3GPP TSG RAN WG1 #106bis-e R1-210xxxx

e-Meeting, October 11 - 19, 2021

**Agenda item: 5**

**Source: Moderator (Nokia)**

**Title:** **[106bis-e-AI5-LSs-01] Moderator summary**

**WI: FS\_NR\_eff\_BW\_util**

**Document for: Discussion and Decision**

# 1 Introduction

This document is facilitating the RAN1#106bis-e email discussion [106bis-e-AI5-LSs-01] Discuss incoming LS on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths for a possible reply LS by October 18. The discussion thread is related to an LS from RAN4 in [R1-2108700/R4-2114751](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106b-e/Docs/R1-2108700.zip)

The following set of documents were identified as relevant to this discussion:

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| **TDoc** | **Title** | **Source** |
| [**R1-2108700**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2108700.zip) | LS on specification impact for methods on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths | RAN4, Nokia |
| [**R1-2108948**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2108948.zip) | Discussion on RAN4 LS regarding methods on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths | vivo |
| [**R1-2109027**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2109027.zip) | Discussion on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths | ZTE |
| [**R1-2109028**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2109028.zip) | [DRAFT] Reply LS on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths | ZTE |
| [**R1-2110010**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2110010.zip) | Discussion on RAN4 LS on irregular channel bandwidths | Apple |
| [**R1-2110011**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2110011.zip) | Draft Reply to RAN4 LS on irregular channel bandwidths | Apple |
| [**R1-2110296**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2110296.zip) | DRAFT LS on specification impact for methods on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths | Nokia, Nokia Shanghai Bell |
| [**R1-2110304**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2110304.zip) | On efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths | Ericsson |
| [**R1-2110336**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_106b-e/Docs/R1-2110336.zip) | [Draft] Reply LS on synchronous operation between Uu and SL in TDD band | Ericsson |

# 2 RAN4 LS questions to RAN1 and RAN2

The RAN4 LS posed the following questions to RAN1

RAN4 is currently studying four methods [1] on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths. One of the Study Item objectives is to evaluate and minimize the impact to RAN1 and RAN2.

RAN4 respectfully requests to provide information if each studied method is compatible with RAN1/RAN2 specifications and in particular to clarify/confirm the following aspects:

* For the wider CBW:
	+ clarify if there is any limitation for the UL carrier positions (not just BWP positions) legacy UEs support for uplinkChannelBW-PerSCS-List and scs-SpecificCarrierList in symmetric operating bands with a fixed duplex distance and asymmetric UL/DL channel bandwidth.
	+ confirm UE behaviour if it is possible to configure a carrier that is not fully contained in the NR band, i.e. the carrier can extend beyond the low edge of the band and/or the high edge of the band?
* For the overlapping CBWs from network perspective (one cell approach):
	+ clarify whether a single SSB and CORESET (e.g. for cases where irregular BWs >10 MHz where a 4.28 MHz wide initial BWP can be in the common frequency range), can be used to configure UEs with different channel BWs on different parts of the BS channel.
	+ clarify whether two time staggered SSBs and CORESET#0 on the same frequency (when the frequency separation is not enough to send them simultaneously at the same time and thus time staggering is needed) are supported in RAN1/2 specifications so that UEs configured with left and right channels of the next smaller regular size can track their own time staggered SSB and CORESET#0.
* For the overlapping CBWs from UE perspective (two cell approach / CA approach):
	+ if two different Bandwidth Parts for the UE are overlapping, and both contain a subset of CSI-RS resources that are mapped to the same subset of overlapping RBs for the same UE, please clarify how does UE report CSI for the overlapped part, e.g. does UE report CSI for each cell separately, or just once for the overlapping part, or something else?
	+ clarify how PDCCH reception in overlapped CA when PCell and SCell PDCCH resources partially overlap and whether there are any impacts to cross-carrier scheduling
* For the overlapping CBWs from UE perspective (one cell approach):
	+ 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?
	+ Clarify for equalization purposes in the DL, does the BS need to know the split between the subset of PRBs from a main RF carrier versus PRBs from an additional RF carrier are received on different channel/antenna before combining. If pre-coding assumes all PRBs experience the same channel/antenna, is signalling required so that BS pre-coding can account for the path differences of main carrier PRBs and additional carrier PRBs.

