and CBW configuration

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Ericsson | Esther Sienkiewicz | [esther.sienkiewicz@ericsson.com](mailto:esther.sienkiewicz@ericsson.com) |
| Ericsson | Christian Bergljung | [christian.bergljung@ericsson.com](mailto:christian.bergljung@ericsson.com) |
| ZTE | Aijun CAO | [Cao.aijun@zte.com.cn](mailto:Cao.aijun@zte.com.cn) |
| China Telecom | Lei GAO | gaol8@chinatelecom.cn |
| CMCC (100kHz channel raster) | Chunxia Guo | guochunxia@chinamobile.com |
| Nokia | Hisashi Onozawa | [hisashi.onozawa@nokia.com](mailto:hisashi.onozawa@nokia.com) |
| T-Mobile USA | Bill Shvodian | [bill.shvodian@t-mobile.com](mailto:bill.shvodian@t-mobile.com) |
| Intel | Mark Lehne | Mark.a.Lehne@intel.com |

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)

# Topic #1: General and TR

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2212866 | Ericsson | draft TR 38.844 v0.0.9 |
| R4-2213380 | ZTE Wistron Telecom AB | TP for the signaling and configuration aspects on the next larger channel bandwidth approach  *Moderator: Companies are encouraged to provide their comments for TP in Clause 1.3.1 in Email Summary* |
| R4-2212074 | Nokia, Nokia Shanghai Bell | Observation ii: Since the contentious issues are UE-related, beginning normative work for the network side would be possible, and it might be useful even without normative work for the Ues because the overlapping UE CBWs from network perspective method does not need UE-related specification changes.  Proposal 2: If UE related open issues discussed in this document are not agreed and finalized in RAN4#104-e, discuss whether to start normative work for the network side, allowing for the overlapping UE channel BWs from network perspective method. |

## 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

*Sub-topic description: UE related open issues*

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

1. It has been proposed in R4-2212074 to consider, if the UE related open issues discussed in section 2.2.1 are not agreed and finalized in this meeting, whether to start normative work for the network side allowing for the overlapping UE channel BWs from network perspective method .

### Open issues

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We do not expect that normative work on *any* method for supporting irregular bandwidth can start before the SIB1 and UE-specific CHBW issues have been resolved (clarified). |
| ZTE | Not sure what would be the outcome of “normative work for the network side”? If it refers to CRs into specs, it seems not the way of an SI. |
| Huawei | Overlapping CA approach does not have such an issue we think. |
| Qualcomm | This is a plenary level discussion, not a RAN4 decision. It’s probably best to have a wholistic view before starting normative work. |
| Intel | It might be better to get plenary buy-off before starting additional work on network perspective |
| Apple | Overlapping channels from the network perspective does not have any impact om the UE side and/or specifications, so in that sense it can be already used by networks and it is not strictly dependent on the outcome of the SIB1 and CHBW issues. Nevertheless, our main preference is to clarify first open issues. |

## Companies views’ collection for 1st round

### 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** |
| R4-2212866 | Company A |
| Company B |
|  |
| R4-2213380 | Ericsson: we propose that this TP is treated when the SIB1/CHBW issues have been resolved. |
| ZTE: Thanks for the comments. However, this TP does not rely on discussion of SIB1/CHBW issues, just clarifying the way it is now. |
| Qualcomm: instead of “standard channel BW” it might be better to use CBW defined in the specifications or point to the table in 38.101-1 |
| Intel: We prefer to discuss this further after the SIB1/CHBW issues are resolved. For this method, as it relates to SIB1, in our view it is not necessary that the next larger CHBW must be selected during initial access. It is perhaps better to perform standard initial access with standard sized CHBW signaled in the SIB1 and then select the next larger CHBW with RRC signaling. |
| Nokia: We are against "The SIB1 DL channel bandwidth is set to the next larger channel bandwidth" because this means, unless the relevant asymmetric CBW combination is required in this operating band since Rel-15, that the SIB1 UL CBW is also the next larger CBW. During the initial access, the UE's unwanted emissions would only need to fulfil the regulatory requirements for the next larger CBW instead of for the irregular BW, i.e. for the licensed spectrum. |
| Apple: We prefer treating this TP once we clarify SIB1/CHBW issues. |

## 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** | *Candidate options:*   1. *Do not start any work until SIB1 and UE specific CBW issues are resolved* 2. *Whether any further work (outside of SIB1 and UE specific CBW) shall start is to be discussed in RAN Plenary*   *Recommendations for 2nd round: Option 2. No further discussion during 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** |
| R4-2212866 | *Agreeable* |
| R4-2213380 | *Noted* |

