3GPP TSG-RAN WG2 Meeting #104 R2-18xxxxx

Spokane, USA, 12 – 16 November, 2018

Agenda Item: 10.x.x.x

Source: Qualcomm Incorporated

Title: Summary of email discussion [103bis#14][NR] Channel Bandwidth Signalling (Cell Accessibility)

Document for: Discussion, Decision

# Introduction

In RAN2#103bis meeting, it was discussed how the UE determines the cell is accessible.

[R2-1814227](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_103bis/Docs/R2-1814227.zip) Channel Bandwidth Signalling Qualcomm Incorporated

- Nokia thinks this list is only use to determine where the PRB grid applies, but the UE just uses the BW from the BWP information.

- Ericsson understand that this list was added by RAN4 to be used to determine the carrier bandwidth and the value can be same or different from the BW in the BWP.

- Huawei understand that RAN4 LS asked us to indicate the channel BW to the UE and should not be per SCS. The transmission BW is per SCS.

- Ericsson under the scs-SpecificCarrierList is only for the purpose of defining the channel BW.

Agreements

1: To add UE specific field configuring RAN4 defined channel bandwidth per subcarrier spacing in ServingCellConfig.

2: To specify that the UE considers the cell is accessible if the UE supports the:

- bandwidth signalled by pdcch-ConfigSIB1 in MIB

FFS the bandwidth of at least one SCS in the scs-SpecificCarrierList in SIB1

FFS bandwidth signalled by locationAndBandwidth in SIB1

3 If the cell is not accessible according to 2 above then the UE treats the cell as barred.

The discussion was motivated by the principle of NR that the operation bandwidth in connected mode is flexible and future extensible [1]. This would mean that it is not guaranteed all UEs support the operational bandwidth the serving cell may support.

This email discussion aims to conclude on the FFS points mentioned in the chairman’s meeting notes above.

# Possible solutions

The following two possible conditions for cell accessibility check were discussed.

**Accessibility check #1:** The UE considers the cell is accessible if the UE supports the bandwidth of at least one SCS in the *scs-SpecificCarrierList* in SIB1.

[Email discussion rapporteur’s remark] This may be beneficial for the network supporting the basic BWP configuration option #1 ([R2-1810943](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_AHs/2018_07_NR/Docs/R2-1810943.zip)). The network may configure additional BWP based on the UE capability later. It should be noted however, the network cannot configure additional BWP beyond the BWP of CORESET#0 in Msg4, because the network does not exactly know which BW and SCS pair the UE supports until it receives the UE capability.

**Accessibility check #2:** The UE considers the cell is accessible if the UE supports the bandwidth signalled by *locationAndBandwidth* in SIB1.

[Email discussion rapporteur’s remark] This looks beneficial for the network supporting the basic BWP configuration option #2 ([R2-1810943](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_AHs/2018_07_NR/Docs/R2-1810943.zip)). It was already agreed in RAN2#103bis that the UE applies the configured *locationAndBandwidth* upon the reception of Msg4.

# Discussion

* 1. Accessibility check #1

Companies are asked to provide their view.

