3GPP TSG-RAN WG1 Meeting #109-e R1-22xxxxx

e-Meeting, 9th – 20th May 2022

**Agenda Item: 8.6.1**

**Title: FL summary for maintenance on UE bandwidth reduction for RedCap**

**Source: Moderator (Ericsson)**

**Document for: Discussion, Decision**

# Introduction

This feature lead (FL) summary (FLS) concerns the Rel-17 work item (WI) for support of reduced capability (RedCap) NR devices [1]. Earlier RAN1 agreements for this WI are summarized in [2], which also includes links to earlier FLSs.

This document captures this email discussion on maintenance issues for UE bandwidth reduction for RedCap:

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| [109-e-R17\_RedCap-01] Email discussion under 8.6.1 for maintenance on UE bandwidth reduction, for issues 1, 2 and 3 under High Priority Proposal 2-1c in the FL summary [R1-2205107](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_109-e/Docs/R1-2205107.zip) – Johan (Ericsson)* Discussion and decision by May 18
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The three issues mentioned above are the following ones:

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| 1. Clarification of case when initial DL BWP is wider than maximum UE bandwidth, including discussion on center frequency alignment for TDD
	* See references [3, 4, 5, 7, 8, 9, 11, 14, 16, 18, 20, 22, 23, 24, 25, 27, 28, 29, 32]
2. SSB presence in separate initial DL BWP in connected mode for BWP configuration option 1
	* See references [5, 7, 8, 9, 11, 14, 16, 18, 20, 22, 23, 24, 25, 27, 28, 29, 32]
3. Corrections for BWP operation description in 38.213 clause 17.1
	* See references [5, 7, 9, 18, 22, 26, 28, 29]
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Each one of the issues listed above is treated in its own section in this document. All contributions submitted to agenda items 8.6.1 and 8.6.2 are included in the References section as references [3] – [32]. The final FLS on UE bandwidth reduction from the previous RAN1 meeting can be found in [33].

The feedback forms in this document are tagged and color coded with High Priority or Medium Priority. The aspects that are in the focus of this round of the discussion are furthermore tagged FL4.

**FL4 Question: Please consider entering contact info below for the points of contact for this email discussion.**

|  |  |  |
| --- | --- | --- |
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# 1 Issue #1: Clarification of case when initial DL BWP is wider than maximum UE bandwidth, including discussion on center frequency alignment for TDD

Clarification of the case when initial DL BWP is wider than maximum UE bandwidth, including discussion on center frequency alignment for TDD, is discussed in contributions [3, 4, 5, 7, 8, 9, 11, 14, 16, 18, 20, 22, 23, 24, 25, 27, 28, 29, 32]. This issue was discussed in the previous RAN1 meeting, and the discussion is captured on pages 3-44 in the FLS in [33]. The following agreement was made regarding DL/UL center frequency alignment for TDD:

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| Agreement:* For FR1 and FR2, for TDD, when a (separate or shared) initial DL BWP includes CD-SSB (for FR1 and FR2) and the entire CORESET#0 (for FR1), the center frequencies for the (separate or shared) initial DL BWP and the (separate or shared) initial UL BWP are assumed to be the same.
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All main options under discussion (Options 1, 2a and 2b) as listed in the following FL proposal were met with both some support and some opposition.

|  |
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| High Priority Proposal 2-1-2b: For the case that the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth, down select between the following options:* Option 1: A separate initial DL BWP is always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth.
	+ Note: For TDD, the center frequencies of the separate initial DL BWP and the initial UL BWP are aligned (in accordance with earlier agreement).
* Option 2a: If a separate initial DL BWP is not configured for RedCap, the RedCap UE continues to use at least the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0.
	+ For TDD, the total frequency span of MIB-configured CORESET#0 and the initial UL BWP does not exceed the RedCap UE maximum bandwidth.
* Option 2b: If a separate initial DL BWP is not configured for RedCap, the RedCap UE continues to use at least the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0.
	+ For TDD, the center frequencies of the MIB-configured CORESET#0 and the initial UL BWP are aligned.
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The latest version of the FL proposal addressing this issue was only shared on the RAN1 reflector and it looked like this:

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| High Priority Proposal 2-1-2e: For the case that the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth,* A separate initial DL BWP is always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth.
* From RAN1 perspective, if generic parameters (location, bandwidth, SCS, and cyclic prefix) of this separate initial DL BWP are absent, RedCap UE can continue to use the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0. Necessity and feasibility of signaling optimizations are up to RAN2.
* Note: For TDD, the center frequencies of the separate initial DL BWP and the initial UL BWP are aligned (in accordance with earlier agreement).
 |

Several contributions [7, 8, 22, 23, 24] propose to use the above FL proposal (Proposal 2-1-2e) as a starting point in this meeting, since there was not enough time to treat it in the previous meeting. Among the other contributions, some [5, 9, 11, 16, 18, 27] lean toward Option 1, some [3, 4, 25] toward Option 2a, and some [20, 29, 32] toward Option 2b.

Some contributions [16, 28] note that the RRC parameter description for *initialDownlinkBWP-RedCap* in TS 38.331 [34] states that if the parameter is absent then “*RedCap UEs use initialDownlinkBWP provided that it does not exceed the RedCap UE maximum bandwidth*” and express that no additional agreement or specification change may be needed. One more contribution [11] also argues that the current specifications are enough and that no further optimization is needed, whereas another contribution [3] argues that an agreement is needed to specify the UE behavior for this case. Some contributions [3, 14] note that the analysis for issue #1 may be different for FDD and TDD.

Based on the submitted contributions, the following proposal can be considered. It is the same as Proposal 2-1-2e which was proposed in the previous meeting but not treated then due to lack of time.

**FL1 High Priority Proposal 1-1a: For the case that the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth,**

* **A separate initial DL BWP is always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth.**
* **From RAN1 perspective, if generic parameters (location, bandwidth, SCS, and cyclic prefix) of this separate initial DL BWP are absent, RedCap UE can continue to use the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0. Necessity and feasibility of signaling optimizations are up to RAN2.**
* **Note: For TDD, the center frequencies of the separate initial DL BWP and the initial UL BWP are aligned (in accordance with earlier agreement).**

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| **Company** | **Y/N** | **Comments** |
| MediaTek |  | We prefer to take Option 1 as an agreement or simply a conclusion to support the current specification text in TS 38.331.  |
| vivo | Y with modification | We would like to suggest as following to make it clear that if CORESET#0 is used as the initial BWP of RedCap UEs, then the center frequencies need to be aligned with CORESET#0 and initial UL BWP.**For the case that the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth,*** **A separate initial DL BWP is always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth.**
* **From RAN1 perspective, if generic parameters (location, bandwidth, SCS, and cyclic prefix) of this separate initial DL BWP are absent, RedCap UE can continue to use the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0 as its separate initial BWP. Necessity and feasibility of signaling optimizations are up to RAN2.**
* **Note: For TDD, the center frequencies of the separate initial DL BWP and the initial UL BWP are aligned (in accordance with earlier agreement).**
 |
| Nordic  | Y | Assuming here that if location parameter is missing (not configured), then CORESET#0 location is center-frequency-aligned with initial UL BWP.  |
| Qualcomm | Y | * A RedCap UE is provided separate IEs for initial DL/UL BWP configurations in SIB.
* If the RedCap-specific IE for initial DL BWP configurations is not provided, the RedCap UE is not required to decode the IE for initial DL BWP configuration of non-RedCap UE.
 |
| Apple  |  | To be honest, the sub-bullets are not very clear for us. Our understanding on the propsoals is as follows: * First, the ‘note’ in 3rd sub-bullet is a high-level principle, which mandates the central freqeuncy of initial DL BWP is always aligned with initial UL BWP, regardless of ‘explicitly’ configured (1st sub-bullet) or implicitly reusing the CORESET #0 (2nd sub-bullet). In other words, the following heavily debated use case is NOT allowed by this proposal,
	+ CORESET#0 is NOT central-aligned with initial UL BWP and Redcap-specific initial DL BWP is NOT configured.