# Topic #2: SIB1 signalling and CBW configuration

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2211567 | China Telecom | Observation 1: The carrier bandwidth indicated by SIB1 is cell-specific UE channel bandwidth instead of BS channel bandwidth.  Proposal 1: For the case that the channel bandwidth smaller than the actual BS channel bandwidth is indicated in SIB1, it should be supported that UEs supporting wider bandwidth could be reconfigured with a UE-specific channel bandwidth wider than the one indicated in SIB1, if needed.  Proposal 2: The carrierBandwidth in SIB1 should correspond to the maximum transmission bandwidth configuration NRB defined in TS 38.101-1/2, so that UE can map it unambiguously to a regular UE channel bandwidth.  Observation 2: When UE-specific BWP is configured, UE-specific channel bandwidth provided by dedicated signaling is used by UE to set channel bandwidth in order to be able to operate in a regulatory compliant way.  Proposal 3: The UE-specific channel bandwidth indicated in dedicated signaling should correspond to the maximum transmission bandwidth configuration NRB defined in TS 38.101-1/2 so that UE can map it unambiguously to a regular UE channel bandwidth.  Proposal 4: It should be supported that the global raster of 5 kHz could be applied to UE-specific channel bandwidth. |
| R4-2212074 | Nokia, Nokia Shanghai Bell | Observation i: RAN4 should agree about whether legacy UEs can support  (a) A UE-specific CBW which goes beyond the resource grid signalled in SIB1,  (b) UL spectrum unwanted emissions during random access that are confined according to the initial UL BWP instead of the UL CBW.  (c) A CBW other than a maximum transmission BW configuration in dedicated signalling of a UE-specific CBW, and  (d) A UE-specific CBW which is not on the channel raster  Proposal 1: For each item on which consensus is achieved, it shall be clarified in a relevant 3GPP specification by a CR to solve the topic once and for all.  Observation iii: The implication of UE RX performance degradation for the larger CBW than licensed BW method is still unclear and would need to be concluded if this method was further considered in the future. |
| R4-2212145 | Intel Corporation | Observation 1: The text in TS 38.331 specifically limits the potential values for carrier bandwidth to meet RAN4 requirements only in the case of the servingCellConfig, UE specific dedicated signaling not for the case of SIB1 signaling.  Observation 2: Signaling gives separate IE fields for Carrier bandwidth and BWP bandwidth: carrier bandwidth tells the UE the channel filter size, whereas BWP tells the UE which PRBs to use. For BWP, it is possible to signal any number of PRBs less than or equal to the number of PRBs signaled for carrier bandwidth.  Proposal: To change the last bullet for agreement to: SIB1->servingCellConfigCommon is used to determine the initial channel bandwidth and location setting for UEs in a cell. servingCellConfig may be further signalled to change the channel bandwidth for a dedicated UE. |
| R4-2212148 | Qualcomm Incorporated | Observation 1: For initial access, the UE will configure itself with a channel BW that is larger or equal to the initial BWP and narrower or equal to the channel bandwidth advertised in SIB1.  Observation 2: Unless the network configures a UE with a dedicated channel BW, the network has no knowledge of the channel bandwidth employed by the UE.  Observation 3: The UE must use a channel BW from the set of channel BWs defined for that band.  Observation 4: The network can configure the UE with a dedicated channel BW which has to be from the set of defined channel BWs for that band and on a valid channel raster position. The number of RBs has to match exactly the number defined in Clause 5.3.2 of 38.101-1.  Observation 5: The channel raster signaling granularity/flexibility has no relationship with the valid channel raster positions.  Observation 6: UEs are designed and tested only based on the current channel raster.  Observation 7: There is no guarantee that UEs will work with channels that are not configured on the defined channel raster. |
| R4-2212320 | CMCC | Observation 1: according field test, neither CBW in SIB1 nor UE dedicated CBW need to be aligned with 100kHz channel raster.  Proposal 1: at least allow some exceptions that channel raster could not be aligned with SIB1 CBW nor UE dedicated CBW especially when UE dedicated CBW is not aligned with CBW in SIB1. |
| R4-2212342 | Apple | Proposal 1: Clarify further expected UE behaviour when the UE is reconfigured to the channel bandwidth larger than what indicated in SIB1.  Proposal 2a: The carrier bandwidth signalled either in SIB1 or the dedicated signalling must correspond to one of the existing carrier bandwidths as defined in TS 38.101-1.  Proposal 2b: UE RF requirements are applied based on the signalled carrier bandwidth.  Proposal 3a: For the legacy UEs the existing design is assumed that the FR1 low-frequency bands must be aligned on the 100kHz raster.  Proposal 3b: For Rel-18, it is possible to consider further enhancements that the FR1 low-frequency bands can be also SCS aligned.  Proposal 3c: It is up to the network configuration and deployment to ensure how legacy and new UEs can be configured. |
| R4-2212491 | Huawei, HiSilicon | Proposal 1: The channel bandwidth value indicated in dedicated signaling must correspond to the maximum transmission bandwidth configuration NRB defined in TS 38.101.  Proposal 2: The carrierBandwidth in SIB1 is cell-specific channel bandwidth and the number of RBs can be different to the maximum transmission bandwidth configuration NRB defined in TS 38.101 if none of UE in the network support the cell-specific channel bandwidth.  Observation: it is not clear whether legacy UE can support all channels in steps of 5 KHz |
| R4-2212778 | Ericsson | Observation 1: The carrierBandwidth indicated in SIB1 or configured in dedicated signaling by ServingCellConfigCommon by the network is the size of the resource grid of the downlink or uplink carrier used for transmitting to or receiving from UEs connected to the BS. There is one set of resource grids per transmission direction and one resource grid (size) per carrier, numerology and transmission direction following 38.211.  Observation 2: the carrierBandwidth is the transmission bandwidth configuration of the BS channel bandwidth. The minimum requirements in 38.104 for each (regular) BS channel bandwidths apply for a maximum BS transmission bandwidth configuration per SCS, but this does not prevent configuration in the field of resource grid sizes other than these maximum values used for BS conformance testing.  Observation 3: the value the carrierBandwidth in SIB1 can be set up to 275 PRB with 1 PRB granularity just like a BWP size (but in practice the carrierBandwidth would not be smaller than the maximum transmission bandwidth configuration of the 5 MHz channel bandwidth).  Observation 4: the center SC of the center PRB of the carrier resource grid, i.e. SC 0/6 of the center PRB for an even/odd-sized carrierBandwidth, must coincide with the NR-ARFCN on the channel raster for at least one SCS to enable sub-carrier/PRB alignment for support of DSS and EN-DC for migrated LTE bands.  Observation 5: the carrierBandwidth configured in the IE ServingCellConfig is only used for configuration of a UE specific channel bandwidth (MHz) with a location set by a PRB offset to Point A of the carrier. The network configures the UE specific channel bandwidth such that it contains the active BWP and within the BS transmission bandwidth configuration (the carrier resource grid).  Observation 6: the UE specific channel bandwidth does not have to be located/centred on the channel raster since the carrier resource grid is centred on the channel raster for at least one numerology as needed for E-UTRA sharing and EN-DC (sub-carrier/PRB alignment with the E-UTRA carrier). The default TX-RX separation should also apply for configured UE specific channel bandwidths such that UE minimum requirements apply.  Observation 7: a restriction that the UE specific bandwidth be located on the 100 kHz channel raster would imply that is it impossible to locate any UE channel bandwidth with an odd/even-sized maximum transmission bandwidth configuration within a wider carrier resource grid with an even/odd-sized carrierBandwidth (SIB1) for SCS = 15k, while a channel bandwidth with an even/odd-sized maximum transmission bandwidth configuration can only be located with 5 PRB granularity within this resource grid.  Observation 8: the existing specification of the nominal CA spacing can be reused for determining if a CA configuration of UE specific channel bandwidths in adjacent component carriers is contiguous or non-contiguous.  Proposal 1: make clear in the Rel-15 versions of 38.101-1, 38.101-2 and 38.104 that  • the carrierBandwidth in SIB1 (and in dedicated signaling of common parameters) is the size of the resource grid of the downlink or uplink carrier used for transmitting to or receiving from UEs connected to the BS  • the carrier grid must be on the channel raster for at least one numerology but not the UE specific channel bandwidths  • the default duplex spacing applies for UE specific channel bandwidths symmetric in the uplink and downlink  • the existing specification of nominal CA spacing is reused for determining whether a CA configuration of UE specific channel bandwidths in adjacent component carriers is contiguous.  Proposal 2: new functionality introducing significant changes such as UE-specific carrier resource grids (carriers with specific BWP allocation) in addition to the common resource grid should be introduced by new features and not by reinterpretation of existing fields/IEs. |
| R4-2212779 | Ericsson | Clarification of carrier grid and channel bandwidth mapping to the channel raster (TS 38.104)  *Moderator: Companies are encouraged to provide their comments for CRs in Clause 2.3.1 in Email Summary* |
| R4-2212782 | Ericsson | Carrier resource grid mapping to channel raster and use of UE-specific bandwidth (TS 38.101-1)  *Moderator: Companies are encouraged to provide their comments for CRs in Clause 2.3.1 in Email Summary* |
| R4-2212785 | Ericsson | Carrier resource grid mapping to channel raster and use of UE-specific bandwidth (TS 38.101-2)  *Moderator: Companies are encouraged to provide their comments for CRs in Clause 2.3.1 in Email Summary* |
| R4-2213379 | ZTE Wistron Telecom AB | Observation 1: A UE has to use a UE specific channel bandwidth to have an initial access a cell which is specified in RAN4 specs.  Observation 2: SIB1 broadcast bandwidth provides an upper limit on the UE specific channel bandwidth which a UE chooses for the initial access to the cell.  Observation 3: SIB1 broadcast bandwidth does not need to be the BS channel bandwidth, and just indicates potential range of DL BWPs placement during the initial access procedure.  Observation 4: After the initial access, the UE may be assigned with other DL BWPs outside the SIB1 bandwidth within the BS channel bandwidth.  Proposal 1: RAN4 aligns the common understanding on the SIB1 bandwidth shown in the above 4 observations.  Proposal 2: SIB1 bandwidth can be configured with any value no more than the maximum value. |

## 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

*Sub-topic description: In order to avoid any misinterpretation of the details described in company contributions, the proposals have been copied/pasted exactly from the contributions. If proponent companies believe their proposal can be merged with other proposals (i.e. there is duplicates) to help narrow down options please indicate this in the comments.*

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

**Issue 2-1: UE interpretation of CBW in SIB1**

1. Please indicate which proposals would be acceptable:
   * Proposal 1: For the case that the channel bandwidth smaller than the actual BS channel bandwidth is indicated in SIB1, it should be supported that UEs supporting wider bandwidth could be reconfigured with a UE-specific channel bandwidth wider than the one indicated in SIB1, if needed. [China Telecom, Qualcomm]
   * Proposal 2: The carrierBandwidth in SIB1 should correspond to the maximum transmission bandwidth configuration NRB defined in TS 38.101-1/2, so that UE can map it unambiguously to a regular UE channel bandwidth. [China Telecom]
   * Proposal 3: To change the last bullet for agreement to: SIB1->servingCellConfigCommon is used to determine the initial channel bandwidth and location setting for UEs in a cell. servingCellConfig may be further signalled to change the channel bandwidth for a dedicated UE. [Intel]
   * Proposal 4: Unless the network configures a UE with a dedicated channel BW, the network has no knowledge of the channel bandwidth employed by the UE. [Qualcomm]
   * Proposal 5: The carrier bandwidth signalled either in SIB1 or the dedicated signalling must correspond to one of the existing carrier bandwidths as defined in TS 38.101-1. [Apple]
   * Proposal 6: the carrierBandwidth in SIB1 (and in dedicated signaling of common parameters) is the size of the resource grid of the downlink or uplink carrier used for transmitting to or receiving from UEs connected to the BS [Ericsson]Proposal 10: SIB1 broadcast bandwidth provides an upper limit on the UE specific channel bandwidth which a UE chooses for the initial access to the cell, and does not need to be the BS channel bandwidth, and can be configured with any value no more than the maximum value. [ZTE]
   * Proposal 7: make clear in the Rel-15 versions of 38.101-1, 38.101-2 and 38.104 that the carrierBandwidth in SIB1 (and in dedicated signaling of common parameters) is the size of the resource grid of the downlink or uplink carrier used for transmitting to or receiving from UEs connected to the BS [Ericsson]
2. Recommended WF
   * TBA