|  |  |  |
| --- | --- | --- |
| Company | Support /  Not Support | Comment |
| Nokia, Nokia Shanghai Bell | Depends | We think this is not a sufficient condition: UE needs to support at least the SCS for initial BWP.  For example, suppose cell indicates SCS= 15/30 kHz in *scs-SpecificCarrierList* and initial BWP is using 15 kHz. If UE supports only 30 kHz, it would be allowed to access the cell based on this condition but could not complete initial access. |
| Intel | Needs discussion | The CBW in terms of SCS is defined to satisfy the RAN4 requirement and we have an LS (R2-1816067) to see if there are further changes needed to this. But the information in this (the CBW in terms of SCS) is not necessarily accurate in terms of BWP deployment, meaning the actual BWPs the NW intends to use in this cell do not necessarily have the BWs as advertised here. In that sense, we think the UE can evaluate the support of SCS versions alone, and if the UE supports atleast one of them without consideration of the BW, the UE proceeds with reading other SIB1 params. Only if the UE does not support any of the SCS, the UE can consider this cell as not accessible (which is also unlikely, as most of the SCS are to be supported mandatorily by the UE).  We are not quite sure how to use this parameter otherwise. For carriers which are considered as forbidden by an UE (Forbidden PLMN) while the MIB indicates that SIB1 is valid, the UE does not have any assistance from the NW to inform the UE how wide this carrier is, and CBW can help here (as MIB does not inform the next valid SSB location), but we need to have an agreement in RAN2 (or involve RAN4?) that the CBW then just provides the complete channel BW of the carrier, in terms of SCS. In such a case, this parameter is not really useful for cell accessibility checks in terms of SCS+BW. |
| Huawei, HiSilicon | Depends on RAN4 response | The usage of the parameter carrierBandwidth configured in scs-SpecificCarrierList in SIB1is indeed confusing. It is being used in TS 38.211, but seems that the only use case is to clarify that the bandwidth configured for a BWP should not exceed the carrierBandwidth (i.e. transmission bandwidth as defined by RAN4). But in this case it does not need a signaling and can be up to network implementation to guarantee this. If this is the only use case for this parameter, cell accessibility check does not need to consider it, as anyway the network can configure a proper bandwidth for the configured BWP based on UE capability.  In the last meeting, some companies thought that carrierBandwidth is to indicate the channel bandwidth defined by RAN4, that means that there would be a mapping between the configured carrierBandwidth in PRBs to the RAN4 defined channel bandwidth in MHz. This understanding is also confusing to me, as in this case the carrier bandwidth does not have to be SCS specific. We already asked RAN4 if there is such mapping. If that is the case, whether cell accessibility check needs to consider this parameter depends on how the UE uses the channel bandwidth derived from the carrierBandwidth. If the usage is like what Intel mentioned, then we agreed that it is not useful for cell accessibility check.  If it is for the UE to decide where to place its RF, then we may need further understand whether the UE can place its RF based on the configured/activated BWPs.  On the other hand, it is possible RAN4 may tell us carrierBandwidth should also be configured in UE specific manner. In that case, the network can also configure this bandwidth based on the UE capability, and then cell accessibilty check does not need this as an input. |
| Qualcomm Incorporated |  | We tend to agree with other companies that the usage of carrierBandwidth configured in scs-SpecificCarrierList in SIB1 is not entirely clear in the current specifications. It may not be clear how the network should set the values in SIB1.  One simple approach could be to not use this parameter at all for cell accessibility check. The UE accessing the cell supports at least the SCS and the bandwidth of CORESET#0, which can be used to configure the additional configured BWP at Msg4 in case of the OPTION#1 operation. The network can further reconfigure the configured BWP in Msg6 once the UE capability is available. |
| NTT DOCOMO |  | Given the current situation that meaning of carrierBandwidth in scs-SpecificCarrierList is not clear, Qualcomm proposal sounds reasonable. |
| Ericsson | Not support  /  Depends on RAN4 response | As Huawei said, it is currently unclear how the UE uses the bandwidth configured in the SCS-SpecificCarrier.  The parameter might only inform the UE about the total width of this serving cell which may be wider than the width of the BWP(s) that the UE is meant to operate in.  If this is the case, a UE would actually be able to operate in the cell even if the indicated SCS-SpecificCarrier is wider than the maximum bandwidth supported by the carrier. And in this case, RAN2 should not make cell selection and access barring dependent on this field. |
| OPPO |  | carrierBandwidth is not needed as an input when UE checking cell accessibility. Tend to agree that current carrierBandwidth in SCS-SpecificCarrier is not clear. We also think it may be a simple way for the UE to check whether at least the SCS and the bandwidth of CORESET#0 is supported or not when access the cell. |
| ZTE | Not support  /  Depends on RAN4 response | We share the same view with Ericsson. In our understanding, the scs-SpecificCarrierList in SIB1 is used to define the PRB grid for different SCSs, but as commented by other companies, it is not entirely clear how to set the values in SIB1(especially, the carrierBandwidth field).  Considering UE is operating on specific BWPs, we prefer not to use this parameter for cell accessibility check. |
| LG | Not support | My understanding is that the carrierBandwidth in SIB1 is system bandwidth per SCS. Though an NR UE doesn’t support the system bandwidth of an NR cell, the UE is able to access the cell. The bandwidth part and IOT bit have been introduced to support it. So if my understanding is right, UE should not use this parameter when it check the cell accessibility. |

**[Rapporteur’s summary]**

Most companies indicated that the use case of channel bandwidths as signaled in *scs-SpecificCarrierList* in SIB1 is not clear. There are views expressed that RAN4 response to the RAN2 LS ([R2-1816067](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_103bis/Docs/R2-1816067.zip)) may provide some clarification. At this stage, it seems clear that the RAN2 should not consider this parameter to be used by the UE for cell accessibility check.

