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RAN1

3GPP TSG-RAN WG1 Meeting
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e-Meeting, 12th – 20th April, 2021

Agenda Item: 8.6.1.1

Title: FL summary #3 on reduced maximum UE bandwidth
 for RedCap

Source: Moderator (Ericsson)

Document for: Discussion, Decision

1 Introduction

For background information, see R1-2103823.

https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Inbox/R1-2103823.zip

https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103823.zip

2 High Priority Proposal 2-1 (locked)

High Priority Proposal 2-1:

During initial access, the initial DL BWP for RedCap UEs can be the same as the MIB-configured initial DL BWP for non-RedCap UEs, regardless of any potential SIB1 configuration of bandwidth.

Feedback Form 1: Can Proposal 2-1 be agreed? If not, please explain why.

Item	Company	Comments
1	QUAL-COMM JAPAN LLC.	Yes
2	NTT DO-COMO INC.	Yes

Item	Company	Comments
3	CATT	Yes
4	ZTE Corporation	<p>We have concern on the 'regardless of' part</p> <p>During initial access, the initial DL BWP for non-RedCap UEs is same as MIB-configured CORESET #0. Since the size of CORESET #0 is within the maximum bandwidth of RedCap UEs, it can be used for RedCap UEs. However, whether to use additional CORESET for scheduling of Msg2/Msg4/Paging/SI messages is conflict with "regardless of any potential SIB1 configuration of bandwidth". This part should be removed.</p> <p>We suggest to change Proposal 2-1 to:</p> <p>During initial access, the initial DL BWP for RedCap UEs can be the same as the MIB-configured initial DL BWP for non-RedCap UEs.</p>
5	Nordic Semiconductor ASA	<p>Agree that it can be the same, but could it be also different, e.g. for offloading purposes? For example CORESET#0/REDCAP RO could be replicated for REDCAP UEs to other parts of the gNB DL/UL carrier indicated in SIB1. This can be achieved by multiple small initial DL BWPs or one large initial DL BWP (configurable in SIB1 already) + RB-sets. Therefore, it would be good to have at least an FFS on whether it can be also different.</p>
6	HUAWEI Technologies Japan K.K.	<p>“, regardless of any potential SIB1 configuration of bandwidth” is not needed.</p>
7	vivo Communication Technology	<p>We are generally OK, but would like to propose the following modification for better clarity:</p> <p>During initial access, the initial DL BWP for RedCap UEs can be the same as the MIB-configured initial DL BWP for non-RedCap UEs, which does not exceed the RedCap UE maximum bandwidth, regardless of any potential SIB1 configuration of bandwidth.</p>
8	Xiaomi Communications	<p>Partially Yes</p> <p>For FDD, our answer is Yes.</p> <p>But for TDD, we think this issue should be discussed with the configuration of initial UL BWP jointly. In TDD system, the center frequency of DL BWP and UL BWP should be kept the same. Then, if the center frequency of the initial UL BWP for Redcap is different from this MIB configured initial DL BWP, then the MIB-configured initial DL BWP can't be reused for Redcap. Considering this point, we think further study is needed for TDD case.</p>
9	Panasonic Corporation	Yes
10	Spreadtrum Communications	<p>Partially Yes. The purpose is to avoid the RedCap UE operation in the wider BWP than the RedCap UE bandwidth after Msg4 and before application of RRC reconfiguration. Our position seems be misunderstood. It is OK for FDD, but for TDD, how to deal with the alignment of center frequency of initial DL BWP and initial UL BWP should be discussed. We do not prefer RF retuning at RedCap UE side.</p>

Item	Company	Comments
11	Shenzhen YZF Network Technolog	During initial access, initial DL BWP shall be defined by CORESET#0, which does not exceed the RedCap UE bandwidth.
12	Shenzhen YZF Network Technolog	[Repeat the comment] OPPO: During initial access, initial DL BWP shall be defined by CORESET#0, which does not exceed the RedCap UE bandwidth.
13	China Mobile Com. Corporation	We want to clarify the configuration of initial DL BWP. When the SIB1-configured separate initial UL BWP for RedCap UEs and MIB-configured initial DL BWP for non-RedCap UEs have the same center frequency, the initial DL BWP for RedCap UEs can be the same as the MIB-configured initial DL BWP. When the SIB1-configured separate initial UL BWP for RedCap UEs and MIB-configured initial DL BWP for non-RedCap UEs have different center frequency, whether the initial DL BWP for RedCap UEs can be configured differently from the MIB-configured initial DL BWP? In this case, if the initial DL BWP for RedCap UEs is the same as the MIB-configured initial DL BWP, frequent RF retuning between initial DL BWP and initial UL BWP during initial access is required.
14	NEC Corporation	[NEC] Yes
15	Futurewei Technologies	No, as written. The intent of the FL with the proposal is not so clear in terms of what new behavior is intended for RedCap UEs, particularly with the "regardless...". We are OK with the proposal with addition of clarification on bandwidth (as Vivo) and removal of the "regardless..." text. However, we also note the two existing agreed bullets and wonder what is the new aspect. Note that we do not support adding an FFS where the MIB for RedCap is different. Agreement from RAN1#104e: <ul style="list-style-type: none"> • Sharing of the same SSB and CORESET#0 between RedCap and non-RedCap UEs is supported when the bandwidth is no wider than the RedCap UE bandwidth • The initial DL BWP (derived based on MIB/SIB) for RedCap UEs can be the same as the initial DL BWP for non-RedCap UEs at least when the initial DL BWP is no wider than the RedCap UE bandwidth.
16	China Telecommunications	[China Telecom] Yes, but we think there is no need to add " regardless of any potential SIB1 configuration of bandwidth ".

3 High Priority Proposal 2-1a (locked)

Based on the received feedback on Proposal 2-1 in this discussion document and in the GTW session on Monday 12th April, the following updated proposal can be considered.

High Priority Proposal 2-1a:

During initial access, the bandwidth and location of the initial DL BWP for RedCap UEs can be the same as the bandwidth and location of the MIB-configured initial DL BWP for non-RedCap UEs.

This does not preclude separate bandwidth and location for initial DL BWP for RedCap UEs in TDD (FFS).

Feedback Form 2: Can Proposal 2-1a be agreed? If not, please explain why.

Item	Company	Comments
1	Ericsson Inc.	[Ericsson] Y. Our understanding is the initial DL BWP is configured in both MIB and SIB1. The configuration (e.g. pdccch-ConfigCommon and pdsch-ConfigCommon) provided in SIB1 is relevant for UE's operation during initial access. But, the specification says that the UE "applies the locationAndBandwidth only after reception of RRCSetup/RRCResume/RRCReestablishment."
2	TCT Mobile Limited	[TCL] Y. The initial DL BWP(drived based on MIB) is no wider the Redcap UE bandwidth, so it is sufficient to shedule all DL meessages to reducap UE during initial access .