**Issue 2-2: Details of UE specific CBW configuration**

* Proposals
  + Option 1: The UE-specific channel bandwidth indicated in dedicated signaling should correspond to the maximum transmission bandwidth configuration NRB defined in TS 38.101-1/2 so that UE can map it unambiguously to a regular UE channel bandwidth. [China Telecom]
  + Option 2: The channel bandwidth value indicated in dedicated signaling must correspond to the maximum transmission bandwidth configuration NRB defined in TS 38.101. [Huawei]
  + Both Option 1 and 2 are the same. Therefore, either option is acceptable.
  + Neither Option 1 or 2. Please indicate why neither Option 1 or Option 2 are agreeable.
* Recommended WF
  + TBA

**Issue 2-3: 100 kHz channel raster**

1. Proposals
   * Option 1: neither CBW in SIB1 nor UE dedicated CBW need to be aligned with 100 kHz channel raster [ CMCC, Apple]
   * Option 2: For Rel-18, it is possible to consider further enhancements that the FR1 low-frequency bands can be also SCS aligned [Apple]
   * Option 3: Unknown UE behaviour whether UEs will work with channels that are not configured on the defined channel raster [Qualcomm]
   * Option 4: global raster of 5 kHz could be applied [China Telecom]
     + Option 4a: UE vendors to confirm with legacy UEs can support Option 4. [Huawei]
   * Option 5: The channel raster signaling granularity/flexibility has no relationship with the valid channel raster positions. [Qualcomm]
   * Option 6: the carrier resource grid (SIB1) shall be on the channel raster for at least one numerology UE specific bandwidth need not be on the raster; a restriction that the UE specific bandwidth be located on the 100 kHz channel raster would imply that is it impossible to locate any UE channel bandwidth with an odd/even-sized maximum transmission bandwidth configuration within a wider carrier resource grid with an even/odd-sized carrierBandwidth (SIB1) for SCS = 15k, while a channel bandwidth with an even/odd-sized maximum transmission bandwidth configuration can only be located with 5 PRB granularity within this resource grid. [Ericsson]
   * Proposal 7: at least allow some exceptions that channel raster could not be aligned with SIB1 CBW nor UE dedicated CBW especially when UE dedicated CBW is not aligned with CBW in SIB1. [CMCC]
2. Recommended WF
   * TBA

## Companies views’ collection for 1st round

### Open issues

Issue 2-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Proposal 6/7 (the same).  The size of the carrier resource grid (SIB1) can take any value up to 275 PRB and is the same as that of the BS transmission bandwidth configuration. This size does not have to correspond to a maximum transmission bandwidth configuration in 38.104 used for BS minimum requirements.  Proposal 4 is true but related to configuration of a CHBW in dedicated signaling (not needed in case the UE channel bandwidth and location are uniquely determined by the SIB1 procedure)  Proposal 3 should be amended: together with the BWP#0 position, the SIB1 carrier bandwidth tells the UE how to select its initial channel bandwidth. The UE channel bandwidth and location can be modified by the BS in dedicated signaling (ServingCellConfig). |
| ZTE | Views on each proposal:  Proposal 1: Agree. However, a UE can be unaware of what is the actual BS channel bandwidth.  Proposal 2: Not agree. SIB1 N\_RB does not need to be in the predefined transmission bandwidth configuration. During the initial access, a UE can choose a supported channel bandwidth covering the initial BWP within the SIB1 PRBs.  Proposal 3: Agree.  Proposal 4: Agree.  Proposal 5: Not agree.  Proposal 6: Agree. The first sentence seems to be similar to Proposal 7. Note that the first statement is only for transmitting to or receiving from UEs connected to the BS during initial access only.  Proposal 7: Partly agree because it only applies to the initial access stage. And a SIB1 carrierBandwidth does not need to act as the BS channel bandwidth. |
| Huawei | We can agree on Proposal 1, proposal 4 and proposal 6 |
| Qualcomm | We agree with Proposal 1, Proposal 4 . we also agree with Proposal 10 from ZTE even though it is not clear if this proposal is up for discussion here.  Please see below some comments on the other proposals:  Proposal 2: This is not true, and the current specs allow any RB value. This is for the purpose of forward compatibility such that even UEs that do not support some channel BW could still access the network.  Proposal 3: In our understanding this is NBC and it would also create issues if the UE doesn’t support this channel bandwidth  Proposal 5: We agree with the part that the carrier bandwidth in dedicated signaling must correspond to one of the existing carrier bandwidths. for the SIB1 part, this could create forward compatibility issues.  Proposal 6. we do not agree with this proposal. the carrier BW in SIB1 is only used by the UE for initial access and as explained in our paper, the UE uses this to configure its own channel BW to a value lower or same. Different UEs in the same cell can use different channel bandwidth sizes so we do not agree that this should be the carrier grid size for all UEs. This might also be narrower than what the base station is actually using.  Proposal 7: we can only agree that the carrierBandwidth in dedicated signaling should be configured to the exact size given in the maximum transmission bandwidth table. |
| Intel | **Issue 2-1: UE interpretation of CBW in SIB1**  P1: In our view, this is already supported by the specifications.  P2: We do not see a real issue here, so there is no need for to change the existing spec to limit the carrierBandwidth signalled by SIB1. The scs-SpecificCarrierList allows flexibility to any PRB. The downlinkChannelBW-PerSCS-List is limited to the PRBs in TS 38.101-1 and TS 38.101-2 and given through dedicated signaling. This allows the UE to set its filter size. BWP is a completely separate parameter and signaled through a separate IE. BWP can set up any number of PRB operating within a CHBW fixed by TS 38.101-1 and TS 38.101-2. Different UE can be assigned different numbers of PRBs through different BWP, yet they all access the same initial PRBs signalled by SIB1. There isn’t a need for the N/W to control the size of the filter used by the UE for the PRBs signalled in SIB1.  P3: Agree.  P4: Disagree. We do not see why the N/W needs to know which CHBW filter size is used by the UE during SIB1 signaling. The N/W does know that the CHBW in terms of PRBs signaled to the UE will be used if it connects. It is up to the UE to select its own best filter from what it has available. By the time RRC configuration is performed, RACH is complete, and then the N/W has knowledge of the UE capabilities and can set the UE to implement any CHBW through dedicated signaling. There is no issue.  P5: According the current spec in TS 38.331, the CBW signaled by dedicated signaling must correspond to one of the existing carrier bandwidths as defined in TS38-101-1. The current spec does not place this requirement on CBW signaled in SIB1. There is no not a clear need to change the existing spec.  P6: Agree  P7: Agree. |
| China Telecom | Proposal 1: Agree.  Proposal 2: If CBW of any RB values in SIB1 can be supported by UE, we are fine to support that CBW configuration in SIB1 can be any number no more than the maximum value. This should be reflected on RAN4 spec to keep consistent understanding.  Proposal 3: Agree.  Proposal 4: Agree.  Proposal 6: Agree.  Proposal 7: Agree. We should make it clear in RAN4 spec that the CBW in SIB1 can take any RB values. Nevertheless, the UE-specific CBW can only be the channel bandwidth defined in 38.101-1/2. |
| Nokia | Proposal 1: Feedback from all UE vendors is needed about whether their UEs support the reconfiguration to a UE-specific channel bandwidth wider than the one indicated in SIB1 and, if not, whether the UEs reject the network's request by signalling in the UL.  Proposal 2: This doesn’t mention if SIB1CBW is the next smaller or next wider regular CBW. If it is the next wider one, we seem to have the TX spectrum issue.  If proposal 2 was right, what should a network with a 35 MHz wide cell signal in SIB1 so that Rel-15 UEs can use the cell? For a Rel-15 UE, 35 MHz is not from the set of CBWs defined in TS 38.101-1. Should a 30 MHz wide carrier be signalled, and if so, would it need to be – as the 35 MHz wide carrier – on the channel raster? In the latter case, if the lower end of the 30 MHz wide carrier signalled in SIB1 cannot be aligned with the lower end of the actually 35 MHz wide carrier because of the channel raster, would the UE-specific CBW for UEs supporting 35 MHz start below the lower end of the resource grid of the 30 MHz carrier signalled in SIB1?  Proposal 4 – would the following be a counter-example? The network configures a NR carrier with a CBW in SIB1 and an initial BWP size of 25 PRBs, respectively. Won't the network in this case know that the UE uses a CBW of 5 MHz even without configuring a UE-specific CBW?"  Proposal 5: This does not seem to align with the agreed WF, but here’s a question: Does this mean that the network is allowed to signal an existing CBW in SIB1 but a new CBW as UE-specific CBW in dedicated signalling? Or does it mean that if there is only an SIB1 signalling of the CBW, it must be an existing CBW, and if not, at least the UE-specific CBW must be an existing CBW? In the latter case, what CBW does the UE use during the initial access? What will a Rel-15 UE do in a 45 MHz cell if no UE-specific CBW is commanded, but the initial BWP is supported?  Proposal 10: UE specific channel bandwidth can be configured in connected mode by dedicated signalling. We should not confuse it with the channel bandwidth in initial access. In addition to the questionable use of "UE specific channel bandwidth" in the context of SIB1, we wonder if the range of the CBW in SIB1 has also a lower bound, namely the maximum transmission BW configuration of the narrowest CBW allowed for the respective operating band.  Proposal 6 and 7: Obviously, it does not harm if different ranges of the resource grid are used in idle and connected mode. Otherwise, the proposed dedicated signalling of a narrower UE-specific CBW than the CBW in SIB1 would not work. Hence we wonder whether all UEs need to know the base station carrier's entire resource grid size already when reading SIB1 or whether the UEs can increase the part of the resource grid on which they operate when they are signalled a larger UE-specific CBW in connected mode than the CBW signalled in SIB1. |
| Apple | Proposal 1: Agree as a principle with a clarification that the larger channel bandwidth is the one supported by the UE (and to be further checked that at least RAN4 specs are aligned with this understanding).  Proposal 2: Our understanding is that RAN2 signalling allows any number of RBs not because any RB value can be signalled, but because it provides the flexible framework when RAN4 can introduce new channel bandwidths without changing SIB1 IE encoding. However, practically speaking, that value should correspond to one of the standard channel bandwidth. Otherwise, if we assume that any value can be signalled there, then it is not even clear why we have this parameter.  Proposal 4: Disagree. This proposal effectively says that unless we re-configure a UE explicitly, we do not know which channel bandwidth is uses. In turn it means that we do not know, for instance, which A-MPR it will apply because most of them are channel bandwidth specific. |
| OPPO | Proposal 1: Ok, and agree the clarification by Apple that precondition is UE support the larger CBW though it is obvious.  Proposal 2: Not agree. SIB1 can signal any PRB numbers.  Proposal 3: Agree  Proposal 4: Agree. The description itself is true.  Proposal 5: Not agree. The carrier bandwidth signalled in SIB1 doesn’t need to be a CBW defined in RAN4.  Proposal 6: Agree.  Proposal 7: Make it clear in RAN4 spec is ok and wording can be FFS. |