There was one comment that the UE can access the cell only if the UE supports the SCS of the initial BWP. This seems to be sufficiently clear in rapporteur’s view, but it can be confirmed explicitly in the conclusion of this email discussion.

* 1. Accessibility check #2

Companies are asked to provide their view.

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| Company | Support /  Not Support | Comment |
| Nokia, Nokia Shanghai Bell | Support | We think this is the minimum condition required for UE to camp on the cell. UE needs to support the SIB1 configuration (especially the UL BWP) for completing initial access. |
| Intel | Not support | To start with, for all idle mode operations, where the UE uses common search space (CSS) for paging/SI reception etc., RAN1 has already restricted that the CORESET#0 or common CORESET should be confined to CORESET#0 BW. So only when the UE is in connected mode ‘after initial access’ the NW can schedule PDSCH/PDCCH resources outside the CORESET#0 (and hence use the expanded SIB1 BW).  So it is still possible for the NW to get the UE capability to understand the BW the UE supports (for the SCS of initial BW), and then it’s a question of whether the NW has any BWPs that can satisfy the UE BW. So it is still possible for the UEs which do not support the SIB1 configured BW, to operate in the cell.  In addition, even though we require that the MIB defined CORESET#0 (max 96 PRBs) should be less than the UE minimum BW, and that UE has to mandatorily support certain BWs in non-CA mode (even ignoring the IOT bits for BW support), the SIB1 configured BWs allow higher values than 96 PRBs!  And in cases where the UE cannot support certain BWs in CA (while supporting in nonCA), the NW may have to reduce the BW of the PCell when configuring CA to the UE, and this might be lower BW than the BW of the initial BWP of SIB1.  Another concern we have is, if we agree in rel-15 that UEs bar cells where the SIB1 BW is not supported, if later on RAN4 introduces lower BW support for certain UEs (in later releases or rel-15 itself), we may have incompatibility problems if the NWs assume that all the UEs that RACH on the cell can support the SIB1 configured BW (and not through the UE capability).  On the other hand, we do understand that it the SIB1 had configured certain BW for initial BWP, that would likely be the minimum BW the NW intends to use for initial BWP, and so may not have other BWPs smaller than this. But in such a case, the NWs have to ensure that this BW is something all UEs should support ( which may include roaming UEs with IOT bit for capability). 96 PRBs would be a better choice, as all UEs are expected to support this BW, but in such a case SIB1 does not have to re-configure the BW anyway ☺..!  Since this is initial access, we have to be careful with backwards compatibility for any agreement we make. |
| Huawei, HiSilicon | Not support | As agreed before, all idle UEs should be able to camp on a cell if the cell is not explicitly barred, as all the downlink transmissions for the idle mode operation are restricted in the bandwidth of CORESET#0 before and during initial access. We did not pay too much attention on the UL transmission during initial access (i.e. Msg3), but it should be a straightforward principle that the initial UL BWP should be configured with a bandwidth mandatorily supported by all UEs, like CORESET#0 bandwidth. After initial access, the bandwidth can be configured according to the network choice (option-1/2) and UE capabilities. |
| Qualcomm Incorporated | Support | This is essential part in the OPTION#2 operation, and it does not make sense to limit the bandwidth of *locationAndBandwidth* to the values that are allowed for CORESET#0. |
| NTT DOCOMO | **Support** | I understand that the proposal is applied for both UL and DL. Unless the UE supports locationAndBandwidth broadcast for both UL and DL, the UE cannot access to the cell. |
| Ericsson | Support | As Nokia, QC and DCM said, the UE must support the width of the initial BWP indicated in SIB1-> locationAndBandwidth: All USS transmissions from Msg5 use the bandwidth of the initial BWP. And the width of the initial BWP is given (for all UEs) in SIB1.  If we later want to allow for narrow-band UEs, we would have to configure such serving cells with “initial BWP option 1”, i.e., make CORESET#0 and initial-BWP sufficiently narrow for all UEs (e.g. 24 PRBs) and configure subsequently additional BWPs in accordance with the UEs’ capabilities. |
| OPPO | Support | Similar view as above, UE has to support the width of the bandwidth indicated by locationAndBandwidth. |
| ZTE | Support  (but no need for any additional barring check mechanism) | As agreed in RAN plenary, for single connected NR UEs, the bandwidths(which marked as “Yes”) listed in TS38.101-1 Table5.3.5-1 shall be mandatory supported by UE(when supporting the corresponding band). In this case, for a specific frequency, network is able to know the maximum supported bandwidth of all UEs, then for OPTION#2 operation, the network can make sure the bandwidth of initial DL/UL in SIB1 will not be beyond UE’s capability.  For CA case, we think network may have to reconfigure the BW of initialBWP due to some UE cannot support certain BWs in CA.  For initial access, at least for now, we do not see much necessity to define a new ”barring checking” mechanism for this. Instead, the field description in TS38.331 can be updated, to say that NW has to make sure the configured BW in SIB1 should be less than or equal to the BWs listed inTS38.101-1 Table5.3.5-1. |
| LG | Not support | If UE doesn’t support locationAndBandwidth, the UE cannot access to the cell. So if this case happens, the UE have to bar the cell. However, I wonder if network really will set locationAndBandwidth to larger value than the maximum bandwidth that all UE support.  I think such a configuration should not be allowed, i.e. locationAndBandwidth should be less than or equal to the maximum bandwidth that all UE mandatorily support, and UE doesn’t need to consider the locationAndBandwidth when it decide whether the cell is accessible or not. |