If the understanding above is correct, we support this proposal.  |
| CATT | Y | We are OK to accept this proposal. |
| Spreadtrum | Y | 1. The current proposal is fine for us. The modification by vivo is better.
2. The purpose is to save the IE overhead. As some companies indicated, the current spec in 38.331 is enough and overhead saving is not to pursue, i.e., if the parameter is absent then “*RedCap UEs use initialDownlinkBWP provided that it does not exceed the RedCap UE maximum bandwidth*”. And the center frequency alignment is still effective in current agreements and in the spec 213, i.e., the center frequencies are aligned b/w initial DL BWP and initial UP BWP.
 |
| Intel |  | While this is not our preference and we still think that Option 2b would have been the cleanest solution as described in our tdoc, considering the current situation, we can compromise and accept the FL proposal with the reference to RAN2 removed. Also, we do not see a need to spell out “From RAN1 perspective” as it’s a RAN1 decision anyway.Lastly, the second bullet should be sub-bullet of the first one.**For the case that the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth,*** **A separate initial DL BWP is always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth.**
	+ **~~From RAN1 perspective, if~~ If generic parameters (location, bandwidth, SCS, and cyclic prefix) of this separate initial DL BWP are absent, RedCap UE can continue to use the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0. ~~Necessity and feasibility of signaling optimizations are up to RAN2.~~**
	+ **Note: For TDD, the center frequencies of the separate initial DL BWP and the initial UL BWP are aligned (in accordance with earlier agreement).**
 |
| NEC | Y | We have similar view as MediaTek, but we are OK with the proposal as a compromise. vivo’s modification would be fine. |
| DOCOMO | Y | We still don’t think it is necessary to mandate gNB to always configure a separate initial DL BWP. However, we believe this proposal does not preclude the possibility that a RedCap UE can continue to use MIB-configured CORESET#0 configurations, thus, we can accept this proposal as it is.Regarding the center frequencies of MIB-configured CORESET#0 and initial UL BWP for RedCap UEs, it is not necessary to be aligned unless the CORESET#0 and the initial UL BWP span larger BW than maximum RedCap BW. |
| Huawei, HiSilicon | N | In our view, a separate initial DL BWP is not needed to be always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth. Whether configure a separate initial DL BWP should be up to network. If not configured, RedCap UE can continue to use the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0 as its separate initial BWP. For center frequency issue, we could compromise to option 2b but still do not think option 1 is better. |
| Samsung |  | We have similar view as MediaTek.We don’t see strong motivation to have second bullet and the note. We think current RAN 2 spec is clear enough. There is no need for further agreement for optimize the RRC overhead with new RAN 1 ageement.  |
| Ericsson |  | We prefer Option 1 like MediaTek. Beside the current specification text in TS 38.331 (as mentioned in the background), some clarification in TS 38.213 may still be needed.We think that whether paging can be configured in CORESET#0 irrespective of whether separate initial DL BWP is configured or not also needs some clarification. |
| LGE |  | We would like to echo the comments from Huawei. As mentioned in our contribution, our preference is Option 2a, but we can consider compromising to Option 2b if it helps to converge toward Option 2a/2b. |
| Panasonic | Y |  |
| Sharp | Y | The current FL proposal is a compromise. We are ok with the FL proposal, although our preference is option 2a. |
| ZTE, Sanechips | Y | We are OK to accept this to move forward.  |
| Nokia, NSB | Y | We can accept this proposal although our preference is Option 2a. Also, we are fine to remove the 2nd sub-bullet and go with the original Option 1. |
| FUTUREWEI |  | We are supportive of option 2a / 2b. It is not necessary to always configure a separate initial DL BWP. Though that is our preference, similar to Intel, we are willing to consider compromises to move us forward. |
| vivo2 |  | As mentioned before, we are fine to accept the current FL proposal (with some minor reivisions shown above) as compromise. However, if there are more companies prefer to go with original option 1, we are certainly fine with that as well.  |
| CMCC | Y | Compared with Option1, current proposal at least save SIB1 signalling overhead when CORESET#0 is center-frequency-aligned with initial UL BWP. We prefer current proposal and vivo's version is acceptable. |
| FL3 | A slight majority of the received responses support the proposal. A few responses are concerned that the proposal might be interpreted as if the separate initial DL BWP might not be center frequency aligned with the separate initial UL BWP if the frequency location is inherited from CORESET#0. A few responses express support for the original Options (1, 2a, 2b). One response expresses that the current specification is clear enough and that there is no need for further agreements.Based on the responses, the following updated proposal can be considered, which aims to further clarify that in TDD the separate initial DL BWP and separate initial UL BWP are center frequency aligned in all cases.**High Priority Proposal 1-1b: For the case that the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth,*** **A separate initial DL BWP is always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth.**
	+ **For FDD, and for TDD when the center frequency of CORESET#0 and the initial UL BWP used by RedCap UEs are aligned,**
		- **~~From RAN1 perspective,~~ if generic parameters (location, bandwidth, SCS, and cyclic prefix) of this separate initial DL BWP are absent, RedCap UE can continue to use the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0. Necessity and feasibility of signaling optimizations are up to RAN2.**
	+ **Note: For TDD, the center frequencies of the separate initial DL BWP and the initial UL BWP are aligned (in accordance with earlier agreement).**
 |
| Qualcomm | Y |  |
| CATT | Y |  |
| Spreadtrum | Y |  |
| vivo | Y |  |
| DOCOMO |  | We prefer Proposal 1-1a, but can accept Proposal 1-1b. As we commented in the previous round, RF retuning is not required unless the CORESET#0 and the initial UL BWP span larger BW than maximum RedCap BW in our understanding. It is unclear for us why center frequencies of the initial UL BWP for RedCap and CORESET#0 need to be aligned. |
| MediaTek |  | Though we prefer Option 1, we can in principle accept this proposal for progresss. Some questions and comments. 1. FDD seems a typo to me and should be removed. 2. While the generic parameters can be absent, we think pdcch-ConfigCommon and pdsch-ConfigCommon in this separate initial DL BWP should be always configured so that RedCap UEs do not need to read the initial DL BWP configured for non-RedCap UEs in this case. 3. Does the added red text intend to say that in TDD, only when the center frequency of the CORESET#0 is aligned with that of the initial UL BWP, gNB can have the flexibility to leave the generic parameters absent? We think the following editorial changes may be easier to understand. With the above, we propose some modification as follows: * **A separate initial DL BWP with *pdcch-ConfigCommon* and *pdsch-ConfigCommon* is always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth.**
	+ **If generic parameters (location, bandwidth, SCS, and cyclic prefix) of this separate initial DL BWP are absent, RedCap UE can continue to use the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0. Necessity and feasibility of signaling optimizations are up to RAN2.**
		- **For TDD, the center frequencies of CORESET#0 and the initial UL BWP used by RedCap UEs are aligned.**
* **Note: For TDD, the center frequencies of the separate initial DL BWP and the initial UL BWP are aligned (in accordance with earlier agreement).**
* **Note: RedCap UEs do not need to read initial DL BWP configured for non-RedCap UEs in this case.**
 |
| ZTE, Sanechips | Y |  |
| NEC | Y |  |
| Huawei, HiSilicon | N | We feel the design is unnecessarily going to be complicated. |
| Samsung | N | We want to understand what is the issue if no agreement is made. We don’t see any broken with current spec without this agreement.  |
| Intel | N | We still need to remove the statement about RAN2 – there is no feasibility issue or further analysis that RAN1 can identify for RAN2 to justify the statement. We do not write such for every RAN1 agreement with impact to RAN2 signalling design.Also, we do not agree with the udpates from MTK since we think there is absolutely no issue in reading the initial DL BWP configuration IE in SIB1 that the UE has to decode and parse any way. In fact, a RedCap UE needs to read this IE anyway to know whether the BW of the SIB1-indicated initial DL BWP is larger than max RedCap UE BW.Hence, the gNB should not be mandated to always provide in SIB1 a separate PDCCH-ConfigCommon or PDSCH-ConfigCommon for RedCap UEs. Instead, PDCCH-ConfigCommon and PDSCH-ConfigCommon should be used from that provided for initial DL BWP for non-RedCap UE.Thus, we can compromise to the latest version with the following changes:**For the case that the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth,*** **A separate initial DL BWP is always configured for RedCap if the initial DL BWP for non-RedCap UEs is wider than the maximum RedCap UE bandwidth.**
	+ **For FDD, and for TDD when the center frequency of CORESET#0 and the initial UL BWP used by RedCap UEs are aligned,**
		- **~~From RAN1 perspective,~~ if ~~generic~~ parameters (location, bandwidth, SCS, and cyclic prefix)** or pdcch-ConfigCommon or pdsch-ConfigCommon **of this separate initial DL BWP are absent, RedCap UE can continue to use the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0 and pdcch-ConfigCommon or pdsch-ConfigCommon from that configured for non-RedCap UEs. ~~Necessity and feasibility of signaling optimizations are up to RAN2.~~**
	+ **Note: For TDD, the center frequencies of the separate initial DL BWP and the initial UL BWP are aligned (in accordance with earlier agreement).**

**As can be seen, the above is a more convoluted representation than necessary and Option 2b would be a much better alternative to capture the UE behavior**. |
| FUTUREWEI |  | The restriction for FDD seems unnecessary |
| LGE |  | We still prefer Option 2a and are willing to compromise to Option 2b for the sake of progress. |
| Ericsson |  | Fine (but with “Necessity and feasibility of signaling optimizations are up to RAN2”). Note that RAN2 has already agreed “For RedCap-specific BWP, both common and dedicated configurations are provided using full configuration, i.e., delta configuration is not supported”. |
| Nordic  | Y | We fine with proposal, as well as Option 2b given that current status of RAN2 decisions is followed.* Option 2b: If a separate initial DL BWP is not configured for RedCap, the RedCap UE continues to use at least the location, bandwidth, SCS, and cyclic prefix of the MIB-configured CORESET#0 until after MSG4.
	+ For TDD, the center frequencies of the MIB-configured CORESET#0 and the initial UL BWP are aligned.
 |
| FL4 | Most of the received responses express that they can accept Proposal 1-1b, but one of the responses questions whether any new agreement is needed at all.One of the contributions [11] to this meeting argues that the current specifications are enough and that no further optimization is needed, based on TS 38.331 [34] clause 5.2.2.4.2:

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| 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), and which- is wider than or equal to the bandwidth of the initial downlink BWP or, for RedCap UE, of the initial downlink BWP for RedCap if configured, and[…]2> else:3> consider the cell as barred in accordance with TS 38.304 [20]; and3> perform barring as if *intraFreqReselection* is set to *notAllowed*; |

Two other contributions [16, 28] point to the last sentence in the following field description for *DownlinkConfigCommonSIB* in TS 38.331 [34] clause 6.3.2:

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| ***initialDownlinkBWP-RedCap***If present, RedCap UEs use this DL BWP instead of *initialDownlinkBWP*. If the *locationAndBandwidth* of this BWP contains the entire CORESET#0, the UE applies the *locationAndBandwidth* upon reception of this field (e.g. to determine the frequency position of signals described in relation to this *locationAndBandwidth*) but it keeps CORESET#0 until after reception of *RRCSetup*/*RRCResume/RRCReestablishment*. Otherwise, i.e., if the *locationAndBandwidth* of this BWP does not contain the entire CORESET#0, the UE uses this BWP also for receiving DL messages during initial access (Msg2, Msg4, ...) and after initial access.If absent, RedCap UEs use *initialDownlinkBWP* provided that it does not exceed the RedCap UE maximum bandwidth (see also clause 5.2.2.4.2). |

Based on the above, the FL would like to ask whether the following potential conclusion can be considered.**High Priority Question 1-1c: Can RAN1 conclude that no spec change is needed for issue #1?** |
| vivo | Y |  |
| CATT |  | We might compromise to no spec, but would like to clarify:Does it mean **‘legacy initialDownlinkBWP *> max RedCap BW* andnot configuring separate initial DL BWP’**is an error case (or consider the cell as barred as in RAN2 spec)?. |
| NEC | Y |  |

# 2 Issue #2: SSB presence in separate initial DL BWP in connected mode for BWP configuration option 1

SSB presence in separate initial DL BWP in connected mode for BWP configuration option 1 is discussed in contributions [5, 7, 8, 9, 11, 14, 16, 18, 20, 22, 23, 24, 25, 27, 28, 29, 32]. This issue was discussed in the previous RAN1 meeting, and the discussion is captured on pages 45-72 in the FLS in [33]. Both main options under discussion (Options 1 and 2) as listed in the following FL proposal were met with both some support and some opposition.

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| High Priority Proposal 3-1h: Down select between the following options during RAN1#108-e:* Option 1:
	+ For FR1, for BWP#0 configuration option 1,
		- A RedCap UE in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0.
	+ For FR2, for BWP#0 configuration option 1,
		- A RedCap UE in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB.
* Option 2:
	+ For FR1, for BWP#0 configuration option 1,
		- For a separate initial DL BWP (if it does not include CD-SSB and the entire CORESET#0) from RAN1 perspective,
			* During a random access procedure in connected mode, RedCap UE does NOT expect it to contain SSB/CORESET#0/SIB.
	+ For FR2, for BWP#0 configuration option 1,
		- For a separate initial DL BWP (if it does not include CD-SSB) from RAN1 perspective,
			* During a random access procedure in connected mode, RedCap UE does NOT expect it to contain SSB/CORESET#0/SIB.
	+ For BWP#0 configuration option 1, upon successful completion of the random access procedure, a RedCap UE supporting FG 6-1 only (but not FG 6-1a) in connected mode is not required to operate on a separate initial DL BWP that does not contain SSB.
	+ Note: The network may choose to configure SSB or MIB-configured CORESET#0 or SIB1 to be within the respective DL BWP.
 |

Some contributions [7, 8, 22] propose to use the above FL proposal (Proposal 3-1h) as a starting point in this meeting. Among the other contributions, some [9, 14, 16, 29, 32] lean toward Option 1, and some [5, 7, 11, 18, 22, 23, 24, 25] toward Option 2. Some contributions [16, 22, 27] suggest that Option 1 could be adopted for RedCap UEs supporting FG 6-1 and Option 2 for RedCap UEs supporting FG 6-1a.

One contribution [24] points out that RAN2 has agreed that “*In connected mode if RA occasions are not configured on the active BWP, RedCap UEs should use the RedCap-specific initial UL BWP, if configured, or else legacy BWP#0*”, whereas another contribution [28] proposes to ask RAN2 to ensure that when *initialDownlinkBWP-RedCap* does not include CD-SSB, a RedCap UE (only supporting FG 6-1) expects to be provided with NCD-SSB until after Msg4.

Some contributions [9, 14, 29] express concerns with the formulation in Option 2 that “*For BWP#0 configuration option 1, upon successful completion of the random access procedure, a RedCap UE supporting FG 6-1 only (but not FG 6-1a) in connected mode is not required to operate on a separate initial DL BWP that does not contain SSB*”. It may not be clear whether the UE capabilities (FG 6-1/6-1a) are known when they need to be known, or what “required to operate” means, or how the UE is switched back to its ordinary active DL BWP, or whether there is a risk that the UE may in practice be required to transmit or receive data even after random access in a separate initial DL BWP that does not contain SSB. Some contributions, e.g., contributions [7, 20] propose some alternative formulations for Option 2.