Issue 2-2

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| **Company** | **Comments** |
| Ericsson | Both Option 1 and Option 2 |
| ZTE | Option 1 and Option 2 are the same. |
| Huawei | Both Option 1 and Option 2 are the same and either one is acceptable. |
| Qualcomm | Both Option 1 and Option 2 are the same in our view |
| Intel | Agree with both Option 1 and 2 as dedicated signaling for CHBW is already included in the spec TS 38.331. There is no need to change the spec. |
| China Telecom | Both Option 1 and 2 are the same. Therefore, either option is acceptable. |
| Nokia | There are operating bands for which, after Rel-15, further CBWs were added to TS 38.101-1 in later 3GPP releases. The UEs' minimum capabilities depend on the 3GPP release that they support. Neither option 1 nor option 2 explicitly address this aspect.  Further clarification is required that the UE-specific CBWs that the network may command depend in some operating bands on the UE's 3GPP release or capabilities. |
| Apple | Both options are the same. |
| OPPO | Ok with option 1 and 2. |

Issue 2-3

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| **Company** | **Comments** |
| Ericsson | Option 6.  Option 7 is not preferred. The problem of locating of UE channel bandwidths within the carrier resource grid (SIB1) for some UE implementations should be resolved, specifications should be clarified. Indeed, if some UE implementations require CHBW alignment with the 100 kHz raster, a SIB1 carrier resource grid off this 100 kHz raster as a result could lead to problems for these UEs in IDLE mode. |
| ZTE | Views on each option:  Option 1: Option 1 is similar to Option 7. SIB1 CBW does not need to be the actual BS channel bandwidth, and just act as an upper limit for a UE during initial access stage, thus SIB1 CBW does not need to be aligned with channel raster. However, a UE specific CBW should be aligned with channel raster.  Option 2: This may lead to multiple channel raster for a band.  Option 3: Agree. UE specific CBW should be aligned with channel raster.  Option 4: 5kHz just provides the superset of frequencies used by both BS and UE.  Option 5: Not sure what “the channel raster signaling granularity/flexibility” means.  Option 6: SIB1 PRB center could deviate from the raster, however, a UE specific CBW should be on raster. The restriction does exist thus it means such UE specific CBW should not be used in this case.  Option 7: Similar to Option 1. |
| Huawei | Option 4a  In our understanding, to take the advantage for BWP concept for NR, 5 KHz raster maybe already supported by UE vendors. Hence we suggest UE vendors to confirm whether legacy UE can support Option 4. |
| Qualcomm | Option 3. As of now there are no requirements/tests for any other raster positions than the one clearly stated in the tables in 101-1/2. Even if some UEs work, this cannot be guaranteed.  Related to Option 6, from a UE point of view, the channel BW configured for all SCSs have to be located on a valid raster position for the specific band.  Proposal 7 can be discussed separately based on needs. |
| Intel | **Issue 2-3: 100 kHz channel raster**  **We would like to point out that RAN directed RAN4 to pursue the SIB1 issue, but said nothing about the 100kHz channel raster issue in the RAN #96 June meeting. Thus, we should limit our discussion to further defining this issue rather than looking for solutions at this time**  Option 1. Agree: According to the current spec, neither CBW in SIB1 nor UE dedicated CBW need to be aligned with 100 kHz channel raster. These are aligned to either ARFCN or GSCN with a number of RB offset and SCS offset (kssb). However, there is the requirement that at least one numerology will be on the 100kHz channel raster  Option 2: We don’t see a need to change the specification to align FR1 low-frequency bands, as this would represent a significant change to NR and there is not clarity about the issue being addressed  Option 3: We would disagree with the statement “unknown UE behavior.” Would prefer to use the term “unsure if UE is performance compliant”. If the UEs are tested for ACLR, MPR etc on 100kHz raster to the band edge, then there may be a small difference in performance if the UE actually uses a BWP with PRBs from ARFCN or GSCN that located a fraction of an SCS (a few kHz) inset from the band edge. Fortunately, this small offset of a few kHz from the band edge typically results in better UE performance not worse, since typically, it is most difficult to get a UE to pass at the very edge of the band. We do not see this issue as significant, although it could be further studied.  Option 4: Although this may be a plausible solution, we would prefer to first quantify the magnitude problem.  Option 6: Agree  Option 7: Although this may be a plausible solution, we would prefer to first quantify the magnitude problem. |
| China Telecom | Option 4a is supported. |
| CMCC | Option 1 is supported and proposal 7 is preferred.  100MHz channel raster alignment with CBW is very important for n28 RRC reconfiguration issue as discussed in email thread [1]. RAN4 should conclude some agreements about this alignment issue.  When UE access the network, it uses SSB frequency location to find Point A and then find carrier frequency. So for NR, UE doesn’t use channel raster information. During our test of n28 RRC reconfiguration issue, it seems UE could work even when UE dedicated CBW nor CBW in SIB1 is not aligned with 100kHz channel raster. |
| Nokia | Regarding Option 1, Option 4, Option 6 and Proposal 7, which release these proposals refer to shall be clarified. We’d need consensus among all UE vendors if all legacy UEs support it.  Once UE behavior is agreed, it shall be clarified in the relevant 3GPP specifications without any ambiguity.  Regarding option 2, it is not clear if this refers to the centre frequency of the UE-specific CBW for Rel-18 UEs or to the centre frequency of the CBW in SIB1 in Rel-18 frequency bands. Changing the latter may require a finer synchronization raster.  Regarding option 6: In many cases, there is no need to command a dedicated CBW that is narrower than the CBW in SIB1. Hence the severe restrictions resulting from the difficulty to align a smaller UE-specific CBW both with the PRB grid and the channel raster do not prove that the interpretation of those is wrong who assume the channel raster to apply to the UE-specific CBW, too. |
| Apple | Option 3 is for all legacy devices.  For new Rel-18 devices we can consider something like Option 2/7, i.e. enabling more flexible raster points either on the per-band basis where it is needed or for all bands. |
| OPPO | Option 1: Agree.  Option 3: For the legacy UE the behaviour when channels that are not configured on the defined channel raster need to be confirmed at least from specification perspective.  Option 4/4a: Agree with HW comment, global raster of 5 kHz could be applied  Option 6: FFS |