**[Rapporteur’s summary]**

6 companies supported this cell accessibility check. 3 companies indicated that the *locationAndBandwidth* of the initial BWP should indicate a bandwidth that all UEs are supposed to support, e.g. one of configurable BWs of CORESET#0. The rapporteur observes however that this limitation almost kills the purpose of the basic BWP configuration option #2, because the initial BWP is the only BWP in use and the *locationAndBandwidth* of the initial BWP can not be reconfigured as UE specific parameter later.

Clear preference was seen to not define any cell barring behavior out of the cell accessibility check. Indeed, after the clarification in RAN2#103bis meeting that the UE shall take the *locationAndBandwidth* of the initial BWP into use upon Msg4 reception ([R2-1815842](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_103bis/Docs/R2-1815842.zip)), one can observe that it is sufficiently clear that the UE shall support the configuration for the initial access. This is generic to any parameter of the same property. It could be left to UE implementation how the UE behaves when the UE does not support a configuration parameter essential for the initial access.

* 1. Other solution / Additional comment

Companies are asked to provide other solution, if any.

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| --- | --- |
| Company | Comment |
|  |  |

**[Rapporteur’s summary]**

No other solution or additional comment was provided.

# Conclusion

Based on this email discussion and additional observations, the email discussion rapporteur suggests that RAN2 agree on the following proposals.

**Proposal 1:** The UE shall not consider the parameters of subcarrier spacing and channel bandwidth as signaled in *scs-SpecificCarrierList* in SIB1 for determining if the cell is accessible.

**Proposal 2:** The UE considers the cell is accessible only when the UE supports the bandwidth of the initial BWP (*locationAndBandwidth* in SIB1).

**Proposal 3:** RAN2 to confirm it is sufficiently clear in the current specification what configuration parameters the UE shall take into use during the initial access (e.g. subcarrier spacing of RMSI in MIB, bandwidth of the initial BWP in SIB1).

**Proposal 4:** The UE behavior when the UE does not support a configuration parameter used during the initial access is left to UE implementation, and there is no need to specify the UE behavior for cell accessibility check (e.g. cell barring).

**Proposal 5:** RAN2 to revisit the handling of the cell-specific parameters of subcarrier spacing and channel bandwidth as signaled in *scs-SpecificCarrierList* in SIB1 after they receive RAN4 response to the RAN2 LS in [R2-1816067](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_103bis/Docs/R2-1816067.zip) [2].

# Reference

[1] [R2-1813541](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_103bis/Docs/R2-1813541.zip) LS on RAN4 design on channel bandwidth (R4-1811905) RAN4

[2] [R2-1816067](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_103bis/Docs/R2-1816067.zip) Reply LS on RAN4 design on channel bandwidth RAN2