**3GPP TSG RAN WG1 #106bis-e R1-21xxxxx**

**e-Meeting, October 11th – 19th, 2021**

**Title:** [DRAFT] ReplyLS on specification impact for methods on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths

**Response to:** [R1-2108700/R4-2114751](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106b-e/Docs/R1-2108700.zip)

**Release:** Rel-17

**Study Item:** FS\_NR\_eff\_BW\_util

**Source:** Nokia [RAN1]

**To:** RAN4, RAN2

**Cc:**

**Contact Person:**

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**Attachments**: N/A

**1. Overall Description:**

RAN1 would like to thank RAN4 on the LS to RAN1 and RAN2 on LS on specification impact for methods on efficient utilization of licensed spectrum that is not aligned with existing NR channel bandwidths in [R1-2108700/R4-2114751](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_106b-e/Docs/R1-2108700.zip)

RAN1 discussed the questions in the LS and would like to provide the following responses to the RAN4 questions:

* 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.
  + RAN1 response: RAN1 specifications do not place any limitations to this for FDD bands as RAN1 specifications are agnostic to the definitions of operating bands, bandwidths and duplex distances while for TDD bands RAN1 requires that the active UL and DL BWP pair must have the same center frequency. It is RAN1 understanding that RAN2 capability and configuration signalling and RAN4 band, duplex and bandwidth definitions place restrictions to carrier positions.
  + 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?
  + RAN1 response: if it were possible to configure a UE with a carrier that is not fully contained in the NR band, RAN1 specifications would be compatible with such a configuration (ref the answer to the previous question). However, it is RAN1 understanding that such a capability cannot be indicated by the UE (RAN2 to confirm) and a UE configured to do something it did not indicate being capable of cannot be assumed to follow the configuration. Hence, according to RAN1 understanding of RAN2 and RAN4 specifications, such a configuration is not possible.
* 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.
  + **RAN1 response**: In idle mode and inactive state, 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, obviously as long as the configuration on each cell in this “one cell” approach is configured in compliance with the RAN1/2/4 specifications.
  + 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.
  + **RAN1 response:** 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.
* 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
* RAN1 response:
  + RAN1 specification do not restrict configuring overlapping carriers for CA for a single UE. However, RAN1 would like to note that in Rel-15/16 RAN1 did not discuss UE capabilities for overlapped CA in Rel-15/16, and it is RAN1 understanding that RAN2-specified UE capability signalling does not provide any possibility for UE to indicate support for overlapped CA.
  + In case of CA, the CSI-RS measurement and reporting for the component carriers are specified in TS38.213 to be performed independently per-carrier and PDCCH monitoring are also specified in TS38.213 to be performed independently for each component carrier.
  + gNB scheduler is responsible for avoiding collisions of different transmissions as a network restriction for the overlapping part with overlapped CA including cross-carrier scheduling as well.
  + RAN1 would like to note that overlapped CA configuration case has not been considered in RAN1 and the UE capabilities agreed in RAN1 for Rel-15/16 were not designed to be able to indicate UE’s support for overlapped CA configuration.
* 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?
  + RAN1 response: RAN1 leaves the configuration related question for RAN2 to answer.
  + 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.
  + RAN1 response: RAN1 has not evaluated, nor plans to evaluate the need for the gNB to know this aspect.

**2. Actions:**

**To RAN4:**

**ACTION:** RAN1 respectfully asks RAN4 to take the RAN1 responses into account in their further work

**To RAN2:**

**ACTION:** RAN1 respectfully asks RAN2 to review the RAN1 responses to RAN4 and provide further information at least on the parts where RAN1 deferred the responsibility to RAN2

**3. Date of Next TSG WG RAN1 Meetings:**

TSG-RAN1 Meeting#107-e 11-19 Nov 2021 E-meeting

TSG-RAN1 Meeting#107bis-e 17-25 Jan 2022 E-meeting

TSG-RAN1 Meeting#108-e 21 Feb – 3 Mar 2022 E-meeting