### 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.*

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| **CR/TP number** | **Comments collection** |
| R4-2212779 | Qualcomm: we disagree with these changes, they are NBC. as we commented, the channel bandwidth from a UE point of view has to be on the channel raster. Also it is not clear to us that some of the terms used in the CR are clearly defined like RF channel, etc.  Also, we cannot agree a CR in a SI. |
| Intel: We agree that these changes are needed to clarify the RAN4 spec based on signaling in TS 38.331. In general, we agree with the proposal. Since RAN directed RAN4 to address the SIB1 issue, not proceed with the SI, we see addressing this SIB1 related CR as acceptable. We see these changes as a clarification based on what is already existing in TS 38.331. As long as there are no changes to signalling or operation, we can not see how these would be NBC.  In section 5.4.2.2, we see the phrases “the RF reference frequency on channel raster” and “carrier grid of the RF channel” as needing further clarification. There appears to be no consensus on how this mapping works in the case of 100kHz channel raster. Since different BWP are multiples of at least 180kHz RB (plus RB/2 if k=1) there can’t be alignment with 100kHz raster for the UE filter applied to each BWP. |
| Nokia: We appreciate the attempt to clarify the channel raster topic in the 3GPP specification, but we first need a consensus, and this includes taking the non-backward-compatibility claims into account that we received already at RAN4#103-e. |
| Apple: Procedurally, the SI cannot generate CRs to the normative specifications. On the actual changes, we need to wait for the outcome of the discussion to conclude which modifications are needed. |
| R4-2212782 | Qualcomm: we disagree with these changes, they are NBC. also, we cannot agree CRs in a SI. |
| Apple: Procedurally, the SI cannot generate CRs to the normative specifications. On the actual changes, we need to wait for the outcome of the discussion to conclude which modifications are needed. |
| Intel: We agree that these changes are needed to clarify the RAN4 spec based on signaling in TS 38.331. In general, we agree with the proposal. Since RAN directed RAN4 to address the SIB1 issue, not proceed with the SI, we see addressing this SIB1 related CR as acceptable. We see these changes as a clarification based on what is already existing in TS 38.331. As long as there are no changes to signalling or operation, we can not see how these would be NBC.  In section 5.4.2.2, we see the phrases “the RF reference frequency on channel raster” and “carrier grid of the RF channel” as needing further clarification. There appears to be no consensus on how this mapping works in the case of 100kHz channel raster. Since different BWP are multiples of at least 180kHz RB (plus RB/2 if k=1) there can’t be alignment with 100kHz raster for the UE filter applied to each BWP.  In the CA section, if the wording “CHBW shall be…” should not imply a new requirement. |
| Nokia: About subclause 5.3.1, a question is, what an NR RF carrier from the TS 38.101-1 (i.e. UE) perspective is and if its BW can be changed by dedicated signalling. Isn't it possible to e.g. narrow the CBW and thus also the UE's RF carrier to a smaller filter BW? R4-2208755 considered having 52 PRBs in the UL in SIB1 and reducing that to 25 PRBs as UE-specific UL CBW. This narrows the BW of the UE's UL RF carrier – the new CBW is rather the UE's entire UL RF carrier than only a part of it. We doubt that your introduction of 'parts' is useful from UE perspective.  About the proposed specification change in subclause 5.4:  • The term "carrier grid" is not very clear and should be avoided.  • We should first clarify if the CBW in SIB1 really must accommodate the entire resource grid. Even if the UE-specific CBW was not meant to modify a resource grid, think of a UE which need not know how large the entire resource grid is and dynamically configures what it needs based on the BWP or based on the UE-specific CBW.  • "does not have to" seems to be used in the sense of "does not need to". |
| R4-2212785 | Qualcomm: we disagree with these changes, they are NBC. also, we cannot agree CRs in a SI. |
| Intel: We agree that these changes are needed to clarify the RAN4 spec based on signaling in TS 38.331. In general, we agree with the proposal. Since RAN directed RAN4 to address the SIB1 issue, not proceed with the SI, we see addressing this SIB1 related CR as acceptable. We see these changes as a clarification based on what is already existing in TS 38.331. As long as there are no changes to signalling or operation, we can not see how these would be NBC.  In section 5.4.2.2, we see the phrases “the RF reference frequency on channel raster” and “carrier grid of the RF channel” as needing further clarification. There appears to be no consensus on how this mapping works in the case of 100kHz channel raster. Since different BWP are multiples of at least 180kHz RB (plus RB/2 if k=1) there can’t be alignment with 100kHz raster for the UE filter applied to each BWP.  In the CA section, if the wording “CHBW shall be…” should not imply a new requirement. |
| Apple: Procedurally, the SI cannot generate CRs to the normative specifications. On the actual changes, we need to wait for the outcome of the discussion to conclude which modifications are needed. |

## 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.*

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|  | **Status summary** |
| **Sub-topic#2-1**  **Issue 2-1** | *Tentative agreements: Captured from GTW August 19*  **Agreement:**   * RAN4 common understanding are   + In the current specification     - SIB1 carrierBandwidth corresponds to BS transmit bandwidth configurations, which is not mandated to be the maximum BS transmission bandwidth configuration specified in TS38.104 and can be any values in MHz.     - The dedicated channel BWP has to be configured within resource grid (refer to Clause 4.4 and Clause 4 in 38.211).       * FFS whether the resource grid can be changed by signalling such that it is different from the SIB1 carrierBandwidth     - Check how UE selects the channel bandwidth for the case when SIB carrierBandwidth is not supported by UE.       * Check it for the initial access and connected mode separately.   + In Rel-18, a new UE capability may be needed to indicate that a UE can be configured with a channel BW wider than the carrier Bandwidth in SIB1.   *Recommendations for 2nd round: Continue to discuss and clarify common understanding on current specification support relating to captured agreements in GTW.* |
| **Sub-topic#2-1**  **Issue 2-2** | *Tentative agreements: Current UE specific channel bandwidth indicated by dedicated signaling should correspond to the maximum transmission bandwidth (NRB) defined in TS 38.101-1/2.*  *Whether Rel-18 UEs may have capabilities to support dedicated signaling that corresponds other than maximum transmission bandwidth is FFS.*  *Recommendations for 2nd round: Continued discussion in second round.* |
| **Sub-topic#2-1**  **Issue 2-3** | *Tentative agreements: Captured from GTW August 19*  FFS on the following bullet:   * For the current RAN4 specification, UE dedicated channel bandwidths and BWPs do not have to be aligned with the 100 kHz raster.   *Recommendations for 2nd round: Further discussions in 2nd round on whether UE dedicated channel bandwidths and BWPs have to be aligned to 100 kHz raster.* |

### 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** |
| R4-2212779 | *Return to* |
| R4-2212782 | *Return to* |
| R4-2212785 | *Return to* |

## Discussion on 2nd round

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

### Sub-topic 3-1

*Sub-topic description: The following issues are continuation from GTW (August 19). The intention of second round is to further discuss the main topics as outcome of GTW.*

*The following is the agreements relating to this topic during GTW.*

**Agreement:**

* RAN4 common understanding are
  + In the current specification
    - SIB1 carrierBandwidth corresponds to BS transmit bandwidth configurations, which is not mandated to be the maximum BS transmission bandwidth configuration specified in TS38.104 and can be any values in MHz.
    - The dedicated channel BWP has to be configured within resource grid (refer to Clause 4.4 and Clause 4 in 38.211).
      * FFS whether the resource grid can be changed by signalling such that it is different from the SIB1 carrierBandwidth
    - Check how UE selects the channel bandwidth for the case when SIB carrierBandwidth is not supported by UE.
      * Check it for the initial access and connected mode separately.
  + In Rel-18, a new UE capability may be needed to indicate that a UE can be configured with a channel BW wider than the carrier Bandwidth in SIB1.