# 3 Reply LS drafting

## 3.1 For the wider CBW

**RAN4 question:**

* For the wider CBW:
	+ clarify if there is any limitation for the UL carrier positions (not just BWP positions) legacy UEs support for *uplinkChannelBW-PerSCS-List* and *scs-SpecificCarrierList* in symmetric operating bands with a fixed duplex distance and asymmetric UL/DL channel bandwidth.
	+ confirm UE behaviour if it is possible to configure a carrier that is not fully contained in the NR band, i.e. the carrier can extend beyond the low edge of the band and/or the high edge of the band?

### 3.1.1 Round #1

**Proposed RAN1 reply:**

* RAN1 specifications require placing the BWP within the *carrierBandwidth* of the *scs-SpecificCarrier*, a BWP cannot extend outside the configured *carrierBandwidth*.
* RAN1 specifications do not place any limitations on the frequency location of the *scs-SpecificCarrier.*

**Comments on the proposal:**

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| **Company** | **Comment** |
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## 3.2 For the overlapping CBWs from network perspective (one cell approach)

**RAN4 question:**

* For the overlapping CBWs from network perspective (one cell approach):
	+ clarify whether a single SSB and CORESET (e.g. for cases where irregular BWs >10 MHz where a 4.28 MHz wide initial BWP can be in the common frequency range), can be used to configure UEs with different channel BWs on different parts of the BS channel.
	+ clarify whether two time staggered SSBs and CORESET#0 on the same frequency (when the frequency separation is not enough to send them simultaneously at the same time and thus time staggering is needed) are supported in RAN1/2 specifications so that UEs configured with left and right channels of the next smaller regular size can track their own time staggered SSB and CORESET#0.

### 3.2.1 Round #1

**Proposed RAN1 reply:**

* In idle mode, all UEs “camp” on the same initial BWP. Once connected, each UE can be configured to different parts of the carrier using a dedicated BWP. A single SSB is enough if a SSB position can be found that allows two UEs placed at either end of the frequency allocation and still receive the SSB within their respective dedicated BWPs.
* RAN1 specifications allow for configuring staggered SSBs and CORESET#0s on the same frequency so that UEs configured with left and right channels of the next smaller regular size can track their own time staggered SSB and CORESET#0.

**Comments on the proposal:**

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## 3.3 For the overlapping CBWs from UE perspective (two cell approach / CA approach)

**RAN4 question:**

For the overlapping CBWs from UE perspective (two cell approach / CA approach):

* + if two different Bandwidth Parts for the UE are overlapping, and both contain a subset of CSI-RS resources that are mapped to the same subset of overlapping RBs for the same UE, please clarify how does UE report CSI for the overlapped part, e.g. does UE report CSI for each cell separately, or just once for the overlapping part, or something else?
	+ clarify how PDCCH reception in overlapped CA when PCell and SCell PDCCH resources partially overlap and whether there are any impacts to cross-carrier scheduling

### 3.3.1 Round #1

**Proposed RAN1 reply:**

* RAN1 specification do not prevent configuring overlapping carriers for CA for a single UE. In case of CA, the CSI-RS measurement and reporting for the component carriers are performed independently per-carrier and PDCCH monitoring are also performed independently for each component carrier.
* gNB scheduler is responsible for avoiding collisions of different transmissions in general, this would be the case with overlapped CA as well.
* There is no impact to cross-carrier scheduling

**Comments on the proposal:**

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| **Company** | **Comment** |
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## 3.4 For the overlapping CBWs from UE perspective (one cell approach):

**RAN4 question:**

* For the overlapping CBWs from UE perspective (one cell approach):
	+ 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?
	+ Clarify for equalization purposes in the DL, does the BS need to know the split between the subset of PRBs from a main RF carrier versus PRBs from an additional RF carrier are received on different channel/antenna before combining. If pre-coding assumes all PRBs experience the same channel/antenna, is signalling required so that BS pre-coding can account for the path differences of main carrier PRBs and additional carrier PRBs.

### 3.4.1 Round #1

**Proposed RAN1 reply:**

* RAN1 specifications are agnostic to the message in which the *carrierBandwidth* is provided, but it is RAN1 understanding that TS 38.331 prevents configuring the UE with a dedicated *carrierBandwidth* in the *ServingCellConfig* that is wider than/partially outside the *carrierBandwidth* configured in SIB1.
* There is no need for the transmitter to know if there is a frequency discontinuity point within the carrier in the receiver implementation, this will need to be accounted for in the receiver implementation so that channel estimate is not interpolated across the discontinuity.

**Comments on the proposal:**

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| **Company** | **Comment** |
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