**FL1 High Priority Question 2-1a: Companies are invited to comment on issue #2 and indicate the preferred option (Option 1 or 2) and potential updates that might address the concerns with current formulations of the options.**

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| --- | --- | --- |
| **Company** | **Option (1/2)** | **Comments** |
| MediaTek | Option 1 | We would like to again emphasize the potential performance loss and suffering is more significant for UE to support RACH w/o SSB in connected modes than in initial access/idle/inactive. In initial access/idle/inactive modes, when UE triggers RACH, RRC (re-)connection request is often transmitted to gNB. Consequently, UE can expect to enter RRC connected mode soon and operate in a BWP w/ SSB. But for connected mode, operating on such a BWP w/o any reference signals (no SSB and no TRS) for synchronization implies a potential throughtput loss. Moreover, there is no guarantee from the NW that NW will switch the UE to a BWP with SSB ***immediately*** when the UE finishes RACH. Even if NW is willing to provide some warranty (which Option 2 does not provide in our view) or UE is willing to fully trust the NW, when the UE is unforntunately out of coverage during the time duration when it waits NW to configure it, it cannot even trigger a RLF on that BWP because there is no RS for it to perform RLM in the first place! Option 2 only says UE does not have to ***operate*** on such a BWP once finishing RACH. Firstly, it is not clear what operate means. Maybe proponents can provide more detailed definition or refer to the specification if it is a commonly terminology in the spec. Secondly, this option still does not give any warranty to the UE that it will not stay on the BWP long. **Observation: If Option 2 is supported, there is no SSB or CSI-RS on the BWP for UE to perform RLM. UE cannot even trigger RLF if it is forgotten by NW or out of coverage of NW.**  |
| vivo | Option 1 | If option 1 or option 2 cannot be coverged, we suggest to conclude that there is no concensus to support using the BWP#0 configuration option 1 to configure the separate initial DL BWP for RedCap. As it is also observed by many companies that the usage of the separate initial DL BWP configured by BWP#0 configuration option 1 is quite limited.  |
| Nordic  | Neither | The problem with both options is that UE currently cannot get NCD-SSB for BWP#0, because the definition of BWP-Option 1 is that BWP#0 is not provided with BWP-DownlinkDedicated.Making NCD-SSB dependent on BWP-DownlinkDedicated is in fact NOT equivalent to the agreement we made, which says that baseline RedCap UE in RRC Connected expects NCD-SSB. We suggest to adopt TP#8 which will solve also this issue (at least in RAN1) and RAN2 can align with it consequently. |
| Qualcomm | Option 1 | If BWP#0 configuration option 1 is supported by RedCap UE, it is necessary for the BWP#0 to include CD-SSB. Otherwise, RedCap UEs in connected mode cannot perform L1/L3 measurements and maintain tracking loops in BWP#0. |
| Apple  |  | Open to both Opt.1 and Opt.2. Similar as Vivo, if Opt.1 and Opt.2 can NOT be converged, we also suggest to conclude the BWP#0 configuration option 1 is NOT supported for Redcap-specific initial DL BWP to close the discussion in maintainance phase.  |
| CATT |  | If we go with Option 1, at least the following change is needed:* **For FR1, for BWP#0 configuration option 1,**
	+ **A RedCap UE supporting FG 6-1 only (but not FG 6-1a) in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0.**
* **For FR2, for BWP#0 configuration option 1,**
	+ **A RedCap UE supporting FG 6-1 only (but not FG 6-1a) in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB.**

Otherwise, it is hard to understand why a RedCap UE with FG 6-1a cannot operate in a separate initial DL BWP with BWP#0 configuration option 1. |
| Spreadtrum | Option 2 | For Option 1, we suspect the separate initial DL BWP containing CD-SSB has to be CORESET#0, and in turn NW would not guarantee the center frequency alignment b/w CORESET#0 and the initial UL BWP. If so, the frequent RF retuning is necessary during RACH procedure. It seems dead knot, since some companies do not think the center frequencies of CORESET#0 and the initial UL BWP are aligned. |
| Intel | Option 1 | We support Option 1 as it is the clear option without any ambiguities. @Nordic, we do not quite see any implications on NCD-SSB that seems to be alluded to for Option 1. It is simply saying that for BWP #0 configuration Option 1, a UE expects a separate initial DL BWP to include CD-SSB (and entire CORESET #0 for FR1).@CATT, we are not sure the additions related to FG 6-1/6-1a would make much difference to configuration provided by the gNB. For the scenario at hand, the gNB would need to configure separate initial DL BWP in any case to include CD-SSB (and entire CORESET#0 in FR1) irrespective of UE capability as it likely would not be aware of UE capabilities of FG 6-1a during configuration in SIB1 for separatae initial DL BWP for RedCap UEs.@Spreadtrum, the center frequency alignment is already guaranteed per following agreement from last meeting.***Agreement******For FR1 and FR2, for TDD, when a (separate or shared) initial DL BWP includes CD-SSB (for FR1 and FR2) and the entire CORESET#0 (for FR1), the center frequencies for the (separate or shared) initial DL BWP and the (separate or shared) initial UL BWP are assumed to be the same.*** |
| NEC |  | For BWP#0 configuration option 1, considering the RAN2 agreement where for RA if active BWP is not configured with RO, a RedCap UE switches to an initial DL BWP if configured, it seems a separate initial DL BWP would need to be configured with NCD-SSB by common configuration in case CD-SSB is not included, or otherwise always to include CD-SSB. If a separate initial DL BWP does not include any SSB, it does not seem much beneficial.We are also OK BWP#0 configuration option 1 is not supported for separate initial BWP as suggested by other companies. |
| DOCOMO |  | We are fine with either Option1 or Option 2, but slightly prefer Option 2. According to the previous RAN1 agreement, SSB is not required to be included in a separate initial DL BWP for random access in RRC idle/inactive mode and this operation is also agreed as a component of RedCap basic feature FG28-1. Thus it is reasonable to allow using the separate initial DL BWP which does not include SSB (i.e., BWP#0 configuration option 1) for random access procedure even in RRC connected mode. |
| Huawei, HiSilicon | Neither | Considering the useage of BWP#0 configuration option 1 is very limited, in our view, there is no strong need to pursue NCD-SSB for BWP#0 configuration option 1. |
| Samsung |  | We support the change from CATT. |
| Ericsson | Option 2 | Option 2 is preferred as it provide more flexibility over Option 1 from NW p.o.v. Also, if the UE can operate without SSB during random access in idle/inactive mode (as already agreed), we think it should be able to do so during random access in connected mode.Regarding Huawei’s comments, we think that none of the options imply that separate initial DL BWP for BWP configuration Option 1 would be configured with NCD-SSB. |
| LGE | Option 2 | We slightly prefer Option 2 for consistency with the idle/inactive mode operation. But we can further discuss if there is a serious impact on connected mode operation unlike the operation in idle/inactive mode. |
| Panasonic |  | We support CATT’s suggestion in principle. “FG6-1” may be replaced with a new FG (for RRC-configured DL BWP with CD-SSB or NCD-SSB) if agreed in the UE feature session. |
| Sharp | Option 2 | Option 2 is preferred. We share same views with DOCOMO and Ericsson. For Option 2, the RRC-configured UL BWP is not required to be always configured with RACH resource. |
| ZTE, Sanechips | Compromise for option1 and option2 | We do not think there is a problem for the UE to operate RACH as in idle mode. For option1, the fallback BWP mechanism would be problematic if separate initial DL BWP is not used in connected mode. Moreover, it does not make sense that the UE with 6-1a can not use the separate initial DL BWP without SSB. Given the current situation, a compromise method to address the concerns should be considered to move forward. More specifically, after RACH, the UE would be configured to a BWP with SSB for measurement requirement when the separate initial DL BWP does not contain CD-SSB. Based on this, the UE would not always stay in the separate initial DL BWP without SSB.After gNB acquiring UE capability, the UE with 6-1a can retune to separate initial DL BWP and operate in this BWP. For RedCap UE with 6-1 only or with 6-1a, the UE still can do the RACH procedure in separate initial DL BWP which is similar as in idle mode.* Compromise Option:
	+ For FR1, for BWP#0 configuration option 1,
		- During RACH procedure, A RedCap UE with or without 6-1a can operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0.
		- Expect during RACH procedure,
			* Before gNB acquiring UE capabilities, A RedCap UE in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0.
			* After gNB acquiring UE capabilities, A RedCap UE with 6-1 only in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0
			* After gNB acquiring UE capabilities, A RedCap UE with 6-1a in connected mode can operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0
	+ For FR2, for BWP#0 configuration option 1,
		- During RACH procedure, A RedCap UE with or without 6-1a can operate in a separate initial DL BWP that does not include CD-SSB.
		- Expect during RACH procedure,
			* Before gNB acquiring UE capabilities, A RedCap UE in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB.
			* After gNB acquiring UE capabilities, A RedCap UE with 6-1 only in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB
			* After gNB acquiring UE capabilities, A RedCap UE with 6-1a in connected mode can operate in a separate initial DL BWP that does not include CD-SSB
 |
| Nokia, NSB | Option 2 | We prefer option 2 as that is aligned with previous agreement that SSB is not required in DL BWP for random access in RRC idle/inactive mode.  |
| CMCC | Option2 | We prefer Option2. If a UE can perform RACH without SSB in idle/inactive mode, it also works in connected mode. Compared with Option1, Option2 does not require RRC-configured UL BWP to be always configured with RACH resource. |
| Spreadtrum2 | Response to Intel’s comments | @Spreadtrum, the center frequency alignment is already guaranteed per following agreement from last meeting.***Agreement******For FR1 and FR2, for TDD, when a (separate or shared) initial DL BWP includes CD-SSB (for FR1 and FR2) and the entire CORESET#0 (for FR1), the center frequencies for the (separate or shared) initial DL BWP and the (separate or shared) initial UL BWP are assumed to be the same.***----------------- Response ---------------Understood. However, Issue #1 is not solved. If we go option 1 (or current FL proposal from option 1) or option 2b (alignment restriction), the center frequencies are aligned. If we go option 2a (the total frequency span restriction), the center frequencies for CORESET#0 and the initial UL BWP may not be aligned. If we keep current spec (neither option 1 nor option 2), gNB still should configure a separate initial DL BWP, and the center frequencies are aligned. Therefore, misalignement can still happen with the above agreement, if we go option 2a for Issue #1.Of course, if we regard CORESET#0 as the initial DL BWP even if the IE of the separate intial DL BWP is absent, the above agreement take effect for any case. However, for Rel-15, companies concluded the center frequencies for CORESET#0 and the initial UL BWP may or may not aligned, even when Rel-15 38.213 explicitly said the alignment for the initial DL BWP and initial UL BWP. CORESET#0 seems to be exceptable from the rules of 38.213…Anyway, if my concern is extra as mentioned by Intel, we are fine for Option 1. |
| FL3 | In the received responses, the support is rather evenly split between Options 1 and 2. Some alternative ways forward have been proposed, but the FL’s understanding is that they may have some issues:* **Potential way forward A:**
	+ Some responses propose to support Option 1 for FG 6-1 (or the equivalent FG for RedCap UEs that “Need NCD-SSB”) and Option 2 for FG 6-1a (or the equivalent FG for RedCap UEs that do “Not need NCD-SSB”).
	+ However, the FL’s understanding is that these FGs concern RRC-configured DL BWP, whereas issue #2 concerns separate initial DL BWP without UE-specific RRC configuration, so this does not seem to be a straightforward way forward.
* **Potential way forward B:**
	+ Some responses suggest that if no consensus can be reached for any option or compromise, then it should be concluded that there is no concensus to support using the BWP#0 configuration option 1 to configure the separate initial DL BWP for RedCap.
	+ Some of these responses mention that the use of separate initial DL BWP configured by BWP#0 configuration option 1 is quite limited.
	+ However, the FL’s understanding is that while the separate initial DL BWP might be of little to no use for power saving purpose, the separate initial DL BWP may still be needed in some cases, e.g., for random access in connected mode.

The FL would like to ask the following question regarding the above proposed ways forward. Further comments on Options 1 and 2 and other potential ways forward are also welcome.**High Priority Question 2-1b: Companies are invited to comment on the potential ways forward A and B listed above. Further comments on Options 1 and 2 and other potential ways forward are also welcome.** |
| Qualcomm | If A is supported, it suggests RedCap UE’s optional capability w.r.t. “not need NCD-SSB” shall be signaled to NW no later than “*RRCSetupComplete*.” It is unclear to us if such signaling support is available in current spec.For the sake of progress, we can live with Potential way forward B for NR R17 RedCap UE.  |
| CATT | In fact, we just cannot understand the difference of performing RACH between IDLE mode and CONNECTED mode. It is strange that any RedCap UE (w/ or w/o FG 6-1a) can perform RACH in separate initial DL BWP without SSB in IDLE, but suddently it CANNOT support RACH in the same separate initial DL BWP in CONNECTED.Concern on Option 2 is mainly about ‘unclear duration to stay in a SSB-less BWP’, as explained by MTK: ‘*Moreover, there is no guarantee from the NW that NW will switch the UE to a BWP with SSB* ***immediately*** *when the UE finishes RACH*.’ But if this is realy the case——* How can every RedCap UE get guaranett from the NW to switch to a BWP with SSB just after IDLE mode RACH in a SSB-less separate initial DL BWP?
* What is changed from IDLE mode RACH to CONNCETED mode RACH?
* Why the network can properly schedule the RACH from IDLE mode for all RedCap UEs, but CANNOT properly schedule the RACH from CONNECTED mode?
* Why the group agree that all RedCap UE (w/ or w/o FG 6-1a) can perform RACH in a separate initial DL BWP without any SSB during IDLE?

Clearly we believe Option 2 is the one with reasonable engineering logic. It is aligned with all agreed principles. |
| Spreadtrum | Seems Wayforward A will complicate the situation.Wayforward B may be a compromise, but missing BWP#0 configuraiton option 1 for RACH seems a little incomplete at least for specification.As mentioned before, we can compromise to Option 1 if aligment of center frequencies for CORESET#0 and the initial UL BWP is confirmed in Issue #1. Option 1 seems fine as follows.* Multiplexing pattern 1
	+ Case 1: The separate initial DL BWP contains CORESET#0 and CD-SSB
		- Center frequencies aligned
		- Used for paging during and after initial access
		- Used for SIB during initial access
		- Used for RACH during initial access and after initial access for both BWP#0 configuration option 1 and option 2
	+ Case 2: The separate initial DL BWP does not contains CORESET#0 (may or may not contain CD-SSB)
		- Center frequencies aligned
		- Not used for paging during initial access (UE receives paging in CORESET#0) or after initial access (gNB solves)
		- Not used for SIB during initial access (UE receives SIB in CORESET#0)
		- Used for RACH during initial access (no SSB if CD-SSB is not present) and after initial access only for BWP#0 configuration option 2 (using NCD-SSB if CD-SSB is not present)
* Multiplexing pattern 2/3 (FR2 only)
	+ Case 1: The separate initial DL BWP contains CORESET#0 (may or may not contain CD-SSB)
		- Center frequencies aligned
		- Used for paging during and after initial access
		- Used for SIB during initial access
		- Used for RACH during initial access (no SSB if CD-SSB is not present) and after initial access for both BWP#0 configuration option 1 (only if CD-SSB is present) and option 2 (using NCD-SSB if CD-SSB is not present)
	+ Case 2: The separate initial DL BWP does not contains CORESET#0 (may or may not contain CD-SSB)
		- Center frequencies aligned
		- Not used for paging during initial access (UE receives paging in CORESET#0) or after initial access (gNB solves)
		- Not used for SIB during initial access (UE receives SIB in CORESET#0)
		- Used for RACH during initial access (no SSB if CD-SSB is not present) and after initial access only for BWP#0 configuration option 2 (using NCD-SSB if CD-SSB is not present)

Only the yellow highlighted part needs a few new implementations dedicated for RedCap UE. Option 2 is also workable in our view. We share the similar view as MTK that the link adaptation and maintanance (RLM) is strict in connected mode, but Network should be responsible for the unstability of linke adaptation and maintanance for RACH in connected mode.Correct me if I’m wrong. |
| vivo | Our preference is still Option 1. We are fine with Potential way forward B. We do not see the issue for way forwad B, the separate initial DL BWP sued for RACH can be configured by BWP#0 configuration option 2. Some companies may consider way forward B has configuration restriction, but the use of separate initial DL BWP configured by BWP#0 configuration option 1 is quite limited, we do not see this is a big restriction. For CATT’s question on the difference between the IDLE and CONNECCTED mode, we share the views with MTK, spreadtrum that the link adaptation, timing requirement and maintanance (RLM) is strict in connected mode.  |
| DOCOMO | We still prefer Option 2. Regarding way forward A, it is uclear for us why a UE may or may not be able to support random access in SSB-less BWP depending on its UE capability (e.g., FG6-1a) in connected mode while any UE can perform random access in SSB-less BWP in idle/inactive mode regardless of its UE capability. In addition, as commented by moderator, the UE capability reporting whether UE can perform random access within separate initial DL BWP configured with BWP#0 configuration option 1 in connected mode may not be exactly the same as FG6-1/6-1a. Thus, if we try to discuss based on way forward A, other UE features than FG6-1/6-1a may need to be considered while it is not preferable since it may complicate UE feature deiscussion. |
| ZTE, Sanechisp | For sake of progress, we can accept the UE with 6-1 only can only operate in the BWP with SSB in connected mode. However, for the UE with 6-1a, we still think the UE still can operate in the separate initial BWP without SSB after the gNB acquire the UE capability. The following compromise solution for potential way forward A is made:* Option 1:
	+ For FR1, for BWP#0 configuration option 1,
		- Before gNB acquiring the UE capability, A RedCap UE in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0.
		- After gNB acquiring UE capabilities, A RedCap UE with 6-1 only in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0
		- After gNB acquiring UE capabilities, A RedCap UE with 6-1a in connected mode can operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0
	+ For FR2, for BWP#0 configuration option 1,
		- Before gNB acquiring the UE capability, A RedCap UE in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB
		- After gNB acquiring UE capabilities, A RedCap UE with 6-1 only in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB
		- After gNB acquiring UE capabilities, A RedCap UE with 6-1a in connected mode can operate in a separate initial DL BWP that does not include CD-SSB

As for potential WF B, at least the BWP#0 configuration option 1 should be supported, when the separate initial DL BWP contains SSB. |
| NEC | We don’t see any issue in potential way forward B. In connected, active BWP would be a separate initial BWP if configured with BWP#0 configuration option 2 (only option in case BWP#0 configuration option 1 is not supported), and random access would be performed in active BWP. On the other hand, in the same condition as option 1, there would be no issue to support BWP#0 configuration option 1.On potential way forward A, a separate initial BWP configured by BWP#0 configuration option 1 without CD-SSB and CORESET#0 would be problematic for RedCap UE of basic BWP operation capability. |
| Samsung | We can be flexible with option 1 with CATT’s change or option 2.  |
| Intel | We still think Option 1 is the right way to go. The issue with Option 2 has been clarified multiple times – it’s not about RACH in idle vs. connected modes, but rather about UE maintaining the link (including time-frequency tracking, and RRM/RLM) in connected mode without any SSB for a potential prolonged time period. As discussed before, due to the unavailability of capability information during configuration of separate initial DL BWP, we do not think Way forward A can work. If we cannot converge on Option 1, unfortunately, we’d have to live with Way forward B.  |
| LGE | Our preference is still Option 2 for consistency with the idle/inactive mode operation. But if that is not acceptable, then we think the Potential way forward B should be the way to go. |
| Ericsson | The implication of Potential way forward B would be that separate ROs need to be configured for the active UL BWP linked to the active DL BWP. Also, it would be unfortunate to not support BWP configuration option 1 assuming that most networks can be expected to rely on BWP configuration option 1. Potential way forward A seems complicated as indicated by a few other companies above.Note that RAN2 has already agreed “In connected mode if RA occasions are not configured on the active BWP, RedCap UEs should use the RedCap-specific initial UL BWP, if configured, or else legacy BWP#0”. Considering that RAN1 couldn’t reach a consensus on this issue even after several meetings and rounds of discussions, we could also consider leaving this issue to RAN2 to settle.  |
| Nordic | We believe that one simple solution at hand is to **mandate configuration of PRACH for dedicated BWP in Option 1 for RedCap**. … if RAN2 is OK with it. |
| FL4 | The received responses show no clear majority for any of the options (1/2) or potential ways forward (A/B). Companies are invited to comment further on the following questions.**High Priority Question 2-1c: Companies are invited to comment further on the following questions:**1. **What would be the consequences if no further agreement is made for issue #2?**
2. **If no consensus can be reached in RAN1 regarding issue #2, can the resolution of issue #2 be left up to RAN2?**
 |
| vivo | For Q1, our understanding of the consequence is there is no concensus to support using the BWP#0 configuration option 1 to configure the separate initial DL BWP for RedCap. If NW configures separate initial DL BWP by BWP#0 configuration option 1 for RedCAp, UE behabior is undefined. For Q2, NO. We do not think the issues on using BWP#0 configuration option 1 we are discussing for several meetings are well understood by RAN2. The issues we see mainly fall into RAN1’s expertise, it does not make sense to ask RAN2 to resolve it.  |
| CATT | Q1. From network’s view, it is of course a RedCap UE supporting FG 6-1a can operate in separate initial DL BWP with BWP#0 configuration option 1 without SSB. 🡸 This in fact is exactly the definition of FG 6-1a. Also from network’s view, sure, RedCap UE supporting only FG 6-1 will not support SSB-less BWP other than RACH.What the network does not know, is whether a RedCap UE supporting only FG 6-1 can perform RACH in separate initial DL BWP with BWP#0 configuration option 1 without SSB or not. This is because SSB is not needed for RACH in IDLE.That’s why we propose the following compromise in the first round, just to make it clear, RAN1 conclude that RedCap UE supporting only FG 6-1 does NOT support any operation (including RACH) without SSB in CONNECTED mode, including in separate initial DL BWP with BWP#0 configuration option 1:* **For FR1, for BWP#0 configuration option 1,**
	+ **A RedCap UE supporting FG 6-1 only (but not FG 6-1a) in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB and the entire CORESET#0.**
* **For FR2, for BWP#0 configuration option 1,**
	+ **A RedCap UE supporting FG 6-1 only (but not FG 6-1a) in connected mode does not expect to operate in a separate initial DL BWP that does not include CD-SSB.**

This should be a fair one. A basic FG 6-1 RedCap UE will no longer worry about the so-call ‘uncertain time camping in a SSB-less BWP in CONNECTED mode’.Q2. We are OK to leave it to RAN2. But we are not sure what RAN2 can conclude other than the compromised proposal above, without many RAN1 knowledge like syntronization, L1 measurement. |
| NEC | Q1) In case active BWP does not have RA configuration, if a separate initial DL BWP is configured, RedCap UE would switch to it regardless SSB is available or not according to RAN2 agreement. If no SSB is available within the separate initial DL BWP, a RedCap UE of only basic BWP operation capability may or may not have problem with SSB measurement for random access.A RedCap UE may fallback to a separate initial DL BWP when *bwp-InactivityTimer* is expired. A RedCap UE of only basic BWP operation capability may or may not have problem with SSB measurement if it stays in the separate initial DL BWP.Q2) RAN2 may somehow be able to resolve the issue#2 as Nordic mentioned. |

# 3 Issue #3: Corrections for BWP operation description in 38.213 clause 17.1

Various corrections for the BWP operation description for RedCap in TS 38.213 clause 17.1 are discussed in contributions [5, 7, 9, 14, 18, 22, 26, 28, 29].

3.1 Text proposal #1

Proposal 6 in contribution [[5]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203114.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

|  |  |
| --- | --- |
| ***Reason for change:*** | The following RAN1 agreements have not been fully captured in 38.213:Agreement:* For FR1,
	+ For a separate initial DL BWP (if it does not include CD-SSB and the entire CORESET#0) from RAN1 perspective,
		- If it is configured for random access while not for paging in idle/inactive mode, RedCap UE does NOT expect it to contain SSB/CORESET#0/SIB.
		- […]
	+ […]
	+ Note: if a separate initial/RRC configured DL BWP is configured to contain the entire CORESET#0, CD-SSB is expected by RedCap UE.
	+ Note: The network may choose to configure SSB or MIB-configured CORESET#0 or SIB1 to be within the respective DL BWP.
	+ […]

Agreement:* For FR2,
	+ For a separate initial DL BWP (if it does not include CD-SSB ~~and the entire CORESET#0~~) from RAN1 perspective,
		- If it is configured for random access while not for paging in idle/inactive mode, RedCap UE does NOT expect it to contain SSB/CORESET#0/SIB.
		- […]
	+ […]
	+ Note: For SSB and CORESET#0 multiplexing pattern 1, if a separate initial/RRC configured DL BWP is configured to contain the entire CORESET#0, CD-SSB is expected by RedCap UE.
	+ Note: The network may choose to configure SSB or MIB-configured CORESET#0 or SIB1 to be within the respective DL BWP.
	+ […]

Agreement:* […]
* For BWP#0 configuration option 1,
	+ For FR1,
		- For a separate initial DL BWP, for a RedCap UE in connected mode, paging can only be configured if it contains CD-SSB and the entire CORESET#0.
	+ For FR2,
		- For a separate initial DL BWP, for a RedCap UE in connected mode, paging can only be configured if it contains CD-SSB ~~and the entire CORESET#0~~.
* […]

Agreement:* A RedCap UE supports existing applicable mandatory feature(s) that are based on SSB using NCD-SSB (including NCD-SSB based measurements) as mandatory feature(s) in an RRC-configured DL BWP that does not include CD-SSB.
	+ NCD-SSB is ‘QCL’-ed with CD-SSB when the NCD-SSB and CD-SSB share the same SSB index.
	+ Note: RAN1 assumes that NCD-SSB is configured by higher layer
 |
|  |  |
| ***Summary of change:*** | Changes to RedCap UE procedures in Clause 17.1 of TS 38.213. |
|  |  |
| ***Consequences if not approved:*** | RedCap UE procedures that are not consistent with the agreements made in RAN1 during Rel-17.  |

Text proposal:

|  |
| --- |
| For an initial DL BWP provided by *initialDownlinkBWP* in *DownlinkConfigCommonRedCapSIB*, if a UE monitors PDCCH according to a Type1-PDCCH CSS set and does not monitor PDCCH according to Type2-PDCCH CSS set, the UE ~~assumes that~~ does not expect the initial DL BWP ~~does not~~ to include SS/PBCH blocks ~~or~~and the CORESET with index 0. If the UE monitors PDCCH according to Type2-PDCCH CSS set, the UE assumes that the initial DL BWP includes a SS/PBCH block and, for SS/PBCH block and CORESET multiplexing pattern 1, the CORESET with index 0 if the UE used the SS/PBCH block to obtain SIB1~~- includes a SS/PBCH block and does not include the CORESET with index 0 if the initial DL BWP does not include the SS/PBCH block the UE used to obtain SIB1~~For an active DL BWP provided by *BWP-DownlinkDedicated*, a UE assumes that the active DL BWP includes a SS/PBCH block, unless the UE indicates a capability to operate in the DL BWP without receiving an SS/PBCH block, and does not expect the active DL BWP to include the CORESET with index 0. If the active DL BWP includes a different SS/PBCH block than the SS/PBCH block the UE used to obtain SIB1, the former and the latter SS/PBCH blocks have the same quasi-colocation properties when they have the same index.  |

**FL2 Medium Priority Question 3.1-1a: Companies are invited to comment on TP1.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Nordic | N | We do not think there is need in RAN1 spec to differentiate CD and NCD SSB. |
| CATT | Y |  |
| Spreadtrum | N (need clarifications) | For paging in connected mode for BWP#0 configuration option 1, we do not see the key words on “connected mode” and “BWP#0 configuration option 1”, so we are not sure whether it correly reflects RAN1#108e agreements. And, we are not clear about the intention of “for SS/PBCH block and CORESET multiplexing pattern 1”, which is not mentioned in RAN1#108e agreements. |
| Intel | Y | We think the TP implements some necessary updates and improves the readability of the relevant parts (e.g., “does not expect …” is much better and more appropriate here than “UE assumes …”-based description; the description of handling of paging reception is clearer now). However, harmonization with TPs #2, #3, and #6 should be considered. |
| vivo | Y | TP#1, TP#2 and TP#3 can be discussed together.  |
| CMCC | N | “BWP#0 configuration option 1” in the agreement about paging is not reflected in TP. |
| Ericsson | Y | @Spreadtrum Based on the agreements from RAN1#108-e, paging CSS can only be configured in the separate initial DL BWP (i.e., initial DL BWP provided by *initialDownlinkBWP* in *DownlinkConfigCommonRedCapSIB*) if it contains CD-SSB, irrespective of whether the UE is in idle/inactive mode or in connected mode.We have added “SS/PBCH block and CORESET multiplexing pattern 1” to capture the following agreements:Agreement:* For FR1,
	+ For a separate initial DL BWP (if it does not include CD-SSB and the entire CORESET#0) from RAN1 perspective,
		- […]
	+ […]

Agreement:* For FR2,
	+ For a separate initial DL BWP (if it does not include CD-SSB ~~and the entire CORESET#0~~) from RAN1 perspective,
		- […]
	+ […]
	+ Note: For SSB and CORESET#0 multiplexing pattern 1, if a separate initial/RRC configured DL BWP is configured to contain the entire CORESET#0, CD-SSB is expected by RedCap UE.

Note that FR1 only supports Pattern 1.@Spreadtrum and @CMCC Regarding why we did not explicitly mention “BWP#0 configuration option 1”, our understanding is that the first paragraph in the TP above is applicable for the separate initial DL BWP for BWP configuration option 1 (in idle/inactive and connected modes) as well as BWP configuration option 2 (in idle/inactive). Note that for BWP configuration option 2, the separate initial DL BWP will be provided with *BWP-DownlinkDedicated* in connected mode, which is captured in the 2nd paragraph. |
| Huawei, HiSilicon |  | Perhaps can revisit this after relevant agreements are able to be made. |
| Sharp | Y | We share same views with Intel and vivo.  |
| Spreadtrum2 | Response to E/// | Understood.The agreeement quoted by you seems RAN1#107e agreement. It has been replaced by RAN1#108e agreement as follows.

|  |
| --- |
| Agreement* The following working assumptions from RAN1#107-e are NOT confirmed for idle/inactive mode and furthermore they are replaced by the agreements further down for connected mode.
	+ For FR1,
		- For a separate initial DL BWP (if it does not include CD-SSB and the entire CORESET#0) from RAN1 perspective, …
	+ For FR2,
		- For a separate initial DL BWP (if it does not include CD-SSB) from RAN1 perspective, …
* For BWP#0 configuration option 1,
	+ For FR1,
		- For a separate initial DL BWP, for a RedCap UE in connected mode, paging can only be configured if it contains CD-SSB and the entire CORESET#0.
	+ For FR2,
		- For a separate initial DL BWP, for a RedCap UE in connected mode, paging can only be configured if it contains CD-SSB.
* Note: For BWP#0 configuration option 2, …
 |

But, the NOTE you quoted is the correct NOTE in RAN1#107e agreement.

|  |
| --- |
| * + **Note: For SSB and CORESET#0 multiplexing pattern 1, if a separate initial/RRC configured DL BWP is configured to contain the entire CORESET#0, CD-SSB is expected by RedCap UE.**
 |

Therefore, capturing the above green highlighted is correct. However, I’m not sure whether we need to address multiplexing pattern 1 and neglect “BWP#0 configuraiton option 1”. |
| LGE | Y | Generally fine with intention. But, we also think harmonization among the TPs should be made. |
|  |  |  |

3.2 Text proposal #2

Proposal 4 in contribution [[7]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203307.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| After RAN1#107e, the Text for the presence of the SSB in the RRC-configured DL BWP is drafted as follows:

|  |
| --- |
| For an active DL BWP provided by *BWP-DownlinkDedicated*, a UE assumes that the active DL BWP includes a SS/PBCH block, unless the UE indicates a capability to operate in the DL BWP without receiving an SS/PBCH block, and does not include the CORESET with index 0. |

In RAN1#108-e [3], the presence of the SSB in the RRC-configured DL BWP in connected mode was updated in terms of the working assumption.

|  |
| --- |
| Agreement:* A RedCap UE supports existing applicable mandatory feature(s) that are based on SSB using NCD-SSB (including NCD-SSB based measurements) as mandatory feature(s) in an RRC-configured DL BWP that does not include CD-SSB.
	+ NCD-SSB is ‘QCL’-ed with CD-SSB when the NCD-SSB and CD-SSB share the same SSB index.
	+ Note: RAN1 assumes that NCD-SSB is configured by higher layer
 |

Considering this agreement, a “basic” RedCap UE should support the NCD-SSB and the NCD-SSB is QCLed with CD-SSB. According to this agreement and initial round of email discussion, the original Text is updated to the following Text:

|  |
| --- |
| If an active DL BWP includes an SS/PBCH block provided by dedicated RRC configuration and does not include the SS/PBCH block the UE used to obtain *physCellId* in *ServingCellConfigCommon*, the UE uses the SS/PBCH block [provided by dedicated RRC configuration] to support all Layer-1 UE features that are mandatory without capability signalling as described in [18, TS 38.306]. The SS/PBCH block the UE used to obtain *physCellId* in *ServingCellConfigCommon* and the SS/PBCH block provided by dedicated RRC configuration have same quasi-colocation properties, if they have the same index. |

Some companies suggested differentiating FR1 and FR2 by using multiplexing patterns. We think it may be a misunderstanding in the context of email discussion. Along this way, the Text is finally updated as the follows.

|  |
| --- |
| For an active DL BWP provided by dedicated RRC signalling* the UE assumes that the active DL BWP includes a SS/PBCH block
* for SS/PBCH block and CORESET multiplexing pattern 1, the UE does not expect the active DL BWP to include the CORESET with index 0
* if the active DL BWP includes an SS/PBCH block provided by dedicated RRC signalling and does not include the SS/PBCH block the UE used to obtain [*physCellId* or *SIB*] in *ServingCellConfigCommon*, the UE uses the SS/PBCH block provided by dedicated RRC configuration to support all Layer-1 UE features that are mandatory without capability signalling. The SS/PBCH block the UE used to obtain [*physCellId* or *SIB*] in *ServingCellConfigCommon* and the SS/PBCH block provided by dedicated RRC configuration have same quasi-colocation properties, if they have the same index
 |

We think the sentence that “for SS/PBCH block and CORESET multiplexing pattern 1, the UE does not expect the active DL BWP to include the CORESET with index 0” is not necessary. The “**but not CORESET#0/SIB**” in the agreement can be resolved in RAN2 spec, since RAN2 confirmed the RAN conclusion that RedCap UE monitors paging/SIB only in the initial DL BWP containing CORESET#0.A RedCap UE in idle/inactive mode monitors paging only in an initial BWP (default or RedCap specific) associated with CD-SSB and performs cell (re-)selection and measurements on the CD-SSBFurthermore, the “**but not CORESET#0/SIB**” indeed means no procedure of paging, cell (re-)selection or measurement, which is not suitable to be captured in RAN1 spec. Therefore, we suggest not mentioning “**but not CORESET#0/SIB**” in 38.213 and keeping the original structure of agreements as follows.* Connected mode
	+ BWP#0 configuration option 2
		- For the active RRC-configured DL BWP
			* The presence of the SSB: It has agreements.
	+ BWP#0 configuration option 1
		- For the active RRC-configured DL BWP (the non-initial DL BWP)
			* The presence of the SSB: It has agreements.
		- For the legacy initial DL BWP
			* The presence of the SSB: containing the CD-SSB as legacy, no spec impact.
		- For the separate initial DL BWP
			* The presence of the SSB for paging: It has agreements.
			* The presence of the SSB for random access: It is TBD (Issue 2).
 |

Text proposal:

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**FL2 Medium Priority Question 3.2-1a: Companies are invited to comment on TP2.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Nordic | N | **“For an RRC-configured active DL BWP in connected mode”**MIB or SIB1 is also RRC as it is part of 38.331, therefore we cannot agree with the statemement that initial DL BWP is excluded from the agreement, i.e.* + - For the active RRC-configured DL BWP (~~the non-initial DL BWP~~)
 |
| Intel |  | The intention of the TP is understood, but some harmonization with TP1, TP3, and TP6 needed.  |
| vivo | Y | TP#1, TP#2 and TP#3 can be discussed together.  |
| Ericsson |  | We think this TP may not be needed if TP #1 is agreed. Also, the formulation “UE that supports all Layer-1 UE features that are mandatory without capability signaling” could, if possible, be avoided in TS 38.213. |
| LGE | Y | Generally fine with intention. But, we also think harmonization among the TPs should be made. |
|  |  |  |

3.3 Text proposal #3

Proposal 8 in contribution [[9]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203517.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

|  |
| --- |
| ***Reason for change:*** 1. The conclusion made in RAN#94-e meeting that Rel-17 RedCap UE in idle/inactive mode only use CD-SSB in an initial BWP to monitor paging has not been captured.
2. The following agreements made in RAN1#108-e meeting has not been captured.

Agreement:* A RedCap UE supports existing applicable mandatory feature(s) that are based on SSB using NCD-SSB (including NCD-SSB based measurements) as mandatory feature(s) in an RRC-configured DL BWP that does not include CD-SSB.
	+ NCD-SSB is ‘QCL’-ed with CD-SSB when the NCD-SSB and CD-SSB share the same SSB index.
	+ Note: RAN1 assumes that NCD-SSB is configured by higher layer
1. The description for CD-SSB and NCD-SSB, and BWP#0 configuration option 1 are not accurate.

***Summary of change:*** 1. Capture above conclusion and agreements in clause 17.1.
2. Correct the description for CD-SSB and NCD-SSB, and BWP#0 configuration option 1 based on TS 38.331.

***Consequences if not approved:*** Incomplete support for UEs with reduced capabilities in NR.  |

Text proposal:

|  |
| --- |
| For an initial DL BWP provided by *initialDownlinkBWP* in *DownlinkConfigCommonRedCapSIB*, if a UE is not provided with *BWP-DownlinkDedicated* for the BWP and the UE monitors PDCCH according to a ~~Type1-PDCCH CSS set and does not monitor PDCCH according to~~ Type2-PDCCH CSS set, the UE assumes that the initial DL BWP ~~does not~~ includes SS/PBCH blocks the UE used to obtain a CORESET for Type0-PDCCH CSS set and for SS/PBCH block and CORESET multiplexing pattern 1 includes ~~or~~ the CORESET with index 0. ~~If the UE monitors PDCCH according to Type2-PDCCH CSS set, the UE assumes that the initial DL BWP~~ ~~- includes a SS/PBCH block and the CORESET with index 0 if the UE used the SS/PBCH block to obtain SIB1~~~~- includes a SS/PBCH block and does not include the CORESET with index 0 if the initial DL BWP does not include the SS/PBCH block the UE used to obtain SIB1~~For an active DL BWP provided by *BWP-DownlinkDedicated*, a UE assumes that the active DL BWP includes a SS/PBCH block, unless the UE indicates a capability to operate in the DL BWP without receiving an SS/PBCH block, and for SS/PBCH block and CORESET multiplexing pattern 1 does not include the CORESET with index 0.If the active DL BWP includes an SS/PBCH block provided by *NonCellDefiningSSB* and does not include the SS/PBCH block the UE used to obtain a CORESET for Type0-PDCCH CSS set in *ServingCellConfigCommon*, the UE uses the SS/PBCH block provided by *NonCellDefiningSSB* to support all mandatory UE features that are based on SS/PBCH block. The SS/PBCH block the UE used to obtain a CORESET for Type0-PDCCH CSS set in *ServingCellConfigCommon* and the SS/PBCH block provided by *NonCellDefiningSSB* have same quasi-colocation properties, if they have the same index |

**FL2 Medium Priority Question 3.3-1a: Companies are invited to comment on TP3.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Nordic | Partly, yes | The change to remove TYPE2 text is OK, but TP does not solve the ISSUE#2 |
| CATT | Y | This can be jointly considered with TP1. |
| Spreadtrum | N (need the clarifications) | The similar comments for TP#1.For RAR in connected mode for BWP#0 configuration option 1, it should wait for the conclusion of Issue#2. |
| Intel | Y (in principle) | Should be considered for harmonization with TP1. |
| vivo | Y | TP#1, TP#2 and TP#3 can be discussed together.  |
| Ericsson |  | We think this TP may not be needed if TP #1 is agreed. |
| LGE | Y | Generally fine with intention. But, we also think harmonization among the TPs should be made. |
|  |  |  |

3.4 Text proposal #4

Proposal 3 in contribution [[14]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203787.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

|  |  |  |
| --- | --- | --- |
| According to the current text, restricting the separate initial UL BWP to be smaller than or equal to the maximum RedCap UE bandwidth (which was agreed in RAN1 106-e and is copied as below) is missing. Thus, the current specification text should be updated to reflect this point.

|  |
| --- |
| Agreement:Confirm the following working assumption from RAN1#105-e regarding RACH occasions.* For enabling/supporting that the RACH occasion (RO) associated with the best SSB falls within the RedCap UE bandwidth, support separate initial UL BWP for RedCap UEs (which is not expected to exceed the maximum RedCap UE bandwidth), and this separate initial UL BWP for RedCap includes ROs for RedCap UEs.
	+ Note: these ROs can be dedicated for RedCap UEs or shared with non-RedCap UEs.
 |

In addition, according to the RedCap CR of 38.331[2] as indicated below, there is no definition of *DownlinkConfigCommonRedCapSIB* and *UplinkConfigCommonRedCapSIB* dedicated for RedCap. RedCap would reuse the IE of *UplinkConfigCommonSIB* and *DownlinkConfigCommonSIB* for UL/DL configuration. As for the configuration of separate initial UL BWP and initial DL BWP, new IE *initialUplinkBWP-RedCap* and *initialDownlinkBWP-RedCap* are defined, respectively. Considering this point, terminology and signalling structure should be aligned across different specifications.

|  |
| --- |
| ***DownlinkConfigCommonSIB* information element**-- ASN1START-- TAG-DOWNLINKCONFIGCOMMONSIB-STARTDownlinkConfigCommonSIB ::= SEQUENCE { frequencyInfoDL FrequencyInfoDL-SIB, initialDownlinkBWP BWP-DownlinkCommon, bcch-Config BCCH-Config, pcch-Config PCCH-Config, ..., [[ initialDownlinkBWP-RedCap-r17 BWP-DownlinkCommon OPTIONAL -– Need R ]]}***UplinkConfigCommonSIB* information element**-- ASN1START-- TAG-UPLINKCONFIGCOMMONSIB-STARTUplinkConfigCommonSIB ::= SEQUENCE { frequencyInfoUL FrequencyInfoUL-SIB, initialUplinkBWP BWP-UplinkCommon, timeAlignmentTimerCommon TimeAlignmentTimer}UplinkConfigCommonSIB-v17xy ::= SEQUENCE { initialUplinkBWP-RedCap-r17 BWP-UplinkCommon OPTIONAL -- Need R}-- TAG-UPLINKCONFIGCOMMONSIB-STOP-- ASN1STOP |

  |

Text proposal:

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|   |

**FL2 Medium Priority Question 3.4-1a: Companies are invited to comment on TP4.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Nordic | Wait | This clarification can be completed when ISSUE#1 is resolved. |
| Spreadtrum | Wait | Share the similar view as Nordic |
| vivo |  | We share with Nordic’s view.  |
| Ericsson | Y | The TP is related to UL BWP. So, we are fine with not waiting until resolution of Issue #1 to agree to the TP. Regarding the change to parameter names, we prefer to wait until RAN2 sends back the list of used RRC parameter names. |
| Sharp | Y | We share same view with Ericsson. |
| LGE | Y | Share the same view with Ericsson. |
| FL4 | Based on the received responses, the following proposal (corresponding to TP4) can be considered.**Medium Priority Proposal 3.4-1b: Agree TP for TS 38.213 clause 17.1 in Proposal 3 in** [**R1-2203787**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203787.zip)**.** |
| vivo |  | We prefer to wait until Issue #1 is resolved. But if majority companies are fine to agree it now, we are fine with it.  |
| CATT | Y |  |

3.5 Text proposal #5

Proposal 3 in contribution [[18]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204036.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

|  |
| --- |
| Next, we discuss corrections to the text in TS 38.213 based on the following considerations. Some of the RedCap parameter names used in TS 38.213 are not aligned with how the RedCap-specific configurations are defined in TS 38.331. Specifically, a separate initial DL BWP (*initialDownlinkBWP*) and initial UL BWP (*initialUplinkBWP*) are not configured, for RedCap UEs in new *DownlinkConfigCommonRedCapSIB* and *UplinkConfigCommonRedCapSIB* IEs, respectively. Rather, a new initial DL BWP IE (*initialDownlinkBWP-RedCap*) and a new initial UL BWP IE (*initialUplinkBWP-RedCap*) are defined in the legacy downlink and uplink common configuration IEs *DownlinkConfigCommonSIB* and *UplinkConfigCommonSIB*, respectively.The name and use of the parameter for enabling/disabling frequency hopping for PUCCH transmission in TS 38.213 is not aligned with the definition and description in TS 38.331. Specifically, frequency hopping is disabled not by providing *disable-FH-PUCCH* (which is not defined) but rather by omitting the parameter *intra-SlotFH*.Another parameter name misalignment issue is related to how the configuration for 4-step or 2-step RACH is provided to the RedCap UE. According to the current specification text in TS 38.213, the RedCap UE is provided *RACH-ConfigCommon-RedCap* or *RACH-ConfigCommonTwoStepRA-RedCap*. This suggests that separate RACH configurations are provided for RedCap UEs and non-RedCap UEs in *BWP-UplinkCommon* configured with the legacy *initialUplinkBWP* IE. This may cause some confusion, however, since according to the specification in TS 38.331, the RACH configurations for a RedCap UE are provided in *rach-ConfigCommon* or *msgA-ConfigCommon* in *BWP-UplinkCommon* configured for the separate UL BWP by *initialUplinkBWP-RedCap*. |

Text proposal:

|  |
| --- |
| A UE expects the initial DL BWP and the active DL BWP after the UE (re)establishes dedicated RRC connection to be smaller than or equal to the maximum DL bandwidth that the UE supports. A UE can be provided a DL BWP by *initialDownlinkBWP-RedCap* in *DownlinkConfigCommon~~RedCap~~SIB*, and an UL BWP by *initialUplinkBWP-RedCap* in *UplinkConfigCommon~~RedCap~~SIB*. If *initialUplinkBWP* in *UplinkConfigCommonSIB* indicates an UL BWP that is larger than a maximum UL BWP that a UE supports, the UE expects to be provided an UL BWP by *initialUplinkBWP-RedCap* in *UplinkConfigCommon~~RedCap~~SIB*.A UE can be provided by *BWP-DownlinkDedicated* a DL BWP, other than the initial DL BWP. A UE can be provided by *BWP-UplinkDedicated* an UL BWP, other than the initial UL BWP, that is smaller than or equal to the maximum UL bandwidth that the UE supports. ~~If a UE is provided~~ *~~RACH-ConfigCommon-RedCap~~* ~~or~~ *~~RACH-ConfigCommonTwoStepRA-RedCap~~*~~, the UE uses corresponding parameters to perform the procedures in clauses 8.1, 8.1A, and 8.3; otherwise, the UE uses corresponding parameters from~~ *~~RACH-ConfigCommon~~* ~~or~~ *~~RACH-ConfigCommonTwoStepRA~~*~~.~~If a UE is provided an UL BWP by *initialUplinkBWP-RedCap* in *UplinkConfigCommonSIB* and is provided *rach-ConfigCommon* or *msgA-ConfigCommon* in *BWP-UplinkCommon* for this UL BWP, the UE uses corresponding parameters to perform the procedures in clauses 8.1, 8.1A, and 8.3; otherwise, the UE uses corresponding parameters from *rach-ConfigCommon* or *msgA-ConfigCommon* in *BWP-UplinkCommon* for the UL BWP provided by *initialUplinkBWP*.If a UE is provided *initialUplinkBWP-RedCap* in *UplinkConfigCommon~~RedCap~~SIB* and does not have dedicated PUCCH resource configuration, the UE transmits PUCCH with HARQ-ACK information as described in clause 9.2.1 using a PUCCH resource set provided by *pucch-ResourceCommonRedCap*, except that frequency hopping for the PUCCH transmission is disabled if the field *intra-SlotFH* is not present *~~disable-FH-PUCCH~~* ~~is provided~~ in *PUCCH-ConfigCommon~~RedCap~~*. If frequency hopping of the PUCCH transmission is disabled then, for the PUCCH transmission, the UE determines the initial cyclic shift index in the set of initial cyclic shift indexes as $r\_{PUCCH}modN\_{CS}$ and determines the PRB index as- $RB\_{BWP}^{offset}+RB\_{BWP}^{offset-add}+\left⌊{r\_{PUCCH}}/{N\_{CS}}\right⌋$, if *BWP-part* = '*FromLowerEdge*'- $N\_{BWP}^{size}-RB\_{BWP}^{offset}-RB\_{BWP}^{offset-add}-1-\left⌊{r\_{PUCCH}}/{N\_{CS}}\right⌋$, otherwisewhere $RB\_{BWP}^{offset-add}$ is provided by *additional-RB-Offset*, if provided; otherwise, $RB\_{BWP}^{offset-add}=0.$ |

**FL2 Medium Priority Question 3.5-1a: Companies are invited to comment on TP5.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Nordic  | Y |  |
| CATT | Y |  |
| Nokia, NSB | Y |  |
| Intel | Y |  |
| vivo | Y |  |
| Ericsson  | Y |  |
| Sharp | Y with modification | According to description in TS38.331 h00 as below, ‘not’ in the ‘if the field *intra-SlotFH* is not present’ should be removed. ***intra-SlotFH-r17***In case a separate initial UL BWP is configured for RedCap UEs, the presence of this parameter indicates whether intra-slot PUCCH frequency hopping within the separate initial UL BWP in the common PUCCH resource is enabled for RedCap UEs. If this field is absent, intra-slot PUCCH frequency hopping within RedCap-specific initial UL BWP is enabled. If this field is present, intra-slot PUCCH frequency hopping within RedCap-specific initial UL BWP is disabled and each PUCCH resource is mapped to a single PRB on one side of the UL BWP and this parameter determines whether the PRB index in the PRB mapping is counted in increasing order from the lower edge or in decreasing order from the upper edge of the UL BWP.  |
| LGE | Y | It seems Sharp made a valid point. The parameter name and the interpretation should be coordinated with the TS 38.331 spec. |
| FL4 | Based on the received responses, the following proposal (corresponding to a modified version of TP5) can be considered.**Medium Priority Proposal 3.5-1b: Agree TP for TS 38.213 clause 17.1 in Proposal 3 in** [**R1-2204036**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204036.zip) **with the following modification: the word ‘not’ is removed in “the field *intra-SlotFH* is not present”.** |
| vivo | Y |  |
| CATT | Y |  |

3.6 Text proposal #6

Section 2.3 in contribution [[22]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204277.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

|  |
| --- |
| In draft CR 38.213, existing text about SSB transmission when paging is configured is as below.If the UE monitors PDCCH according to Type2-PDCCH CSS set, the UE assumes that the initial DL BWP - includes a SS/PBCH block and the CORESET with index 0 if the UE used the SS/PBCH block to obtain SIB1- includes a SS/PBCH block and does not include the CORESET with index 0 if the initial DL BWP does not include the SS/PBCH block the UE used to obtain SIB1In last round of discussion on CR, there has been no consensus on how to capture SSB transmission for paging reception in separate initial DL BWP for BWP#0 configuration option 1 and option 2. |

Text proposal:

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**FL2 Medium Priority Question 3.6-1a: Companies are invited to comment on TP6.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Y/N** | **Comments** |
| Nordic  | N | Again, we think there is no need to differentiate CD and NCD SSB in RAN1 |
| Spreadtrum | N (need the clarifications) | The similar comments for TP#1. |
| Intel |  | The intention of the TP is understood, but some harmonization with TP1, TP2, and TP3 needed.  |
| vivo | Wait | This TP can be discussed after Issue#2 is solved.  |
| Ericsson |  | We think this TP may not be needed if TP #1 is agreed. |
| LGE |  | Same view with Intel |
|  |  |  |

3.7 Text proposal #7

Proposal 1 in contribution [[26]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204663.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

|  |  |
| --- | --- |
| ***Reason for change:*** | 1. Current specification does not clearly describe, when the RedCap UE is provided the initial DL BWP by the separate initial DL BWP configuration if the RedCap UE receives the separate initial DL BWP configuration in SIB1 and the separate DL BWP does not include the CORESET#0. 2. Current specification does not clearly describe, when the RedCap UE is provided the initial UL BWP by the separate initial UL BWP configuration if RedCap UE receives the separate initial UL BWP configuration in SIB1.  |
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| ***Summary of change:*** | 1.Clarify that if RedCap UE receives the seperate initial DL BWP configuration in SIB1 and the separate initial DL BWP does not include the CORESET#0, the RedCap UE is provided the initial DL BWP by the separate initial DL BWP configuration upon and after the initiation of the random access procedure. 2. Clarify that if RedCap UE receives the seperate initial UL BWP configuration in SIB1, the RedCap UE is provided the initial UL BWP by the separate initial UL BWP configuration.  |
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| ***Consequences if not approved:*** | 1.It is unclear when the RedCap UE is provided the initial DL BWP by the separate initial DL BWP configuration if the separate initial DL BWP does not include the CORESET#0. 2. It is unclear when the RedCap UE is provided the initial UL BWP by the separate initial UL BWP configuration.  |

Text proposal:

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| A UE expects the initial DL BWP and the active DL BWP after the UE (re)establishes dedicated RRC connection to be smaller than or equal to the maximum DL bandwidth that the UE supports. A UE can be provided a DL BWP by *initialDownlinkBWP* in *DownlinkConfigCommonRedCapSIB*, and an UL BWP by *initialUplinkBWP* in *UplinkConfigCommonRedCapSIB*. If a UE is provided the DL BWP by *initialDownlinkBWP* in *DownlinkConfigCommonRedCapSIB* not including the CORESET with index 0, the UE is provided an initial DL BWP by the *initialDownlinkBWP* in *DownlinkConfigCommonRedCapSIB* upon initiation of the physical random access procedure. If a UE is provided *initialUplinkBWP* in *UplinkConfigCommonRedCapSIB*, the UE is provided an initial UL BWP by the *initialUplinkBWP* in *UplinkConfigCommonRedCapSIB.* If *initialUplinkBWP* in *UplinkConfigCommonSIB* indicates an UL BWP that is larger than a maximum UL BWP that a UE supports, the UE expects to be provided an UL BWP by *initialUplinkBWP* in *UplinkConfigCommonRedCapSIB*.A UE can be provided by *BWP-DownlinkDedicated* a DL BWP, other than the initial DL BWP. A UE can be provided by *BWP-UplinkDedicated* an UL BWP, other than the initial UL BWP, that is smaller than or equal to the maximum UL bandwidth that the UE supports. |

**FL2 Medium Priority Question 3.7-1a: Companies are invited to comment on TP7.**

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| **Company** | **Y/N** | **Comments** |
| Nordic  | Wait | This seems to address ISSUE#1. |
| Spreadtrum | Wait | Share the similar view as Nodic |
| vivo |  | For downlink, we can wait for issue#1. For uplink, if TP#5 is adopted, the TP seems not needed.  |
| Ericsson | Needs clarification | The reason for changes, at least those related to UL BWP, is not clear to us. Perhaps Sharp could clarify the intention in the next round.  |
| Sharp |  | @Ericsson. Thanks for your comments. As in Rel-15/16, there are specific definitions for initial DL/UL BWPs. For a UE, before SIB1 recetpion, initial DL BWP is CORESET#0, which upon reception of SIB1, initial DL BWP is the SIB1-configured DL BWP. And upon reception of SIB1, the UE is provided initial UL BWP. However, we fail to see a clear definition of initial DL/UL BWP in the current spec for RedCap UE. Therefore, the intention of the TP related to DL BWP is to solve the ambiguity on definition of the separate initial DL BWP if the separate initial DL BWP does not include CORESET#0. In this case, even if the RedCap UE receives the SIB1, the RedCap UE can not be immediately provided the separate initial DL BWP as initial DL BWP until initiation of RACH procedure. On the other hand, the intention of the TP related to UL BWP is to clarity that separate initial UL BWP should be provided to RedCap UE as initial UL BWP if the RedCap UE receives the SIB1.Lastly, futher wording modification including correction of RRC parameters seems necessary. |
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3.8 Text proposal #8

Proposal 4 in contribution [[28]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204744.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

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| In our opinion, SSB presence shall not be dependent on TYPE-2 CSS being configured for BWP or not. At the same time, it should not depend on whether BWP has been configured with BWP-DownlinkDedicated or not (as in current spec). Instead, based on agreements (“For an RRC-configured active DL BWP in connected mode (if it does not include CD-SSB and the entire CORESET#0) from RAN1 perspective”) it should depend on whether UE is RRC connected or not. When it comes to paging, RAN1 should leave capturing of current RAN1 paging agreements to RAN2. |

Text proposal:

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| For an initial DL BWP provided by *initialDownlinkBWP-RedCap* if the BWP does not include CORESET with index 0 and UE does not monitor PDCCH candidates for DCI formats with CRC scrambled by a C-RNTI, UE assumes that the BWP does not include SS/PBCH block. *~~initialDownlinkBWP~~* ~~in~~ *~~DownlinkConfigCommonRedCapSIB~~*~~, if a UE monitors PDCCH according to a Type1-PDCCH CSS set and does not monitor PDCCH according to Type2-PDCCH CSS set, the UE assumes that the initial DL BWP does not include SS/PBCH blocks or the CORESET with index 0. If the UE monitors PDCCH according to Type2-PDCCH CSS set, the UE assumes that the initial DL BWP~~ ~~- includes a SS/PBCH block and the CORESET with index 0 if the UE used the SS/PBCH block to obtain SIB1~~~~- includes a SS/PBCH block and does not include the CORESET with index 0 if the initial DL BWP does not include the SS/PBCH block the UE used to obtain SIB1~~If a UE monitors PDCCH candidates for DCI formats with CRC scrambled by a C-RNTI, for an active DL BWP ~~provided by~~ *~~BWP-DownlinkDedicated~~*~~,~~ a UE assumes that the active DL BWP includes a SS/PBCH block, unless the UE indicates a capability to operate in the DL BWP without receiving an SS/PBCH block, and does not include the CORESET with index 0. |

**FL2 Medium Priority Question 3.8-1a: Companies are invited to comment on TP8.**

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| **Company** | **Y/N** | **Comments** |
| Nordic  | Wait | This has two aspects included* Removing paging stuff from RAN1 similar to TP#3
* Removing dependency on BWP-DownlinkDedicated, to align RAN1 specification to RAN1 agreement. And solving also Issue #2
 |
| vivo |  | We share Nordic’s views.  |
| Ericsson | Wait | Wait until Issue #2 is resolved |
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3.9 Text proposal #9

Proposal 2 in contribution [[29]](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204771.zip) has the following motivation for its text proposal for TS 38.213 clause 17.1:

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| The following have been agreed in past RAN1 meetings.

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| **Agreement***For FR1,** *For TDD, center frequencies are assumed to be the same for the initial DL (FFS: if it does not include CD-SSB and the entire CORESET#0) and UL BWPs used during random access for RedCap UEs.*
	+ *FFS: For Option 1 and Option 2, whether the case that the center frequencies are different is also supported, and whether RedCap UE can expect CD-SSB and CORESET#0 in this case*
* *For TDD, center frequencies are assumed to be the same for non-initial DL and UL BWPs with the same BWP id for a RedCap UE.*
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| **Agreement*** **For FR1 and FR2, for TDD, when a (separate or shared) initial DL BWP includes CD-SSB (for FR1 and FR2) and the entire CORESET#0 (for FR1), the center frequencies for the (separate or shared) initial DL BWP and the (separate or shared) initial UL BWP are assumed to be the same.**
 |

that, in TDD deployments, center frequencies of initial UL and initial DL BWPs are expected to be the same for RedCap UEs. However, this has not yet been captured in the latest version of TS 38.213. As part of the post-meeting CR review discussions after RAN1 #107-e meeting, the specification editor had indicated the reason for not capturing it since the center frequency alignment is captured since Rel-15 in Section 12 of TS 38.213. However, in our understanding, the current text in Section 12 of TS 38.213 is not sufficient since it does not capture the decision pertinent to RedCap accurately. The current spec-text (since Rel-15) says the following:

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However, the above fails to capture the decision for RedCap accurately since, with the possible configuration of one or more of separate initial DL BWP and separate initial UL BWP for RedCap UEs the notion of “same BWP-Id” becomes ambiguous. For instance, when configured with separate initial DL BWP for RedCap UE for monitoring of Type1-PDCCH CSS set while Types 0/0A/2 PDCCH CSS sets are configured to MIB-configured CORESET#0, the UE should expect the BWP associated with Type1-PDCCH CSS set should have aligned center frequency with initial UL BWP in which the UE is expected to transmit Msg1/Msg3 or MsgA and not necessarily the initial DL BWP defined by MIB-configured CORESET#0 which the UE would use for receiving CD-SSB, SIB, or paging. Thus, it would be necessary to capture in the RAN1 specifications that a RedCap UE does not expect to receive a configuration where the center frequency for an initial DL BWP in which the UE is configured to monitor Type1-PDCCH CSS set (separate or shared with non-RedCap UEs) is different than the center frequency for an initial UL BWP (separate or shared with non-RedCap UEs) in which the RedCap UE may transmit Msg1/Msg3 or MsgA. |

Text proposal:

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| A RedCap UE does not expect to receive a configuration where the center frequency for an initial DL BWP in which the UE is configured to monitor Type1-PDCCH CSS set (separate or shared with non-RedCap UEs) is different than the center frequency for an initial UL BWP (separate or shared with non-RedCap UEs) in which the RedCap UE may transmit Msg1/Msg3 or MsgA. |

**FL2 Medium Priority Question 3.9-1a: Companies are invited to comment on TP9.**

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| **Company** | **Y/N** | **Comments** |
| Intel | Y | For the TP, the text in the parentheses should be deleted 😊. |
| vivo | Y | Text in parentheses can be removed.  |
| Ericsson | Y | Agree with Intel and Vivo that the text within parentheses should be removed. |
| Huawei, HiSilicon | Wait | The TP does not say for TDD.The TP concerns the highlighted part of a R15 text while the sentence ahead of that part may also needs clarification, since the proponent consider the same BWP-id becomes problematic.  |
| Sharp | Y | ‘For unpaired spectrum operation,’ can be added at the beginning of the TP. |
| LGE | Y | Agree with the comment from Intel and Sharp. |
| FL4 | Based on the received responses, the following proposal (corresponding to a modified version of TP9) can be considered.**Medium Priority Proposal 3.9-1b: Agree the following TP for TS 38.213 clause 17.**

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| For unpaired spectrum operation, a RedCap UE does not expect to receive a configuration where the center frequency for an initial DL BWP in which the UE is configured to monitor Type1-PDCCH CSS set is different than the center frequency for an initial UL BWP in which the RedCap UE may transmit Msg1/Msg3 or MsgA. |

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| vivo | Y |  |
| CATT | Y |  |

# References

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| --- | --- | --- | --- |
| [1] | [RP-220966](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_95e/Docs/RP-220966.zip) | Revised WID on support of reduced capability NR devices | Ericsson |
| [2] | [R1-2202535](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_108-e/Docs/R1-2202535.zip) | RAN1 agreements for Rel-17 NR RedCap | Rapporteur (Ericsson) |
| [3] | [R1-2203053](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203053.zip) | Remaining aspects of Bandwidth Reduction for RedCap UEs | Futurewei |
| [4] | [R1-2203109](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203109.zip) | Remaining issues on UE complexity reduction | Huawei, HiSilicon |
| [5] | [R1-2203114](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203114.zip) | Maintenance issues for UE complexity reduction for RedCap | Ericsson |
| [6] | [R1-2203115](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203115.zip) | Draft summary of WI on support of reduced capability (RedCap) NR devices | Ericsson |
| [7] | [R1-2203307](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203307.zip) | Remaining issues on aspects related to reduced maximum UE bandwidth | Spreadtrum Communications |
| [8] | [R1-2203438](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203438.zip) | Remaining issues on RedCap UE complexity reduction in Rel-17 | CATT |
| [9] | [R1-2203517](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203517.zip) | Remaining issues on reduced maximum UE bandwidth | Vivo, Guangdong Genius |
| [10] | [R1-2203518](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203518.zip) | Remaining issues on RedCap half-duplex operation | Vivo, Guangdong Genius |
| [11] | [R1-2203593](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203593.zip) | Discussion on UE complexity reduction for Rel-17 Redcap UE | ZTE, Sanechips |
| [12] | [R1-2203594](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203594.zip) | Remaining aspects for Rel-17 RedCap UE | ZTE, Sanechips |
| [13] | [R1-2203762](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203762.zip) | SIB reception for RedCap UE | Panasonic |
| [14] | [R1-2203787](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203787.zip) | Discussion on the remaining issues of complexity reduction | Xiaomi |
| [15] | [R1-2203788](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203788.zip) | Discussion on the other aspects for R17 RedCap | Xiaomi |
| [16] | [R1-2203866](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203866.zip) | Remaining issues on UE complexity reduction | Samsung |
| [17] | [R1-2203992](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2203992.zip) | Other remaining issues for Reduced Capability NR Devices | OPPO |
| [18] | [R1-2204036](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204036.zip) | Remaining Issues in UE Complexity Reduction | Nokia, Nokia Shanghai Bell |
| [19] | [R1-2204037](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204037.zip) | Other Remaining Issues in RedCap Support | Nokia, Nokia Shanghai Bell |
| [20] | [R1-2204208](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204208.zip) | Reduced maximum UE bandwidth for Redcap | Apple |
| [21] | [R1-2204209](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204209.zip) | On other UE complexity reduction aspects of RedCap | Apple |
| [22] | [R1-2204277](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204277.zip) | Remaining issues on UE complexity reduction | CMCC |
| [23] | [R1-2204347](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204347.zip) | Maintenance on complexity reduction for RedCap | NTT DOCOMO, INC. |
| [24] | [R1-2204435](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204435.zip) | Remaining details on BWP operation for RedCap | NEC |
| [25] | [R1-2204619](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204619.zip) | Remaining aspects of UE complexity reduction for RedCap | LG Electronics |
| [26] | [R1-2204663](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204663.zip) | Remaining issues on UE complexity reduction for RedCap NR devices | Sharp |
| [27] | [R1-2204711](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204711.zip) | On RedCap UE complexity reduction | MediaTek Inc. |
| [28] | [R1-2204744](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204744.zip) | On remaining aspects related to reduced maximum UE BW | Nordic Semiconductor ASA |
| [29] | [R1-2204771](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204771.zip) | Remaining details on UE complexity reduction for Rel-17 RedCap | Intel Corporation |
| [30] | [R1-2204772](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204772.zip) | Remaining details on support of HD-FDD for Rel-17 RedCap | Intel Corporation |
| [31] | [R1-2204906](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204906.zip) | Remaining issues on RAN2 related issues | Huawei, HiSilicon |
| [32] | [R1-2204987](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_109-e/Docs/R1-2204987.zip) | Remaining Issues on UE Complexity Reduction | Qualcomm Incorporated |
| [33] | [R1-2202532](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_108-e/Docs/R1-2202532.zip) | FL summary #5 on reduced maximum UE bandwidth for RedCap | Moderator (Ericsson) |
| [34] | [TS 38.331 V17.0.0](https://www.3gpp.org/ftp/Specs/archive/38_series/38.331/38331-h00.zip) | NR; Radio Resource Control (RRC) protocol specification (Release 17) | 3GPP |