**Issue 3-1: Current specification relating to SIB1**

*Continue to discuss and clarify common understanding on current specification support on the 3 aspects listed below:*

1. Current specification SIB1 carrierBandwidth corresponds to BS transmit bandwidth configurations which is not mandated to be maximum BS transmission bandwidth configuration (TS 38.104). BS transmission bandwidth can be any value in MHz
2. Current specification UE dedicated channel BW must be configured within resource grid (Clause 4 and 4.4 in TS3 38.211)
   1. FFS Resource grid can be changed by signalling such that it is different from SIB1 carrierBandwidth
3. Current specification UE selects the channel bandwidth for the case when SIB1 carrierBandwidth is not supported by UE. Initial access versus connected mode operation.

**Issue 3-2: Rel-18 specification relating to SIB1**

1. For Rel-18, a new UE capability may be needed to indicate that an UE can be configured with a channel bandwidth wider than the carrierBandwidth indicated in SIB1

**Issue 3-3: UE specific channel bandwidth indicated by dedicated signalling**

*Continue to discuss and clarify common understanding on release dependent aspects:*

1. Whether Rel-18 UEs may have capabilities to support dedicated signalling that corresponds other than maximum transmission bandwidth is FFS. (Majority view after 1st round)
2. There are operating bands for which, after Rel-15, further CBWs were added to TS 38.101-1 in later 3GPP releases. The UEs' minimum capabilities depend on the 3GPP release that they support. [Nokia]

**Issue 3-4: UE specific channel bandwidth indicated by dedicated signaling**

*Captured from GTW discussions:*

FFS on the following bullet:

* For the current RAN4 specification, UE dedicated channel bandwidths and BWPs do not have to be aligned with the 100 kHz raster.

Proposal 1: Agree with above bullet.

Proposal 2: Do not agree. Please specify in which aspects the above statement captured from GTW is not correct understanding of current RAN4 specifications.

## Companies views’ collection for 2nd round

### Open issues

Issue 3-1

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| **Company** | **Comments** |
| T-Mobile USA | On the FFS resource grid, as Intel asked on the GTW session, the Point A has to stay the same, but why can’t the number of PRBs be increased beyond the initial channel BW in SIB1? |
| Huawei | For existing specification, once point A is fixed, the resource grid is determined. We are open for Rel-18. |
| ZTE | The current specs is clear. However, if RAN4 consider to introduce a resource grid different from SIB1 carrierBandwidth for a UE, we would like to understand at first what is the demand behind, why such a configurable dedicated resource grid is required. |
| Nokia | About 1.:  Since we wonder if all UEs in idle mode need to know the BS transmit BW configuration, we look forward to seeing a specification support for this statement. In the case of overlapping UE CBWs from network perspective for an irregular BW of 13 MHz, signalling a BS transmit BW configuration of 67 RBs has the disadvantage that an odd number of PRBs must be centred on the channel raster and that the 52 RBs for the 10 MHz UE-specific CBWs cannot be centered on the channel raster. To ensure that all legacy UEs operate correctly, it would be safer to configure two separate 10 MHz wide carriers in 2.7 MHz offset with separate SSBs and to signal in each SIB1 a carrierBandwidth of 52 RBs irrespective of the true BS transmit configuration. The irregular BWs of 6 MHz and 11 MHz have similar problems. Hence RAN4 should not preclude signalling the carrierBandwidth of each carrier from UE perspective although it is narrower than the BS transmit bandwidth configuration. Furthermore, the statement from the GTW is not consistent w.r.t. the unit. A maximum BS transmission bandwidth configuration (according to TS 38.104) is a number of RBs. This does not fit to "any value in MHz". Unless the signalled carrierBandwidth is a maximum transmission BW configuration in TS 38.104, it is undefined to what exact BW in MHz the signalled number of RBs corresponds.  See also our comment about issue 3-2 (second paragraph).  **Hence we suggest replacing the statement 1 by the following: "The carrierBandwidth in SIB1 can be any number of RBs between the maximum transmission BW configuration of the narrowest CBW allowed for the operating band and 275".** TS 38.331 supports this statement: Subclause 5.2.2.4.2:  2> if the UE supports a downlink channel bandwidth with a maximum transmission bandwidth configuration (see TS 38.101-1 [15] and TS 38.101-2 [39]) which  - is smaller than or equal to the *carrierBandwidth* (indicated in *downlinkConfigCommon* for the SCS of the initial downlink BWP or, for RedCap UE, of the initial downlink BWP for RedCap if configured)  Hence if the network used a carrierBandwidth smaller than the maximum transmission BW configuration of the narrowest CBW allowed for the operating band, UEs could not fulfil the quoted condition. Subclause 6.4: maxNrofPhysicalResourceBlocks INTEGER ::= 275  About 2. including 2.a.: The statement implies that the carrierBandwidth in SIB1 is the resource grid. We will appreciate seeing specification support for this assumption because we wonder if all UEs must know the entire resource grid in idle mode. |
| Intel | P1: We agree with the statement agreed in GTW. The SIB1 carrierBandwidth defines the resource grid size for the cell (TS 38.211). There is no mandate for the size to be the maximum BS transmission bandwidth. Yet the size should be of sufficient size to contain all of the planned bandwidth parts.  P2: We agree that the for the current specification, the UE dedicated carrierBandwidth must be configured within the resource grid as defined in SIB1 carrierBandwdith.  P2a: If the resource grid can be changed after initial access seems feasible from a RAN4 perspective as long a PointA stays the same, but would also need to be addressed by RAN1,2  P3: The current specification UE, during initial access reception of SIB1, the UE selects the channel bandwidth needed to support the number of PRBs signaled in in the initialDownlinkBWP. The UE does not need to support the full size of the grid, but only the size of the initialDownlinkBWP. According to TS38.331 clause 5.2.2.4.2, the UE must support a downlink channel bandwidth that “is smaller than or equal to *carrierBandwidth*”. If this is true, the UE applies a CHBW which “is wider than or equal to the bandwidth of the initial BWP”. If UE doesn’t support one of these sizes, it considers the cell as barred. Later, with dedicated signaling, the UE can be reconfigured to a different dedicated channel BWP. |
| China Telecom | P1: Agree with Nokia's modification, SIB1 carrierBandwidth must cover the initial BWP bandwidth.  P2: Based on P1, SIB1 carrierBandwidth can be equal to or smaller than BS channel bandwidth and can take any PRB number. From UE perspective, it's a real channel bandwidth for the cell. However, from BS view, it can be a virtual channel bandwidth which may be smaller than the real channel bandwidth the BS has. So why can’t the number of PRBs be increased beyond the initial channel BW in SIB1 so that UE-specific BWP can be configured? We have the same question as T-Mobile. In addition, it's not very clear to us what does resource grid exactly means? What the difference between the term " carrierBandwidth " and " resource grid"? Perhaps an example is needed to elaborate on this.  P3: We think the current process (defined in 38.331) is clear enough for initial access. For connected status, a UE-specific channel bandwidth is configured. |
| CMCC | P1: We support this proposal  P2: whether number of PRBs of resource grid can be wider than carrierbandwidth in SIB1 still not very clear. At least we see no issue to reconfigure the number of PRBs of resource grid in Rel-18.  P3: According to current spec, in idle mode, UE only needs to support the bandwidth larger than the number of PRBs in initialDownlinkBWP and smaller than carrierbandwdith. Our understanding is that what exact channel bandwidth UE selects up to UE implementation. |
| Ericsson | 2. This follows from the 38.104  For each numerology, all *UE transmission bandwidth configurations* indicated to UEs served by the BS by higher layer parameter *carrierBandwidth* defined in TS 38.331 [11] shall fall within the *BS transmission bandwidth configuration*.  SIB1 indicates the resource grid (that has a starting point and size as specified in 38.211) of the carrier for each numerology. Configuration of UE-specific CHBW was specified later (2018-12) and is *only* used for the purpose of channel bandwidth and location determination (R2-1902778). The 38.104 requires that the UE-specific CHBW must be within the BS transmission bandwidth configuration, that is, the said carrier resource grid.  The gNB configures all BWP to all UEs in the cell within the carrier resource grid. The maximum size of a BWP is 275 PRB that is also the maximum carrierBandwidth that can be indicated in SIB1. The active BWP must be within the UE-specific CHBW.  a. UE-specific resource grids configured in dedicated signaling – presumably UE-specific carriers – would require changes to 38.331 (at least)  3. During initial access the UE selects a supported channel bandwidth based on the BWP#0 and the carrierBandwidth (not necessarily corresponding to a maximum transmission bandwidth configuration of a UE CHBW) as part of the SIB1 procedure. If this bandwidth selection and the location are not unambiguous, the network configures the UE with a CHBW *and location* in dedicated signaling in connected mode according to the UE capability. |
| Apple | 3. It is not entirely clear which bandwidth a UE shall select upon initial access, which may lead to completely different UE behavior and may even result in failed compliance testing.  Let’s assume that the initial BWP is slightly smaller than 5MHz (e.g. 20RB) and the SIB1 carrier bandwidth is slightly larger than 40MHz (e.g. 220RB). Which bandwidth a UE shall apply, 5MHz because it is the next larger standard bandwidth or 40MHz because it is the next smaller standard bandwidth? Depending on the chosen bandwidth a UE will apply different RF requirements, which in turn will set applicable A-MPR values. For the UE operating at cell edge at the maximum Tx power it may lead to the situation when a particular UE implementation fails to connect. Last but not least, it may also violate regulatory and compliance requirements.  So the question is not even whether a UE can or cannot camp on the cell, but which RF requirements we need to apply in this case. |
| Nokia | We agree with China Telecom's comment that the carrierBandwidth in SIB1 must be at least as wide as the initial BWP. Taking this aspect into account results in the following proposed rephrasing:  The minimum carrierBandwidth in SIB1 is  the BW of the initial BWP or  the maximum transmission BW configuration of the narrowest CBW allowed for the operating band,  whatever is larger.  The maximum carrierBandwidth in SIB1 is 275 RBs.  To Ericsson: Can you provide a clear specification reference for your assumption that the carrierBandwidth in SIB1 must indicate the resource grid? Can't the carrierBandwidth in SIB1 indicate a part of the resource grid if the UEs do not need more BW in idle mode? |
| Intel | We prefer the original text on the SIB1 carrierBandwidth agreed in the GTW. |