Item	Company	Comments
3	Intel Corporation (UK) Ltd	<p>[Intel] We would like to suggest to update the proposal to also cover the aspect on size of the DL BWP #0 in Idle/Inactive modes.</p> <ul style="list-style-type: none"> • During initial access, the bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth. • During initial access, the bandwidth and location of the initial DL BWP for RedCap UEs can be the same as the bandwidth and location of the MIB-configured initial DL BWP for non-RedCap UEs. <ul style="list-style-type: none"> – This does not preclude separate or additional bandwidth and location for initial DL BWP for RedCap UEs in TDD (FFS). <p>The suggested changes in the "FFS" sub-bullet is to capture the case of configuring an additional DL BWP/CORESET for offloading and this case is not limited to TDD use-cases. On that note, for TDD, we do not think it is necessary to ensure that DL and UL BWP #0 have common center frequency, especially in the context of initial access (idle/inactive mode behavior). This is because the instances of UL reception are rather limited when in Idle/Inactive modes, and any DL-UL frequency retuning time that may be needed can be easily accommodated as part of the random access procedure. In this context, we should also ask RAN4 on frequency retuning time if needed during DL-to-UL BWP switching and vice versa in TDD systems.</p> <p>We also agree with Ericsson's description on the relevance of both MIB and SIB1 signaling for DL BWP #0 configuration for operations in Idle/Inactive modes.</p>
4	vivo Communication Technology	<p>[vivo] We think it should be also clarified that the initial DL BWP for Redcap UEs during initial access does not exceed the RedCap UE BW capability, and we support the proposed update from Intel.</p>
5	Nokia	<p>[Nokia] Yes. We support also the clarification that the initial DL BWP during initial access is less than the RedCap UE BW.</p>

Item	Company	Comments
6	China Telecommunications	<p>[China Telecom] Yes, and we generally support the updated proposal from Intel. In our understanding, the first main bullet is additional clarification for the second main bullet. We would like to have the following updated proposal:</p> <ul style="list-style-type: none"> • During initial access, the bandwidth and location of the initial DL BWP for RedCap UEs can be the same as the bandwidth and location of the MIB-configured initial DL BWP for non-RedCap UEs. <ul style="list-style-type: none"> – The bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth. – This does not preclude separate or additional bandwidth and location for initial DL BWP for RedCap UEs in TDD (FFS). <p>During initial access, the initial DL BWP for RedCap UEs can be the same as MIB-configured initial DL BWP for non-RedCap UEs, but does not exceed the maximum bandwidth of RedCap UEs.</p>
7	NTT DO-COMO INC.	[DOCOMO] Yes, and we are also fine with the update from intel
8	QUAL-COMM JAPAN LLC.	[Qualcomm] Yes
9	WILUS Inc.	[WILUS] Yes. For the last bullet, we are also fine with removing "in TDD" as suggested by Intel and China Telecom.
10	Samsung Electronics Polska	<p>[Samsung] We suggest to change the second bullet as FFS Separate bandwidth and location for initial DL BWP for RedCap UEs. In addition, we think this can be also apply to idle/inactive mode.</p>
11	Futurewei Technologies	Yes. Like other other companies, we would like to add a statement that the initial DL BWP is no wider than the RedCap maximum BW.
12	LG Electronics Inc.	[LG] Yes if the "in TDD" is removed in the second sentence as we also see the benefit of separate initial DL BWP/CORESET#0 for offloading is not limited to the TDD case. The update suggested by Intel is okay to us in general.
13	Lenovo (Beijing) Ltd	[Lenovo, Motorola Mobility] Yes.
14	Nordic Semiconductor ASA	Do not support. We do not understand why separate initial DL BWP/CORESET#0 is restricted to TDD only. We suggest to update the bullet: This does not preclude different bandwidth and/or location for initial DL BWP/CORESET#0 for RedCap UEs. (FFS)

Item	Company	Comments
15	NEC Corporation	[NEC] Yes. We agree with Intel's comment on center frequency alignment between active UL and DL BWP for TDD during initial access. It would be worth consideration.
16	CATT	[CATT] Yes. Also, we are fine to add the explanation of 'initial DL BWP is no wider than the maximum RedCap UE BW'.
17	ZTE Corporation	[ZTE] Yes if the "in TDD" is removed.
18	SHARP Corporation	[Sharp] Yes. We are also fine with the update by Intel.
19	HUAWEI Technologies Japan K.K.	<p>[Huawei] Modify Intel's proposal by removing the sub-bullet. The additional part is being discussed in other proposals (e.g.3-2).</p> <ul style="list-style-type: none"> • During initial access, the bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth. • During initial access, the bandwidth and location of the initial DL BWP for RedCap UEs can be the same as the bandwidth and location of the MIB-configured initial DL BWP for non-RedCap UEs. <ul style="list-style-type: none"> – This does not preclude separate or additional bandwidth and location for initial DL BWP for RedCap UEs in TDD (FFS).
20	China Mobile Com. Corporation	[CMCC] Yes, with small modification that the "in TDD" for FFS bullet is removed. Although FDD doesn't have the center frequency alignment for DL BWP and UL BWP, it can also rely on a separate initial DL BWP for offloading purpose. And also fine with bandwidth restriction for initial DL BWP proposed by intel.
21	Spreadtrum Communications	Supportive. Regarding "in TDD" for FFS point, we think alignment of center frequency b/w DL and UL BWP is essential feature not only for non-RedCap UE but also for RedCap UE (maybe even critical). It is common understanding for TDD there is no RF retuning b/w DL and UL. Further, even if we introduce a new RF retuning time b/w DL and UL different from that of legacy UE, it will make an additional time gap for RedCap UE, which is harmful for co-existence of RedCap UE and non-RedCap UE. Moreover, some companies shows the time duration of misalignment is limited in RACH, but indeed before RRC reconfiguration effectiveness the RedCap UE should operate under the misalignment, which is still time consumed. Therefore, what we want to address is we should strive to align center frequency b/w DL and UL BWP, and removing "in TDD" to seek the solution for offloading in FDD is also fine for us.
22	Inter-Digital Communications	Ok with the proposal.
23	Sony Europe B.V.	Yes. We also support the update from Intel.

4 High Priority Proposal 2-1b

Based on the received feedback on Proposal 2-1a, the following updated proposal can be considered. It is based on the proposal provided in the feedback from China Telecom, which is similar to the proposal provided in the feedback from Intel. A few companies indicated that they would like to extend the proposal to also cover idle/inactive mode in general. A few companies indicated that they would prefer to remove or rephrase the FFS.

High Priority Proposal 2-1b:

During initial access, the bandwidth and location of the initial DL BWP for RedCap UEs can be the same as the bandwidth and location of the MIB-configured initial DL BWP for non-RedCap UEs.

- **The bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth.**
- **This does not preclude separate or additional bandwidth and location for initial DL BWP for RedCap UEs (FFS).**

Feedback Form 3: Can Proposal 2-1b be agreed? If not, please explain why.

Item	Company	Comments
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5 High Priority Proposal 2-2 (locked)

After initial access, at least for BWP#0 configuration option 1, a RedCap UE is not allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth.

FFS: BWP#0 configuration option 2.

Feedback Form 4: Can Proposal 2-2 be agreed? If not, please explain why.

Item	Company	Comments
1	QUAL-COMM JAPAN LLC.	Yes
2	NTT DO-COMO INC.	Yes
3	CATT	Yes. Though we are still sceptical on feasibility of Option 2, we are fine with this proposal for the sake of progress.

Item	Company	Comments
4	ZTE Corporation	Yes. Also not allowed for BWP#0 configuration option 2
5	Nordic Semiconductor ASA	We would be fine with the proposal, if the common understanding is that baseline R15 BWP feature (FG 6-1) of single dedicated BWP is also a baseline for RedCap UE.
6	HUAWEI Technologies Japan K.K.	It is undesirable for UE to differentiate the behaviour based on whether the signalling is taken from Option 1 or Option 2, i.e. a RedCap UE is not allowed to operate with an <u>active DL BWP</u> wider than the maximum RedCap UE bandwidth
7	vivo Communication Technology	Regardless of the BWP#0 configuration option, after initial access, UE capability already known by gNB, there is no strong motivation to allow a RedCap UE to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth. This view is also shared by majority of companies, therefore we would like to have the same conclusion for option 1 and option 2, i.e. the following <p style="text-align: center;">After initial access, at least for BWP#0 configuration option 1, a RedCap UE is not allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth.</p> <p>o FFS: BWP#0 configuration option 2.</p>
8	Xiaomi Communications	We are generally OK with the proposal. But for the main bullet, we would like to update the phase “BWP #0 configuration option 1” to “SIB1-based BWP#0 configuration” to make the proposal more clear. Furthermore, since there is no common understanding on the BWP#0 configuration option 2, so we prefer to remove the FFS sub bullet.
9	Panasonic Corporation	Yes
10	Spreadtrum Communications	Yes. It is natural way.
11	China Mobile Com. Corporation	Yes. After initial access, if a RedCap UE is allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth, RF retuning or gNB configuration is required to restrict RedCap UEs within its bandwidth, which is more complex than configuring separate initial DL BWP.

Item	Company	Comments
12	Shenzhen YZF Network Technology	<p>OPPO Partially Y.</p> <p>We agree for BWP#0 configuration option 1, a RedCap UE is not allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth.</p> <p>For BWP#0 configuration option 2, we also don't see the necessity to allow RedCap to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth which would complicate UE's implementation and increase the specification load.</p>
13	NEC Corporation	[NEC] Yes.
14	Futurewei Technologies	No, as written. We should to remove the statement "After initial access", and remove the "At least for BWP#0" and the FFS on BWP#0 options. We do not agree under any circumstances to redefine the BWP framework from NR to allow a UE BWP to be bigger than its max BW.
15	Intel Corporation (UK) Ltd	<p>Prefer to remove the FFS case. We support the version from Vivo.</p> <p>BWP #0 configuration option 2 can still be supported for non-RedCap UEs while RedCap UEs either continue in the BWP #0 defined by MIB, or in another (e.g., larger, as long as it is within max RedCap UE BW) DL BWP #0 configured separately for RedCap UEs (via SIB1). Functionally, there is no difference between restricting scheduling of a RedCap UE within a set of resources within a larger BWP and when configuring a separate BWP for a RedCap UE. On the other hand, with a larger BWP, DCI format sizes are unnecessarily increased, while there would be degraded link performance in the DL.</p>
16	Ericsson Inc.	<p>[Ericsson] Y.</p> <p>Regarding the FFS, Ericsson is one of the companies interested in having a solution that can work with a single BWP per cell using BWP#0 configuration option 2. If the network needs to configure multiple BWPs from the cell perspective, it loses a major incentive to use BWP#0 configuration option 2, and the network may as well migrate to BWP#0 configuration option 1. We do anticipate that most of the networks that support configuration option 2 today will migrate to option 1 in the next few years. Thus, perhaps we do not need to spend too much efforts on option 2. We would be fine to take an agreement on option 1 (1st bullet below) and working assumption on option 2 (2nd bullet below). This working assumption allows time for the MNOs who currently use option 2 to confirm.</p> <ul style="list-style-type: none"> • After initial access, for BWP#0 configuration option 1, a RedCap UE is not allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth. <p>working assumption After initial access, for BWP#0 configuration option 2, a RedCap UE is not allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth</p>

Item	Company	Comments
17	TCT Mobile Limited	Yes
18	SHARP Corporation	[Sharp] Yes. At least BWP#0 configuration 1, no impact for both RedCap UEs and non-RedCap UEs by this limitation will be found.
19	Nokia	[Nokia] Yes. We also think it should also applies to BWP#0 configuration option 2 but are OK to keep it FFS.
20	China Telecommunications	[China Telecom] Yes, it needs more discussion on BWP#0 configuration option 2. Hence, we are fine to keep it as FFS.
21	LG Electronics Inc.	[LG] We also think the proposal should apply to both Option 1 and Option 2. So, we support the proposed changes from vivo. As a compromise, making WA for Option 2 as suggested by Ericsson is acceptable to us.
22	WILUS Inc.	[WILUS] We are supportive of the proposal and prefer to keep the FFS point.
23	Samsung Electronics Polska	<p>[Samsung]</p> <p>We see some benefits to allow UE operate in a wider DL BWP, for example, scheduling gain. This could come from schedule the RedCap UE to a better frequency range (with wider BWP CSI) and this provide flexibility to gNB to allocate RedCap UE based on the load as well.</p> <p>There are many companies proposed faster BWP switching to provide flexibility for resource allocation. However, current BWP switching is not design for frequently switching for resource allocation. UE needs to buffer more RRC configurations, flush buffer and configurations, etc.</p> <p>If it is benefit to support fast BWP switching, we like to keep the door open for allowing UE operate in a wider BWP, compare with BWP switching scheme and decide it later.</p> <p>However, for the sake of progress, we can live with a working assumption for this proposal, including keep FFS for option 2.</p>
24	Lenovo (Beijing) Ltd	[Lenovo, Motorola Mobility] Yes, we share similar view with CMCC.
25	Inter-Digital Communications	Yes.
26	Sony Europe B.V.	Yes.

6 High Priority Proposal 2-2a

Based on the received feedback on Proposal 2-2, the following updated proposal for a working assumption can be considered.

High Priority Proposal 2-2a:

Working assumption: After initial access, a RedCap UE is not allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth.

Feedback Form 5: Can Proposal 2-2a be agreed? If not, please explain why.

Item	Company	Comments
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7 High Priority Proposal 3-1 (locked)

High Priority Proposal 3-1:

During initial access, for the scenario where the initial UL BWP for non-RedCap UEs is configured to be wider than the RedCap UE bandwidth, down select between the following options.

Option 1: The scenario is allowed, and a RedCap UE can use the same UL BWP.

Option 2: The scenario is allowed, but a separate initial UL BWP is configured for RedCap UEs.

Option 3: The scenario is not allowed.

Feedback Form 6: Can Proposal 3-1 be agreed? If not, please explain why.

Item	Company	Comments
1	NTT DO-COMO INC.	Yes. The down-selection depends on the discussion in Sections 5 and 6
2	QUAL-COMM JAPAN LLC.	We support option 2 of Proposal 3-1. Specifically, the initial UL BWP separately configured for RedCap UEs cannot be wider than the max UE BW of RedCap UEs.
3	CATT	Yes. In addition, we have the following elaboration. Hope this is the common understanding. Option 1: ... a RedCap UE is allowed to operate in an initial UL BWP wider than its maximum bandwidth. Option 2: ... a RedCap UE is NOT allowed to operate in an initial UL BWP wider than its maximum bandwidth. Option 3: ... a RedCap UE is NOT allowed to operate in an initial UL BWP wider than its maximum bandwidth.

Item	Company	Comments
4	ZTE Corporation	<p>No progress to agree the three options. For Option 1, disabling PUSCH Msg3 frequency hopping may cause performance loss. For PUCCH, without additional specification efforts, the PUCCH transmission during initial access cannot be disabled. To support PUCCH hopping out of the UE's transmission capability, significant PUCCH performance loss may be expected due to drop of PUCCH transmission in the RF retuning gap. Option 3 may cause configuration restriction to non-RedCap UEs. The performance of non-RedCap UEs may be impacted.</p> <p>We suggest to use the following proposal instead.</p> <p>During initial access, for the scenario where the initial UL BWP for non-RedCap UEs is configured to be wider than the RedCap UE bandwidth, a separate initial UL BWP is configured for RedCap UEs.</p>
5	HUAWEI Technologies Japan K.K.	<p>Suggest modifications on Option 2 as</p> <p>The scenario is allowed, but a separate initial UL BWP <u>no wider than the RedCap UE maximum bandwidth</u> is configured for RedCap UEs.</p>
6	vivo Communication Technology	<p>We do not support option 1, and would be open to option 2 or 3.</p> <p>This proposal is related to the discussion in section 5 and section 6. Suggest discussing this proposal after decision is made for ensuring the RACH occasion and PUCCH/PUSCH during the initial access fall with RedCap UE's bandwidth.</p>
7	Nordic Semiconductor ASA	<p>We support Option 1. In R15/16, RF requirements are defined for carrier instead of BWP. Therefore, for REDCAP UEs, RF requirements could be defined in RAN4 for RB-set/BWP instead. Therefore, there would not be any issue with supporting BWP larger than UE maximum supported channel BW.</p>
8	Xiaomi Communications	Yes
9	Panasonic Corporation	Yes
10	Spreadtrum Communications	Yes. Option 2 is our preference.
11	China Mobile Com. Corporation	<p>We support Option2.</p> <p>When the initial UL BWP for non-RedCap UEs is configured to be wider than the RedCap UE bandwidth, RO and FH of msg3/PUSCH may exceed the RedCap UE bandwidth. Option 1 may result in coverage loss of UL channels due to RF retuning and more specification impact is expected to dedicated msg3 FH configuration. Separate initial UL BWP is a unified solution to deal with the above coexistence problems and performs early identification, meanwhile it has benefit in offloading and capacity extension.</p>

Item	Company	Comments
12	Shenzhen YZF Network Technologies	<p>OPPO Modified Option 2 During initial access, a separate initial UL BWP is defined/configured for RedCap UEs when the initial UL BWP for non-RedCap UEs is configured to be wider than the RedCap UE bandwidth. And this separate initial UL BWP shall not be wider than the RedCap UE bandwidth. Therefore we propose modified Option 2. Option 2: The scenario is allowed, but a separate initial UL BWP is configured/defined for RedCap UEs.</p>
13	NEC Corporation	[NEC] Yes. Our preference would be option 2.
14	Futurewei Technologies	<p>Option 1 should be not included at all and no further study is needed. Between the other options (2 and 3), we are ok to study further and downselect between options 2 and 3, but not to downselect at the moment. We agree Option 2 can be clarified as other companies suggested that the BW is not bigger than the RedCap UE bandwidth.</p>
15	Ericsson Inc.	<p>[Ericsson] Y. We are also okay with the suggestion from Huawei. We think it's too early to down select. Avoiding or minimizing PUSCH resource fragmentation is an important consideration. We would like to see how each of these three options avoids or minimizes PUSCH resource fragmentation.</p>
16	Intel Corporation (UK) Ltd	<p>Options 3 or 2. We can accept Option 3 as we do not anticipate significant constraints for UL BWP #0 size for non-RedCap UEs, nor much overall impact considering the minimum BW we have at hand is 20 MHz. The constraint on the number of FDM-ed PRACH occasions (ROs) is not expected to be significant. Further, non-RedCap UEs can be moved to larger non-initial ULBWP upon connection establishment. However, if it is desired to maintain same flexibility for non-RedCap UEs as Rel-15/16, then configuration of larger UL BWP #0 for non-RedCap UEs can be allowed. In such cases, RedCap UEs can be configured with a separate UL BWP #0 (Option 2), as long as the UL BWP is not larger than max RedCap UE BW. Beyond the ability to configure larger UL BWP #0 for non-RedCap UEs, having such <i>configurability</i> of separate UL BWP can be useful in enabling RedCap UE identification. Impact from UL resource fragmentation can be minimized by appropriately placing the UL BWP #0 for RedCap UEs relative to the UL carrier (e.g., at an edge, etc.). In this regard, Option 1 does not provide benefit to UL resource usage due to OH from frequency retuning gaps that could span 3-4 symbols or more, implying inferior link performance or, alternatively, necessitating longer PUSCH and PUCCH allocations.</p>
17	TCT Mobile Limited	[TCL] YES

Item	Company	Comments
18	SHARP Corporation	[Sharp] Yes. we are also fine to modify option 2 as proposed by companies. For down-selection, it should be after discussion of other sections.
19	Nokia	[Nokia] Yes. Our preference is Option 3.
20	China Telecommunications	[China Telecom] We prefer Option 2.
21	LG Electronics Inc.	[LG] Yes. Option 2 is our preference as it can be kind of an easy solution to those known issues related to RO and PUCCH/PUSCH during initial access, and also to the early RedCap UE indication in Msg1 without a serious concern on further fragmentation of the PRACH resources. However, as none of the Options are free from the impact on the non-RedCap UEs in terms of UL resource fragmentation, it should be okay to take some more time to think about the pros and cons of Option 1 and Option 2 rather than down-selecting one right away. One way to make a progress would be that we agree to support the scenario first and then leave FFS down-selection between Option 1 and Option 2.
22	WILUS Inc.	[WILUS] Yes. Our preference is option 1 or option 2, i.e., the scenario is allowed. At least to provide higher frequency diversity and avoid unnecessary UL resource fragments to non-RedCap UE, the initial UL BWP for non-RedCap UE can be configured as wide as possible, which may wider than the RedCap UE BW.
23	Samsung Electronics Polska	[Samsung] Yes. We share the same understanding with CATT's explanation, that for option 2, the separated UL BWP is no larger than BWP's bandwidth. And we support option 1.
24	Lenovo (Beijing) Ltd	[Lenovo, Motorola Mobility] Yes. We prefer option 2 to configure separate initial UL BWP for RedCap UEs.
25	Fujitsu Limited	In general, support for configuring a separate initial UL BWP for RedCap UEs seems anyway a desirable feature (like option 2). Whether a RedCap UE can operate in a UL BWP wider than its bandwidth capability can be considered as a separate question. It would be good to align the final solution with proposal 3-2.
26	Inter-Digital Communications	We support configuring a separate BWP and agree on this proposal for further down-selection.
27	Sony Europe B.V.	Yes. Our preference is for option 2, with the same understanding as CATT's or Huawei's.

8 High Priority Proposal 3-1a

Based on the received feedback on Proposal 3-1, the following updated proposal can be considered, where Options 2 and 3 have been updated based on the proposals in the feedback from CATT, Huawei and Oppo. Several companies expressed their preferences among the different options, and some companies indicated that they would like to exclude one or more of the options.

High Priority Proposal 3-1a:

During initial access, for the scenario where the initial UL BWP for non-RedCap UEs is configured to be wider than the RedCap UE bandwidth, down select between the following options.

- **Option 1:** The scenario is allowed, and a RedCap UE can use the same UL BWP.
- **Option 2:** The scenario is allowed, but a separate initial UL BWP no wider than the RedCap UE maximum bandwidth is configured/defined for RedCap UEs.
- **Option 3:** The scenario is not allowed, and a RedCap UE is not allowed to operate in an initial UL BWP wider than the RedCap UE maximum bandwidth.

Feedback Form 7: Can Proposal 3-1a be agreed? If not, please explain why.

Item	Company	Comments
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9 High Priority Proposal 3-2 (locked)

High Priority Proposal 3-2:

After initial access, for the scenario where the initial UL BWP for non-RedCap UEs is configured to be wider than the RedCap UE bandwidth, down select between the following options.

Option 1: The scenario is allowed, and a RedCap UE can use the same UL BWP.

Option 2: The scenario is allowed, but a separate initial UL BWP is configured for RedCap UEs.

Option 3: The scenario is not allowed.

Feedback Form 8: Can Proposal 3-2 be agreed? If not, please explain why.

Item	Company	Comments
1	NTT DO-COMO INC.	Yes

Item	Company	Comments
2	QUAL-COMM JAPAN LLC.	Yes. We support Option 2 of Proposal 3-2.
3	CATT	OK with this proposal. Though we are not sure whether we need to discuss 'during initial access' and 'after initial access' separately for initial UL BWP. The initial UL BWP seems remain the same one after all.
4	ZTE Corporation	Initial UL BWP for non-RedCap UEs is same during or after initial access. Proposal 3-1 and 3-2 can be handled together.
5	HUAWEI Technologies Japan K.K.	Suggest <ul style="list-style-type: none"> · After initial access, for the scenario where the active UL BWP for non-RedCap UEs is configured to be wider than the RedCap UE bandwidth, down select between the following options. <ul style="list-style-type: none"> ○ Option 1: The scenario is allowed, and a RedCap UE can use the same UL BWP. ○ Option 2: The scenario is allowed, but a separate active UL BWP no wider than the RedCap UE maximum bandwidth is configured for RedCap UEs. Option 3: The scenario is not allowed.
6	vivo Communication Technology	We do not support option 1, and would be open to option 2 or 3. and we have same comments as proposal 3-1 regarding its connection with section 5 and 6
7	Xiaomi Communications	Yes
8	Nordic Semiconductor ASA	Yes, similar comments as for P3-1
9	Panasonic Corporation	Yes
10	Spreadtrum Communications	Partially Yes. After initial access, it is up to gNB implementation to configure BWP in UE specific way, so that is not so necessary to discuss. It is not a critical issue.
11	China Mobile Com. Corporation	We support Option2.

Item	Company	Comments
12	Shenzhen YZF Network Technology	OPPO Option 2 is preferred. RRC signalling can be used easily to configure a separate initial UL BWP for RedCap UEs. There is no necessity to allow RedCap to operate with an initial UL BWP wider than the maximum RedCap UE bandwidth after initial access.
13	NEC Corporation	[NEC] Yes. Our preference would be option 2.
14	Futurewei Technologies	Option 1 should be not included at all and no further study is needed. Between the other options (2 and 3), we are ok to study further and downselect between options 2 and 3, but not to downselect at the moment. We agree option 2 can be clarified as other companies suggested that the BW is not bigger than the RedCap UE bandwidth.
15	Ericsson Inc.	[Ericsson] Y. This proposal is more relevant for BWP#0 configuration option 2, as a non-initial UL BWP (e.g. UL BWP#1) is likely to be configured after initial access for the UE, in the case of BWP#0 configuration option 1. Similar to our comments for Proposal 2-2, supporting multiple BWPs in the cell do not go well with the motivation of using for BWP#0 configuration option 2, and one may as well migrate to BWP#0 configuration option 1. But also as we mentioned earlier, we do anticipate that most of the networks that support configuration option 2 today will migrate to option 1 in the next few years. Thus, perhaps we do not need to spend too much efforts on BWP#0 configuration option 2. We would be fine to take Option 2 in the proposal as a working assumption.
16	Intel Corporation (UK) Ltd	Same reasons as described in response to Proposal 3-1. If Option 2 is pursued for Proposal 3-1 for behavior during initial access, it would be natural to follow such an approach for after initial access as well.
17	TCT Mobile Limited	[TCL] Yes. We prefer Option 2
18	SHARP Corporation	[Sharp] Yes. Same view with proposal 3-1.
19	Nokia	[Nokia] Yes. Our preference is Option 3.
20	China Telecommunications	[China Telecom] The same view with Proposal 3-1 and we prefer Option 2.
21	LG Electronics Inc.	[LG] Yes. Same view as in Proposal 3-1.
22	WILUS Inc.	[WILUS] Yes. Our preference is to allow the scenario, same as in proposal 3-1.

Item	Company	Comments
23	Samsung Electronics Polska	[Samsung] Yes. Same comment: for option 2, the separated UL BWP is no larger than BWP's bandwidth.
24	Lenovo (Beijing) Ltd	[Lenovo, Motorola Mobility] Yes. We prefer option 2.
25	Fujitsu Limited	As suggested for 3-1, in general, support for configuring a separate initial UL BWP for RedCap UEs seems anyway a desirable feature (like option 2). Whether a RedCap UE can operate in a UL BWP wider than its bandwidth capability can be considered as a separate question. It would be good to align the final solution with proposal 3-1.
26	Inter-Digital Communications	Ok with further down-selection.
27	Sony Europe B.V.	Yes. Our preference is option 2. We are OK with the update from Huawei. In any case, we are OK to downselect between this set of options.

10 High Priority Proposal 3-2a

Based on the received feedback on Proposal 3-2 (for after initial access), the following updated proposal can be considered, where Options 2 and 3 have been updated similarly as in Proposal 3-1a (for during initial access). Some companies proposed to treat "after initial access" and "during initial access" together, and a few companies proposed to change "initial UL BWP" in this proposal to "active UL BWP", which would create some overlap with Proposal 4-3.

High Priority Proposal 3-2a:

After initial access, for the scenario where the initial UL BWP for non-RedCap UEs is configured to be wider than the RedCap UE bandwidth, down select between the following options.

- **Option 1:** The scenario is allowed, and a RedCap UE can use the same UL BWP.
- **Option 2:** The scenario is allowed, but a separate initial UL BWP no wider than the RedCap UE maximum bandwidth is configured/defined for RedCap UEs.
- **Option 3:** The scenario is not allowed, and a RedCap UE is not allowed to operate in an initial UL BWP wider than the RedCap UE maximum bandwidth.

Feedback Form 9: Can Proposal 3-2a be agreed? If not, please explain why.

Item	Company	Comments
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11 High Priority Proposal 4-2 (locked)

High Priority Proposal 4-2:

A RedCap UE cannot be configured with a non-initial DL BWP (i.e., a DL BWP with a non-zero index) wider than the UE maximum bandwidth.

Feedback Form 10: Can Proposal 4-2 be agreed? If not, please explain why.

Item	Company	Comments
1	NTT DO-COMO INC.	Yes
2	QUAL-COMM JAPAN LLC.	Yes
3	CATT	Yes
4	ZTE Corporation	Yes
5	HUAWEI Technologies Japan K.K.	Y
6	vivo Communication Technology	Yes
7	Xiaomi Communications	Yes. In our understanding, supporting Redcap to monitor or use larger frequency resource is beneficial to performance in terms of frequency diversity gain or frequency selective gain. We think Supporting wider BWP or monitoring multiple BWPs with fast switching are two possible directions. But we are OK with proposal for sake of progress
8	Nordic Semiconductor ASA	No, because that precludes UE/gNB from utilization of available carrier efficiently. Many companies note that BWP switching would be the way to go, but it takes >10ms to change BWP with R15 baseline capabilities. Plus multiple BWP configurations have large configuration overhead and memory requirements and does not coincide well with a reduced capability UE.

Item	Company	Comments
9	Panasonic Corporation	Yes, support the proposal
10	Spreadtrum Communications	Yes. It is a natural way
11	China Mobile Com. Corporation	Yes.
12	Shenzhen YZF Network Technolog	OPPO Yes We don't see it is necessary to allow RedCap to operate with a non-initial DL/UL BWP wider than the maximum RedCap UE bandwidth. With RRC signalling, it is easy to configure DL/UL BWP which is not wider than the maximum RedCap UE bandwidth. For the cell can only support one BWP configuration which is equal to the carrier bandwidth, it can be updated to support flexible BWP configuration when RedCap feature is deployed.
13	NEC Corporation	[NEC] Yes.
14	Futurewei Technologies	Yes. It is natural and also for initial BWP. OK to agree for clarity, but even if not agreed that does NOT mean that RAN1 has agreed to redefine the BWP framework.
15	Ericsson Inc.	[Ericsson] Y. The benefit of allowing a RedCap UE to operate on a non-initial DL BWP wider than its RF bandwidth is very small. Another issue to consider is whether BWP operation without restriction needs to be a mandatory feature for RedCap UEs when a RedCap UE cannot be configured with a non-initial DL BWP wider than the UE maximum bandwidth.
16	Intel Corporation (UK) Ltd	Yes.
17	TCT Mobile Limited	[TCL] Yes.
18	Nokia	[Nokia] Yes
19	SHARP Corporation	[Sharp] Yes.
20	China Telecommunications	[China Telecom] Yes, we support FL proposal.

Item	Company	Comments
21	LG Electronics Inc.	[LG] Yes. We support the FL proposal. We also don't see the benefit of allowing RedCap UEs to operate on a non-initial DL/UL BWP wider than its RF bandwidth to be significant at all.
22	WILUS Inc.	[WILUS] Yes.
23	Samsung Electronics Polska	[Samsung] No We think allow RedCap operates in a wider DL BWP can provide benefit, e.g., <ul style="list-style-type: none"> ü Frequency selective gain ü Better scheuling flexiblity ü Less UE memory and BWP switching operation
24	Lenovo (Beijing) Ltd	[Lenovo, Motorola Mobility] Yes
25	Inter-Digital Communications	Yes.

12 High Priority Proposal 4-2a

A vast majority support Proposal 4-2. A few companies express concerns. As a possible way forward, the proposal can be considered as a working assumption, which may be confirmed after the BWP switching/operation discussion has progressed a bit further.

High Priority Proposal 4-2a:

Working assumption: A RedCap UE cannot be configured with a non-initial DL BWP (i.e., a DL BWP with a non-zero index) wider than the UE maximum bandwidth.

Feedback Form 11: Can Proposal 4-2a be agreed? If not, please explain why.

Item	Company	Comments

13 High Priority Proposal 4-3 (locked)

High Priority Proposal 4-3:

A RedCap UE cannot be configured with a non-initial UL BWP (i.e., an UL BWP with a non-zero index) wider than the UE maximum bandwidth.

Feedback Form 12: Can Proposal 4-3 be agreed? If not, please explain why.

Item	Company	Comments
1	NTT DO-COMO INC.	Yes
2	QUAL-COMM JAPAN LLC.	Yes.
3	CATT	Yes
4	ZTE Corporation	Yes
5	HUAWEI Technologies Japan K.K.	Y
6	vivo Communication Technology	Yes
7	Xiaomi Communications	Yes. In our understanding, supporting Redcap to monitor or use larger frequency resource is beneficial to performance in terms of frequency diversity gain or frequency selective gain. We think Supporting wider BWP or monitoring multiple BWPs with fast switching are two possible directions. But we are OK with proposal for sake of progress
8	Panasonic Corporation	Yes, support the proposal
9	Spreadtrum Communications	Yes. It is a natural way.
10	China Mobile Com. Corporation	Yes.
11	Shenzhen YZF Network Technolog	OPPO Yes. We don't see it is necessary to allow RedCap to operate with a non-initial DL/UL BWP wider than the maximum RedCap UE bandwidth. With RRC signalling, it is easy to configure DL/UL BWP which is not wider than the maximum RedCap UE bandwidth. For the cell can only support one BWP configuration which is equal to the carrier bandwidth, it can be updated to support flexible BWP configuration when RedCap feature is deployed.

Item	Company	Comments
12	NEC Corporation	[NEC] Yes.
13	Futurewei Technologies	Yes. It is natural and also for initial BWP. OK to agree for clarity, but even if not agreed that does NOT mean that RAN1 has agreed to redefine the BWP framework.
14	Ericsson Inc.	[Ericsson] Y, if our concern on PUSCH resource fragmentation is accommodated. We would like to make sure PUSCH resource fragmentation can be avoided or minimized. In the Rel-15/16 specs, PUCCH FH does not have to be enabled after initial access. Thus, if the non-initial UL BWP is placed at the edge of the carrier and PUCCH FH is disabled, PUSCH resource fragmentation can be avoided. For TDD operation, according to the Rel-15/16 specifications, “a BWP-pair (UL BWP and DL BWP with the same bwp-Id) must have the same center frequency”. Thus, this implies that if the non-initial UL BWP (e.g. UL BWP#1) is placed at the edge of the carrier, the non-initial DL BWP (e.g. DL BWP#1) also needs to be placed at the carrier edge.
15	Intel Corporation (UK) Ltd	[Intel] Yes.
16	TCT Mobile Limited	[TCL] Yes.
17	Nokia	[Nokia] Yes
18	SHARP Corporation	[Sharp] Yes.
19	China Telecommunications	[China Telecom] Yes, we support FL proposal.
20	LG Electronics Inc.	[LG] Yes. We support the FL proposal. Same view as in Proposal 4-2.
21	WILUS Inc.	[WILUS] Yes.
22	Samsung Electronics Polska	[Samsung] No We think allow RedCap operates in a wider UL BWP can provide benefit, e.g., Avoid UL resource fragmentation Frequency selective gain Better scheduling flexibility Less UE memory and BWP switching operation

Item	Company	Comments
23	Lenovo (Beijing) Ltd	[Lenovo, Motorola Mobility] Yes
24	Inter-Digital Communications	Yes.

14 High Priority Question 4-3a

A vast majority support Proposal 4-3. A few companies express concerns. As a possible way forward, the proposal can be considered as a working assumption, which may be confirmed after the BWP switching/operation discussion has progressed a bit further.

High Priority Question 4-3a:

Working assumption: A RedCap UE cannot be configured with a non-initial UL BWP (i.e., an UL BWP with a non-zero index) wider than the UE maximum bandwidth.

Feedback Form 13: Can Proposal 4-3a be agreed? If not, please explain why.

Item	Company	Comments
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15 High Priority Question 8-1 (locked)

High Priority Question 8-1: Should RAN1 send an LS to ask RAN4 about the worst-case RF retuning time that would apply in case RF retuning within a BWP is supported? If so, please provide any comments on the detailed formulation of the question to RAN4 (for example, can RAN4 assume that the only thing that changes is the centre frequency?).

Feedback Form 14: Please provide your answer to Question 8-1.

Item	Company	Comments
1	NTT DO-COMO INC.	Yes, we are supportive to send an LS. As the RF retuning due to narrower UE BW, such as for RACH occasions and PUSCH/PUSCH FH outside RedCap UE's BW, does not require any changes other than the center frequency, we think RAN4 can assume that the only thing that changes is the center frequency.

Item	Company	Comments
2	QUALCOMM JAPAN LLC.	We don't think RAN1 should send such a LS to RAN4, because there is no consensus in RAN1 regarding the definition and benefits of "RF retuning" for RedCap UE. Besides, it is unclear to us which use cases of RedCap UE require RF retuning within "a BWP", and whether the BWP is separately configured for RedCap UE and within its max BW.
3	CATT	Yes. We are supportive to send the LS. RAN1 may not have to list out all the retuning channels (e.g. from A to B). 'Only change the centre frequency' seems to be a reasonable assumption. But still, we would like to remind that the RF retuning may happen in different ways, for example, 'from UL to UL (e.g. Msg3 PUSCH hopping)' or 'from DL/UL to UL/DL (e.g. RACH procedure in TDD cell)'.
4	HUAWEI Technologies Japan K.K.	1. Our proposal may not be correctly reflected in the background information so we suggest to modify the below as <ul style="list-style-type: none"> · During initial access or after initial access: <ul style="list-style-type: none"> o BWP hopping/retuning (i.e. switching of a BWP to another BWP <u>or location switching of a BWP</u>, having same or restricted configurations but different centre frequencies 2. At least RAN4 should be consulted with about whether there is room to reduce the time gap when UE changes its centre frequency, and if so, how, e.g. by which conditions/triggering/configurations the latency can be reduced to what level. 3. The LS should include all possible options clearly, e.g. RF retuning within a BWP, RF retuning for a BWP among different locations, and BWP switching.
5	ZTE Corporation	Yes. send an LS to ask RAN4 the RF retuning time for a RedCap UE when the Redcap UE changes the centre frequency in a BWP which size is wider than the maximum RedCap UE bandwidth.
6	vivo Communication Technology	Before consulting RAN4, RAN1 should first discuss whether (use case, benefits, drawbacks) to support the RF retuning for the RedCap UEs. For example, if we do not allow Redcap UE to operate in a BWP larger than its BW capability, there is no need to ask such question to RAN4. Therefore we do not agree to send the LS until the above becomes clear.
7	Nordic Semiconductor ASA	Yes. Question could be the following: RAN1 would like to kindly ask RAN4 on what would be the RF retuning time, assuming retuning within the max supported FR1/FR2 gNB carrier and assuming that UE RF BW is 20MHz and does not change. For example, maximum retuning BW distance for FR1 would be 80MHz.
8	Panasonic Corporation	Yes, we are supportive to send an LS. RAN4 can assume that the only thing that changes is the centre frequency. Therefore, especially QCL is the same before and after the change of the frequency. In addition, the candidates frequency position of centre frequency should be limited to ease the complexity.

Item	Company	Comments
9	Nordic Semiconductor ASA	Yes, assumptions for retuning should be (1) fixed RF BW and (2) max 80MHz frequency change for FR1 and max 300MHz for FR2
10	Spreadtrum Communications	No. There is no solidate benefit to support RF retuning in BWP or fast BWP switch. Indeed, it is not a WID objective that coverage improvement in RedCap. The valid place to discuss these enhancement could be CE topic.
11	Shenzhen YZF Network Technolog	OPPO N. As we replied above, RedCap UE shall not be configured with a DL or UL BWP which is wider than RedCap maximum bandwidth.
12	Futurewei Technologies	A clear NO to this LS, as you never need to retune within a BWP (agree with Qualcomm).
13	NEC Corporation	We are not sure what is the use case RF retuning within a BWP as RAN1 has not agreed BWP wider than max. RedCap UE BW.
14	Ericsson Inc.	[Ericsson] Y. An LS to RAN4 does not imply that RAN1 has agreed to introduce RF retuning within a BWP. But the information from RAN4 could help RAN1 discussion progress forward.
15	Intel Corporation (UK) Ltd	[Intel] No, we do not see a need to ask about frequency retuning within a BWP as we think the following question on inter-BWP switching under assumption of all parameters except center frequency being the same between the BWPs (as in Proposal 8-2) is more general and can effectively address both.
16	TCT Mobile Limited	[TCL] No. Similar with QC and NEC. It is unclear to us what is the use case RF retuning "within a BWP"
17	Nokia	[Nokia] No. We do not support RedCap UE in BWP larger than the maximum RedCap UE BW. Therefore, we do not need to ask RAN4 about retuning time within a BWP.
18	China Telecommunications	[China Telecom] We support sending an LS to ask RAN4 about RF retuning time after RAN1 consensus.
19	SHARP Corporation	[Sharp] Yes, we are supportive. As mentioned by other companies, the LS should focus on the change of the center frequency.

Item	Company	Comments
20	Samsung Electronics Polska	[Samsung] Yes We support sending LS. For RF retuning switching, the one or combination of the following can be assumed: (1)Fixed BW, (2) Fixed SCS (3) assuming from the same gNB and/or same QCL (4) Retuning range is within a certain BW, e.g., within 100MHz BW for FR1. Or can simply assume UE only change centre frequency assuming no ACG is needed (from same gNB and same RF).
21	LG Electronics Inc.	[LG] No. From our perspective, we are okay to further consider the RF retuning only as one of potential solutions to the known issues of ROs and PUSCH/-PUSCH FH outside RedCap UE's BW during initial access. Other than that case, we are not supportive of RF retuning as we think the benefits claimed so far are not significant at all. Before we discuss whether to send the LS or not, we prefer to take some time to narrow down the cases where we are willing to consider the RF retuning based on RAN4 feedback on the worst-case RF retuning time.
22	Inter-Digital Communications	We can send an LS to RAN4.
23	Sony Europe B.V.	No. RAN1 should first decide whether retuning within a BWP or between BWPs is needed.

16 High Priority Question 8-2 (locked)

High Priority Question 8-2: Should RAN1 send an LS to ask RAN4 about the worst-case BWP switching delay that would apply in case faster BWP switching is supported? If so, please provide any comments on the detailed formulation of the question to RAN4 (for example, can RAN4 assume that the only thing that changes is the centre frequency?).

Feedback Form 15: Please provide your answer to Question 8-2.

Item	Company	Comments
1	NTT DO-COMO INC.	Yes, we are supportive to send an LS. Same as Question 8-1, as the BWP switching due to narrower UE BW, such as for RACH occasions and PUSCH/PUSCH FH outside RedCap UE's BW, does not require any changes other than the center frequency, we think RAN4 can assume that the only thing that changes is the center frequency.

Item	Company	Comments
2	CATT	Yes. Similar to Question 8-1, at least the general case of ‘only the centre frequency is changed’ can be asked. If possible, we would like to know whether the ‘Frequency range from the 1st hop to the 2nd hop’ and ‘Number of the hopping range candidates.’ will have impact on the switching delay, in addition to the above restriction.
3	QUALCOMM JAPAN LLC.	No, we do not think RAN1 should send such an LS to RAN4. First of all, we do not think a BWP switching timeline faster than that of non-RedCap UE should be supported, which defeats the purposes of UE complexity reduction and power saving. Based on the LLS and SLS results for PDSCH/PUCCH/PUSCH (assuming the only thing that changes is the center frequency) in FR1, the hypothetical and short retuning gap (symbol level, faster than Type-1 BWP switching timeline) lead to performance loss when the switching occurs within a slot. Besides, it increases the complexity of channel estimation, CSI measurements/reporting and HARQ procedures.
4	HUAWEI Technologies Japan K.K.	The same thing as response to Q 8-1.
5	ZTE Corporation	Yes. We are supportive to send an LS to ask RAN4 if RF retuning delay of RedCap UEs has impact on BWP switching delay
6	vivo Communication Technology	RAN1 should first have common understanding on whether to support (use case, benefits and drawbacks) faster BWP switching for FR1 and FR2 before consulting RAN4. In general, we have concern on considering faster BWP switching for redcap UEs than non-redcap UEs. If there is desire to optimize BWP switching time, it should be discussed in some other work items targeting general enhancements.
7	Xiaomi Communications	Yes. At least the RF retuning timing when only change the frequency center should be asked.
8	Panasonic Corporation	Yes, (as well as Question 8-1) we are supportive to send an LS. RAN4 can assume that the only thing that changes is the centre frequency. Therefore, especially QCL is the same before and after the change of the frequency. In addition, the candidates frequency position of centre frequency should be limited to ease the complexity.
9	Nordic Semiconductor ASA	Yes, and question should include RRC (baseline) and DCI (optional) based BWP switching

Item	Company	Comments
10	Shenzhen YZF Network Technologies	OPPO Y. We propose RAN1 to send an LS to ask RAN4 about the worst-case BWP switching delay that would apply in case faster BWP switching is supported. Fast hopping is beneficial for RedCap UE to harvest frequency hopping gain when narrow BWP is configured for power saving in case of light traffic.
11	Futurewei Technologies	No if combined with any question related to 8-1. The requirements for BWP switching times are already specified for non-RedCap UEs. It may be reasonable to expect those requirements apply to RedCap UEs.
12	Qualcomm CDMA Technologies	[Qualcomm] Yes for FR2. For FR2, as demonstrated in our paper, BWP frequency hopping may contribute to performance gains. Hence, we do support the LS to RAN4 for FR2. It can be beneficial for RAN4 to study this for the following cases: 1. RRC-based (i.e., preconfigured) and DCI-based switching with priority to RRC-based 2. BWP before and after the switch have the exact same configuration, i.e., only thing changing is frequency 3. Is there a range of frequencies (BW range 1) that switching is faster if the UE is limited to switch within this range compared to switching from the range (BW range 1) to another range (BW range 2) <ul style="list-style-type: none"> • I.e., is it faster to switch from certain freq (A) to another (B) compared to switching from (A) to (C), if A is closer to B compared to C • If so, what is this range of frequencies (fast switching BW range) • Can we get the 2 numbers (switching within the fast BW range and switching across BW ranges)?
13	Ericsson Inc.	[Ericsson] Y. An LS to RAN4 does not imply that RAN1 has agreed to introduce faster BWP switching. But the information from RAN4 could help RAN1 discussion progress forward. In the LS, we can ask RAN4 to assume that the only things that change are the center frequency and possibly bandwidth as well.
14	Intel Corporation (UK) Ltd	[Intel] Yes, We are supportive of asking RAN4 on potential faster BWP switching under the assumption that only center frequency may change between the two BWPs. We would also be supportive of the specific questions suggested by Qualcomm, but we think they should not be limited to FR2 only.
15	Intel Corporation (UK) Ltd	[Intel2] In addition to our previous comment, we should also ask RAN4 to advise us on worst case switching times for frequency retuning during DL-to-UL BWP switches (and vice versa) in TDD systems if the center frequencies between DL and UL BWPs may be different, and whether any part of the frequency retuning time may be assumed as being included within the currently-specified Rx-to-Tx and Tx-to-Rx switching times.

Item	Company	Comments
16	vivo Communication Technology	[vivo2] Question to the proponents, it is not clear what is the motivation to support faster BWP switching time redcap UE than non-redcap UE? We can see Qualcomm's reply above mentioning performance gain, which can be understood, however it seems to be generally applicable to all UE types. It is unclear to us why this topic is specific to RedCap UE.
17	Nokia	[Nokia] No. We should discuss first in RAN1 the need for fast BWP switching beyond existing mechanism. In our view, BWP frequency hopping does not appear to provide significant gain and we prefer not to introduce this for RedCap.
18	China Telecom- munications	[China Telecom] The same view with Proposal 8-1. We support sending an LS to ask RAN4 about BWP switching delay after RAN1 consensus.
19	SHARP Corporation	[Sharp] Yes. As same as proposal 8-1, the LS should focus on the change of the center frequency of the BWP.
20	LG Elec- tronics Inc.	[LG] No. The name "faster" BWP switching seems misleading as it gives the impression that the RedCap capability may be beyond that of the non-RedCap UEs. We also have interest in knowing how much the switching time can be reduced for RedCap UEs to switch b/w BWPs of RedCap UEs but still within the same BWP for non-RedCap UEs meaning the same numerology. But, we think we need some more time to discuss whether the RedCap UEs can/need to assume the faster BWP switching before working on the LS to RAN4.
21	Samsung Elec- tronics Polska	[Samsung] Yes. We support sending LS. For BWP switching, the one or combination of the following can be assumed: (1) Fixed BW, (2) Fixed SCS (3) assuming from the same gNB and/or same QCL (4) Retuning range is within a certain BW, e.g., within 100MHz BW for FR1
22	QUAL- COMM JAPAN LLC.	[Qualcomm2] We think RAN1 can answer Question 8-1 first. After that, RAN1 can further discuss the following questions: 1) If "faster" BWP switching is supported by RedCap UE, should it be supported by non-RedCap UE as well ? 2) How often is such "faster" switching allowed for a RedCap UE within N ms, where N=10, 100, ...? 3) Does the switching time depend on FR ? 4) Shall it be studied in R17 CE WI ? 5) If there is a retransmission for PDSCH/PUSCH during the course of frequency hopping, when and where (in which BWP) the UE is expected to receive the grant ? 6) What are the impacts on RRM measurements, CSI measurements and reporting and power saving ?

Item	Company	Comments
23	Spreadtrum Communications	No. The purpose of fast BWP switch could be to exploit the frequency diversity gain, similar as RF retuning in BWP. The intention is still coverage improvement. The coverage recovery is out of scope of RedCap, so spending large WI workload is not acceptable. We do not think the spec impact is small.
24	Inter-Digital Communications	Yes.
25	Sony Europe B.V.	The issue seem similar to 8-1. RAN1 should decide how important this faster BWP switching is before asking RAN4 about parameters.

17 High Priority Proposal 8-3

Based on the feedback for Questions 8-1 and 8-2, there is no clear consensus regarding whether there is a need to send an LS to RAN4. The following proposal is based on the suggestions regarding what cases and assumptions to consider in a potential LS.

High Priority Proposal 8-3:

Send an LS to ask RAN4 about RF retuning delay for the following cases:

- **Case 1: RF retuning for (DL/UL) BWP switching**
- **Case 2: RF retuning for (DL/UL) BWP retuning to another frequency location**
- **Case 3: RF retuning between DL BWP and UL BWP in different centre frequencies**
- **Case 4: RF retuning within an UL BWP**

and whether there is room to reduce the delay under the following assumptions:

- **The RF retuning takes place between two frequency locations with different centre frequencies.**
- **The maximum frequency change is 80 MHz for FR1 and 300 MHz for FR2.**
- **The RF bandwidth and SCS can be assumed to be the same before and after the RF retuning.**
- **The RF retuning may take place during initial access or after initial access.**

Feedback Form 16: Can Proposal 8-3 be agreed? If not, please explain why and/or propose potential revisions.

Item	Company	Comments
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