Issue 3-2

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| **Company** | **Comments** |
| T-Mobile USA | From R4-2119411:  · For the overlapping CBWs from UE perspective (one cell approach):  o Is it possible to configure the UE with a dedicated carrierBandwidth in the ServingCellConfig that is wider than/partially outside the carrierBandwidth configured in SIB1?  O RAN1 response: RAN1 leaves the configuration related question for RAN2 to answer.  And from R4-2200031  · For the overlapping CBWs from UE perspective (one cell approach):  o Is it possible to configure the UE with a dedicated carrierBandwidth in the ServingCellConfig that is wider than/partially outside the carrierBandwidth configured in SIB1?  O RAN2 response: UE behaviour is not specified when the channel bandwidth configuration exceeds the frequency band borders. RAN2 thinks it is possible from signalling view to override the SIB1 channel bandwidth by the dedicated channel bandwidth signalling in RRC\_CONNECTED if the UE is capable of the dedicated channel bandwidth, and if network ensures the SIB1 channel bandwidth and dedicated channel bandwidth use the same PRB grid. RAN2 has no consensus whether a new capability is needed to support that the dedicated channel bandwidth is outside SIB1 channel bandwidth.  So, clearly RAN1 and RAN2 don’t require that the dedicated channel BW has to be contained within the SIB1 channel BW. RAN4 should assume that new capability signalling is required to allow a UE to indicate that it supports UE dedicated channel BWs that are not contained within the SIB1 cell specific channel BW. |
| Huawei | Share similar view as T-Mobile USA |
| ZTE | If such a new UE capability is introduced in Rel-18, the capability is actually not static but changed according to the SIB1 carrierBandwidth, for example, if physically a UE supports a maximum CBW as 75MHz, and SIB1 broadcasts 60MHz, then the UE should report the capability as “Yes”, however, if in another cell, the SIB1 broadcasts 80MHz, then the same UE should report the capability as “No”.  Of course, we are open to continue the discussion in Rel-18. |
| Nokia | If anyone knows about a legacy UE implementation that does not support a wider UE-specific CBW than the carrierBandwidth in SIB1, it will be good to know as it would confirm the need of a new UE capability in case the feature is desired. In the TR 38.844, sections 6.1.2.2 and 6.1.2.3, it is assumed that legacy UEs support the feature.  Furthermore, this sentence only makes sense if the BS transmit bandwidth configuration is wider than the carrierBandwidth indicated in SIB1 which means that the carrierBandwidth in SIB1 need not equal the BS transmit bandwidth configuration. |
| T-Mobile USA | To ZTE: We disagree with your point about the capability being dynamic. The UE capability would be static. If a UE supports a maximum of 75 MHz and supports carrier bandwidths that are wider than the carrierbandwidth in SIB1, if the carrier bandwidth in SIB1 is 80 MHz, then the gNB can tell that 75 MHz is the maximum bandwidth supported by the UE, so obviously it cannot support a carrier bandwidth wider than 80 MHz. 😊 |
| China Telecom | In our understanding, this issue is the same as bullet 'a' of issue 3-1. If a channel bandwidth wider than the carrierBandwidth indicated in SIB1 is configured, whether does it mean the resource grid is changed? |
| CMCC | We also think this capability is static. Network knows the supported channel bandwidth of UE, and UE can simply indicate whether it supports a wider dedicated channel bandwidth configuration other than SIB1. |
| Ericsson | The same view as T-Mobile. |

Issue 3-3

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| **Company** | **Comments** |
| ZTE | For the second point, though there could be new CBWs added in different release, however, the support of CBWs is supposed to be a release independence manner from Rel-15. |
| Nokia | In TS 38.331 V17.1.0 subclause 6.3.2, the sentence about downlinkChannelBW-PerSCS-List/uplinkChannelBW-PerSCS-List  "Network only configures channel bandwidth that corresponds to the channel bandwidth values defined in TS 38.101-1 [15] and TS 38.101-2 [39]."  should be understood as referring to   * TS 38.101-1/TS 38.101-2 of the same 3GPP release as the UE supports and the respective operating band as well as * the CBWs that the UE supports according to its reported SupportedBandwidth capability.   (The UE may support CBWs from a later release as a release independent feature and report them in its SupportedBandwidth capabilities for DL and UL, provided that the signalling for these CBWs was already introduced in the 3GPP release that the UE supports.)  The tentative agreement listed under subtopic#2-1 issue 2-2 should be revised before capturing it in the chairman's notes because more details should be provided to prevent a misinterpretation. A UE-specific CBW commanded by dedicated signalling should be chosen among   * the maximum transmission bandwidth configurations (NRB) defined in TS 38.101-1 and TS 38.101-2 for the corresponding operating band in the 3GPP release that the UE supports and * the CBWs that the UE supports according to its reported SupportedBandwidth capability. |
| Intel | P1: There may not be a need for Rel-18 UE to support CHBW other than the maximum transmission BW. Due to the flexibility of the BWP methodology, a smaller number of PRBs than the maximum number may be signaled for the active BWP which is different than the size of the UE CHBW indicated through dedicated signaling (which must be the maximum number). The existing BWP flexibility is sufficient to support the proposed irregular channel BW methods. Further adding additional flexibility in the UE CHBW indicated through dedicated signaling could be a potential improvement for supporting UEs but is not necessary for irregular BW methodologies to work.  P2: The N/W knows the UE capability before sending UE specific channel bandwidth indicated by dedicated signaling. |
| China Telecom | We think the UE-specific channel bandwidth should correspond the maximum transmission bandwidth defined in 38.101-1/2. This is the reason why UE-specific channel bandwidth is introduced. |
| Ericsson | 1. This would require a new IE for a specific purpose in 38.331 Rel-18 or later. It should not be accommodated by reinterpreting the channel bandwidth and location configuration by ServingCellConfig.  2. Release independence for existing regular channel bandwidths added to bands is related to the applicability of RF requirements, not RRC signaling (no new fields, parameters or procedures). |
| Apple | 1. UE specific channel bandwidth must correspond to the one of the values defined in TS 38.101-1 because all the RF requirements are linked to the discrete values from the specification. And since the network knows UE capabilities, it can always signal the appropriate value. |

Issue 3-4

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| **Company** | **Comments** |
| T-Mobile USA | Agree. Our understanding is that only the SIB1 channel has to align with the 100 kHz in order to ensure alignment between LTE and NR RBs. However, BWP and UE specific channel BWs use the same PRB grid and so the PRBs will also align with LTE PRBs. There is no need for BWP and UE specific carriers to align with the 100 kHz grid. If there was, the center frequency of the BWPs or UE specific carriers could only be offset by multiples of 900 kHz from the SIB1 channel center frequency. That would be an extremely limiting restriction, and was not mentioned in the CRs for UE specific channel BWs in RP-182896. |
| ZTE | (1) SIB1 carrierBandwidth can be any number of PRBs no larger than the maximum transmission bandwidth configuration corresponding to the BS channel bandwidth, i.e., it can be part of the BS channel bandwidth, so the question whether or not a SIB channel needs to be aligned with 100k channel raster is not applicable at all.  (2) The center of UE dedicated BWPs does not have to be aligned with 100k raster.  (3) UE dedicated channel bandwidth has to be aligned with 100k raster. We understand it may impose restrictions in some cases, but it is what the current specs is. |
| T-Mobile USA | To ZTE: Where is (3) documented? We could not find that in the specs. In fact, in addition to posing a restriction of the center frequency of the UE dedicated channel BW only being offset in integer multiples of 900 kHz from the channel broadcast in SIB1, it would also require that if the channel BW broadcast in SIB1 contains an even number of PRBs the dedicated UE channel BW also contain an even number of PRBs, or if the channel BW broadcast in SIB1 contains an odd number of PRBs the dedicated UE channel BW also contain an odd number of PRBs or else PRB alignment would not be possible. |
| Intel | P1: Agree with the above bullet. Only the resource grid indicated by SIB1 must be aligned to the 100kHz raster. Because the PRBs are on 180kHz spacing (for SCS=15kHz), it is not feasible for all UE dedicated channel bandwidths and BWPs to be aligned with 100kHz raster. |
| China Telecom | Agree with the bullet. |
| CMCC | Proposal 1. We support that UE dedicated channel bandwidths and BWPs do not have to be aligned with 100KHz raster. As we commented in 1st round, actually, we also do not see the necessity to align the gNB carrier with 100KHz if no co-existence with LTE is needed. Also, during our field test, no issue is observed when gNB or UE bandwidths is not aligned with 100KHz. |
| Ericsson | Proposal 1.  In the beginning (of NR), there was only one carrierBandwidth – the size of the carrier resource grid indicated in SIB1. RAN4 specified a mapping of this carrier resource grid (of the RF channel) to the channel raster in Clause 5.4.2.2 in the BS and UE specifications. For low bands this implies alignment of this grid with a 100k channel raster for at least one SCS. Configuration of UE-specific bandwidths, albeit necessary, was specified later (2018-12) to allow configuration of the CHBW location with PRB granularity just like the BWP. There is no requirement on channel raster alignment.  To ZTE: we ask for a pointer to where this is specified. An enforced alignment with the 100k would not only impose restrictions in some cases; it would break the UE-specific bandwidth and location feature and make it impossible to specify wider bandwidths in a band in some cases; one example is 20 MHz to 25 MHz that cannot both be on the 100k channel raster and PRB aligned. |
| Apple | (2) For BWP, our understanding is that it can be any number of RBs at any location within the UE carrier bandwidth, and thus it does not have to be aligned on 100kHz raster.  (3) According to sub-clause 5.4.2.3 in TS 38.101-1, the RF channel positions on the channel raster are given through the applicable NR-ARFCN points. So, our understanding is that a UE channel is on the 100kHz raster; otherwise, all tables with raster points do not have any sense. Nevertheless, we are open to discuss it further as maybe this is indeed too restrictive and not needed, which can be considered later in Rel-18. |

## Summary for 2nd round

### Open issues

GTW discussion topics:

-- Can SIB1 carrier bandwidth take any value below 275?

New wording suggested:

The minimum carrierBandwidth in SIB1 is

• the BW of the initial BWP or

• the maximum transmission BW configuration of the narrowest CBW allowed for the operating band,

whatever is larger. The maximum carrierBandwidth in SIB1 is 275 RBs. [Nokia, CT]

-- it is the carrier grid?

-- can the UE BW be allocated outside the SIB1 carrier bandwidth?

-- does the UW CHBW have to be in the 100k raster [QC, Apple and ZTE]

*Moderator tries to summarize discussion status for 2nd round.*

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|  | **Status summary** |
| **Sub-topic#3-1**  **Issue 3-1** | *Summary after 2nd round:*   1. Current specification SIB1 carrierBandwidth corresponds to BS transmit bandwidth configurations which is not mandated to be maximum BS transmission bandwidth configuration (TS 38.104). BS transmission bandwidth can be any value in MHz   Keep current wording from GTW [Intel]  Reword the statement to the follow:  The minimum carrierBandwidth in SIB1 is  • the BW of the initial BWP or  • the maximum transmission BW configuration of the narrowest CBW allowed for the operating band,  whatever is larger. The maximum carrierBandwidth in SIB1 is 275 RBs. [Nokia, CT]   1. Current specification UE dedicated channel BW must be configured within resource grid (Clause 4 and 4.4 in TS3 38.211)   Is the carrierBandwidth in SIB1 the resource gird? Would UEs need to know the entire resource grid in idle mode? [Nokia]  It is still unclear whether number of PRBs of resource grid can be wider [CMCC]  FFS Resource grid can be changed by signalling such that it is different from SIB1 carrierBandwidth  Offset to Point A is fixed the resource grid is determined [TMO, Huawei, Intel, CT, Ericsson]  Can resource grid extend beyond the initial channel bandwidth in SIB1 [CT, TMO]  SIB1 carrierBandwidth determines the resource grid [ZTE]   1. Current specification UE selects the channel bandwidth for the case when SIB1 carrierBandwidth is not supported by UE. Initial access versus connected mode operation.   During initial access reception of SIB1, the UE selects the channel bandwidth needed to support the number of PRBs signaled in in the initialDownlinkBWP [Intel]  In idle mode, UE only needs to support the bandwidth larger than the number of PRBs in initialDownlinkBWP and smaller than carrierbandwdith. Our understanding is that what exact channel bandwidth UE selects up to UE implementation. [CMCC]  During initial access the UE selects a supported channel bandwidth based on the BWP#0 and the carrierBandwidth (not necessarily corresponding to a maximum transmission bandwidth configuration of a UE CHBW) as part of the SIB1 procedure. If this bandwidth selection and the location are not unambiguous, the network configures the UE with a CHBW and location in dedicated signaling in connected mode according to the UE capability. [Ericsson]  It is not entirely clear which bandwidth a UE shall select upon initial access, which may lead to completely different UE behavior. Unclear whether a UE can or cannot camp on the cell [Apple] |
| **Sub-topic#3-1**  **Issue 3-2** | *Summary after 2nd round:*   1. For Rel-18, a new UE capability may be needed to indicate that an UE can be configured with a channel bandwidth wider than the carrierBandwidth indicated in SIB1   *Tentative agreements: It seems a consensus to study the aspect listed above for Rel-18 capability* |
| **Sub-topic#3-1**  **Issue 3-3** | *Summary after 2nd round:*   1. Whether Rel-18 UEs may have capabilities to support dedicated signalling that corresponds other than maximum transmission bandwidth is FFS. (Majority view after 1st round)   Moderator: This is same as Issue 3-2.   1. There are operating bands for which, after Rel-15, further CBWs were added to TS 38.101-1 in later 3GPP releases. The UEs' minimum capabilities depend on the 3GPP release that they support. [Nokia]   Release independence for existing regular channel bandwidths [Ericsson, Intel, ZTE] |
| **Sub-topic#3-1**  **Issue 3-4** | *Summary after 2nd round:*  FFS on the following bullet:   * For the current RAN4 specification, UE dedicated channel bandwidths and BWPs do not have to be aligned with the 100 kHz raster.   Proposal 1: Agree with above bullet. [TMO, Intel, CT, CMCC, Ericsson, Apple]  Proposal 2: Do not agree. Please specify in which aspects the above statement captured from GTW is not correct understanding of current RAN4 specifications. [ZTE] |

# 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** |
| R4-2212866 |  | draft TR 38.844 v0.0.9 | Ericsson | Agreeable |  |
| R4-2213380 |  | TP for the signaling and configuration aspects on the next larger channel bandwidth approach | ZTE Wistron Telecom AB | To be noted |  |
| R4-2212779 |  | Clarification of carrier grid and channel bandwidth mapping to the channel raster (TS 38.104) | Ericsson | Return to in 2nd round | Depending on outcome of Issue 2-1 |
| R4-2212782 |  | Carrier resource grid mapping to channel raster and use of UE-specific bandwidth (TS 38.101-1) | Ericsson | Return to in 2nd round | Depending on outcome of Issue 2-1 |
| R4-2212785 |  | Carrier resource grid mapping to channel raster and use of UE-specific bandwidth (TS 38.101-1) | Ericsson | Return to in 2nd round | Depending on outcome of Issue 2-1 |

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.
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   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents