

3GPP TSG-RAN WG1 Meeting #104bis-e

e-Meeting, 12th – 20th April, 2021

Tdoc R1-2103944

Agenda Item: 8.6.1.1

Title: FL summary #4 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/Docs/R1-2103823.zip

2 High Priority Proposal 2-1

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 |
| 3 | CATT | Yes |

| Item | Company | Comments |
|------|--------------------------------|---|
| 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 | <p>Yes</p> |
| 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

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. pdcch-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 |
|------|--------------------------|--|
| 1 | QUALCOMM JAPAN LLC. | [Qualcomm] Yes, we support this proposal. |
| 2 | Nordic Semiconductor ASA | Do not support the latest wording. Sub-bullet <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. is redundant. Since we all know that MIB-configured initial DL BWP , i.e. CORESET#0 cannot be larger than 20MHz. Furthermore, during initial access, R15 UE is not expected to receive in more than 48RB in 30kHz SCS (max size of CORESET#0 for a given SCS), while in principle maximum nominal BW for 30kHz SCS would be 51RB. Some companies want to mandate RedCap UE to receive in more than 48PRB during initial access in 30kHz SCS? |
| 3 | Sierra Wireless, S.A. | Yes we support this proposal |
| 4 | CATT | [CATT] OK |
| 5 | LG Electronics Inc. | We are okay with this proposal. |
| 6 | ZTE Corporation | [ZTE] We are fine with this proposal. |

| Item | Company | Comments |
|------|---------------------------------|---|
| 7 | vivo Communication Technology | [vivo] We support the proposal |
| 8 | China Mobile Com. Corporation | [CMCC] OK |
| 9 | China Telecommunications | [China Telecom] We support FL proposal. |
| 10 | SHARP Corporation | [Sharp] We are OK with the proposal. |
| 11 | Xiaomi Communications | [Xiaomi]: OK with the proposal |
| 12 | NEC Corporation | [NEC] OK |
| 13 | Shenzhen YZF Network Technology | [OPPO] we are fine with this proposal. |
| 14 | China Mobile Com. Corporation | <p>[CMCC2] During RAN1#104-e, the following agreement was made, it seems the combination of main bullet of first sub-bullet of proposal 2-b is similar to this agreements.</p> <p>Agreements:</p> <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> – FFS: after initial access, whether a RedCap UE is allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth <ul style="list-style-type: none"> * Discuss further whether or not it is also applicable during initial access |
| 15 | Spreadtrum Communications | <p>Supportive. Two minor comments:</p> <p>First, the separate initial DL BWP means the different configuration of initial DL BWP, but with current wording "bandwidth and location", it seems only the "LocationAndBandwidth" parameter can be different from that configured by MIB-configured. Is it really the intention? In our view, most of parameters of initial DL BWP can be separately configured by SIB1.</p> <p>Second, can "(FFS)" be removed? It seems "not excluded" is a FFS point. We think here we want to say the separate initial DL BWP is FFS.</p> |

| Item | Company | Comments |
|------|--------------------------------|--|
| 16 | Intel Corporation (UK) Ltd | [Intel] We support the proposal. To Nordic, the sub-bullet on BW is relevant in the context of potential separate/additional initial DL BWP for RedCap UEs (currently FFS). |
| 17 | HUAWEI Technologies Japan K.K. | [Huawei] We have problem with making "the bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth" as a sub-bullet. In our view, this statement is not limited to the case mentioned in the main bullet, so it can be a main bullet while the current main bullet in 2-1b can be a sub-bullet. |
| 18 | Ericsson Inc. | [Ericsson] We support the proposal. |
| 19 | NTT DOCOMO INC. | [DOCOMO] We support the proposal |
| 20 | Samsung Electronics Polska | <p>[Samsung]</p> <p>We have concern on the first sub-bullet.</p> <p>In our understanding, the SIB1 configured initialdownlinkBWP can be wider than CORESET #0 bandwidth for non-RedCap UE. It is not clear for us if we agreed on the proposal</p> <ul style="list-style-type: none"> Does it mean that gNB has to configure a initialDownlinkBWP no larger than 20MHz, if RedCap UE and non-RedCap UE share the same initial-DownlinkBWP? <p>We share similar view as Nordic. Even RedCap and non-RedCap UE shared the same initialDownlinkBWP, it may not have issue even in the end, we don't support RF retuning within a wider bandwidth. For example, for option 2, RedCap UE can be configured by a BWP #0 in Msg 4, where BWP #0 is not allowed to be wider than RF Bandwidth. We think more discussion is needed for the first sub-bullet.</p> |
| 21 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 22 | Futurewei Technologies | <p>Yes with several modifications. As pointed out by CMCC2, we had a similar agreement in the last meeting</p> <ul style="list-style-type: none"> 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. <p>This proposal mentions location and bandwidth. Does the same initial DL BWP agreed from the last meeting imply the same location and bandwidth? The sub-bullet "The bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth" should be promoted, like in the agreement from the last meeting.</p> |

5 High Priority Proposal 2-1c

Based on the feedback for Proposal 2-1b, the following proposal can be considered, where one of the sub-bullets has been promoted to the main bullet, and the former main bullet is now one of a sub-bullets, and a new sub-bullet has been inserted regarding the case with a wider SIB-configured initial DL BWP bandwidth for non-RedCap UEs.

This proposal is intended to address the FFS from RAN1#104e regarding whether a RedCap UE is allowed to operate with an initial DL BWP (derived based on MIB/SIB) wider than the maximum RedCap UE bandwidth during initial access.

High Priority Proposal 2-1c:

During initial access, the bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth.

- **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 a SIB-configured initial DL BWP for non-RedCap UEs with a wider bandwidth than 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 4: Can Proposal 2-1c be agreed? If not, please explain why.

| Item | Company | Comments |
|------|--------------------------------|-------------------------------------|
| 1 | QUAL-COMM JAPAN LLC. | [Qualcomm] Yes |
| 2 | NTT DO-COMO INC. | [DOCOMO] We support the proposal |
| 3 | WILUS Inc. | [WILUS] We support proposal 2-1c. |
| 4 | HUAWEI Technologies Japan K.K. | [Huawei] Yes |
| 5 | vivo Communication Technology | support |
| 6 | Ericsson Inc. | [Ericsson] We support the proposal. |

| Item | Company | Comments |
|------|--------------------------------|--|
| 7 | CATT | [CATT] Support. |
| 8 | NEC Corporation | [NEC] Support the proposal. |
| 9 | Spreadtrum Communications | [SPRD] Supportive. For the wording "bandwidth and location", it seem necessary to address the issue of alignment of center frequency b/w DL and UL BWP in TDD. |
| 10 | China Mobile Com. Corporation | [CMCC] Yes. |
| 11 | LG Electronics Inc. | [LG] Yes. |
| 12 | SHARP Corporation | [Sharp] We support the proposal. |
| 13 | Intel Corporation (UK) Ltd | [Intel] Yes. |
| 14 | Xiaomi Communications | [Xiaomi]: Yes |
| 15 | TCT Mobile Limited | [TCL] We are fine with the proposal |
| 16 | China Telecommunications | [China Telecom] We are fine to change the position of the main bullet and the first sub-bullet. |
| 17 | Shenzhen YZF Network Technolog | [OPPO] OK |
| 18 | ZTE Corporation | We are fine with the proposal |
| 19 | Lenovo (Beijing) Ltd | We are fine with the proposal |
| 20 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 21 | Samsung Electronics Polska | [Samsung] We are fine with the proposal. |

| Item | Company | Comments |
|------|------------------------------|---|
| 22 | Nordic Semiconductor ASA | Our comments from previous round were perhaps not clear, let us clarify During initial access, the bandwidth of the initial DL BWP for RedCap UEs is not expected to exceed the maximum RedCap UE bandwidth bandwidth of CORESET#0 for the given SCS. |
| 23 | Nokia | [Nokia] We support the proposal |
| 24 | Futurewei Technologies | Yes |
| 25 | Inter-Digital Communications | Yes. |

6 High Priority Proposal 2-2

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 5: 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. |
| 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. |

| Item | Company | Comments |
|------|---------------------------------|--|
| 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</u> DL BWP 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 <ul style="list-style-type: none"> · 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. |
| 8 | Xiaomi Communications | We are generally OK with the proposal. But for the main bullet, we would like to update the phrase “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. |
| 12 | Shenzhen YZF Network Technology | OPPO Partially Y. 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. 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. |
| 13 | NEC Corporation | [NEC] Yes. |

| Item | Company | Comments |
|------|----------------------------|--|
| 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 | Prefer to remove the FFS case. We support the version from Vivo. 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. |
| 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> |
| 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. |

| Item | Company | Comments |
|------|------------------------------|---|
| 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 | [Samsung] 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. 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. 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. However, for the sake of progress, we can live with a working assumption for this proposal, including keep FFS for option 2. |
| 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. |

7 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 6: Can Proposal 2-2a be agreed? If not, please explain why.

| Item | Company | Comments |
|------|-------------------------------|--|
| 1 | QUALCOMM JAPAN LLC. | [Qualcomm] Yes. |
| 2 | Nordic Semiconductor ASA | We strongly disagree with the previous-round comment from CMCC. It is much less complex to retune between parts of active BWP than to change between configurations of multiple BWPs. Our understanding is that if BWP larger than 20MHz is precluded for RedCap UE, then RedCap UEs will be locked to one BWP of max 20MHz after initial access. Therefore, we prefer Proposal 2-2, including the note that FG 6-1 is a baseline feature also for RedCap UEs. |
| 3 | CATT | [CATT] OK |
| 4 | LG Electronics Inc. | We support this proposal. |
| 5 | ZTE Corporation | [ZTE] Yes |
| 6 | vivo Communication Technology | [vivo]We support the proposal |
| 7 | China Mobile Com. Corporation | [CMCC] Yes. May be we can make our comment of last round a bit clear. What we mean is that the spec effort can be simplified with separate BWP (BW smaller than maximum bandwidth of RedCap), when the initial DL BWP is wider than the maximum RedCap UE bandwidth. For RF retuning, the influence of retuning gap needs to be considered and the orthogonality will be destroyed for RedCap PUCCH with some symbols being dropped, when they multiplex with non-Redcap UEs and FH is enabled, so more spec handling is desired. For the solution of dedicated configuration/indication or a different interpretation for the same configuration/indication for RedCap, gNB can realize the same purpose by configuring separate BWP with bandwidth smaller than maximum RedCap UE bandwidth , and reusing the framework of BWP, therefore the spec effect can be reduced. |
| 8 | China Telecommunications | [China Telecom] We support FL proposal. |
| 9 | Xiaomi Communications | [Xiaomi]:We are OK with the proposal |
| 10 | NEC Corporation | [NEC] Yes. |

| Item | Company | Comments |
|------|---------------------------------|--|
| 11 | Shenzhen YZF Network Technology | [OPPO] OK |
| 12 | HUAWEI Technologies Japan K.K. | [Huawei] Support |
| 13 | Intel Corporation (UK) Ltd | [Intel] Yes, we can agree to making a WA for now. |
| 14 | Ericsson Inc. | [Ericsson] We are fine with the proposed working assumption. |
| 15 | Spreadtrum Communications | [SPRD] Supportive. We assume the reason why it is WA instead of agreement is just for BWP configuration Option 2, which is still concern by some companies for the current deployment. In addition, locking RedCap UE in a BWP not wider than 20MHz is beneficial in some aspects, e.g. limited negative impact to network spectrum efficiency (so-called 20% upper bound of reduction in 100MHz carrier. Otherwise, the reduction can be far beyond 20%), separate CORESET/search space set configuration, separate eDRX, separate RRM relaxation. Regarding offloading, BWP is UE specific, and gNB can still configure different BWP for different RedCap UE. Regarding frequency diversity gain, it is out of scope as a candidate scheme of coverage recovery, and the gain may not be higher than other candidate schemes or the complexity may be higher than other candidate schemes. |
| 16 | Nordic Semiconductor ASA | Thanks to CMCC for the follow up, appreciated. Reusing advanced/optional BWP framework requires clearly special capabilities which are not even required from eMBB UEs, I am glad that this has been understood by companies based on today's GTW, contrary RF retuning is capability that every UE has. Regarding specification effort (i) hopping for HD-FDD UE could be defined based on size of R16 RB-set instead of BWP, rather straightforward extension of R16 spec. The point is to ensure that it is clear where UEs center frequency /DC is and that UE does not need to retune during transmission/reception of a single channel. Here we agree with you. (ii) Regarding retuning/between different channels/signals, 1-2symbols retuning gaps can be handled by gNB scheduling, similarly as directional switch of TDD or TA in NR, this is nothing gNBs would not be capable of. And finally, I would like to understand what is the intention of this WID, to minimize spec change, or to enable a reduced capability UE to efficiently operate in the NR cell with legacy UEs. Thanks. |
| 17 | NTT DO-COMO INC. | [DOCOMO] We prefer to keep FFS on BWP#0 configuration option 2 |

| Item | Company | Comments |
|------|----------------------------|---|
| 18 | Samsung Electronics Polska | <p>[Samsung]</p> <p>We have some concerns on this WA with the same reason for proposal 2-1b. We don't want to force gNB to configure a iBWP with small BW to support RedCap UEs.</p> <p>On the other hand, we understand that the majority view is not introduce new scheme to support RedCap UE hopping within a wider BWP. If so, we can be flexible to non-initial BWP case. Therefore, we suggest to change the proposals as:</p> <p>Working assumption: After initial access, a RedCap UE is not allowed to operate with an initial DL BWP other than initial DL BWP wider than the maximum RedCap UE bandwidth.</p> <ul style="list-style-type: none"> • FFS on whether a RedCap UE is allowed to operate with an initial DL BWP wider than the maximum RedCap UE bandwidth. |
| 19 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 20 | Futurewei Technologies | Yes |

8 High Priority Proposal 2-2b

Most responses expressed support for Proposal 2-2a, but a couple of responses preferred the earlier version in Proposal 2-2. Perhaps the following hybrid between Proposals 2-2 and 2-2a can be considered as a compromise. Regarding the suggested reformulation proposed in the responses from Samsung, please note that the non-initial DL BWP case is already covered by Proposal 4-2a.

High Priority Proposal 2-2b:

Working assumption: 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 7: Can Proposal 2-2b be agreed? If not, please explain why.

| Item | Company | Comments |
|------|---------------------|----------------|
| 1 | QUALCOMM JAPAN LLC. | [Qualcomm] Yes |

| Item | Company | Comments |
|------|---------------------------------|--|
| 2 | NTT DO-COMO INC. | [DOCOMO] We support the proposal |
| 3 | HUAWEI Technologies Japan K.K. | [Huawei] OK |
| 4 | vivo Communication Technology | We still prefer to make the working assumption for both option 1 and option 2, which already give the room for further discussion for option 2 if critical issue is found. |
| 5 | WILUS Inc. | [WILUS] We support the proposal. |
| 6 | Ericsson Inc. | [Ericsson] We support the proposal. |
| 7 | CATT | [CATT] OK. |
| 8 | NEC Corporation | [NEC] We support the proposal. |
| 9 | Spreadtrum Communications | [SPRD] Yes |
| 10 | LG Electronics Inc. | [LG] Yes. |
| 11 | SHARP Corporation | [Sharp] We support the proposal. |
| 12 | Xiaomi Communications | [Xiaomi]: Yes |
| 13 | Intel Corporation (UK) Ltd | [Intel] We would prefer to agree as WA for both Config 1 and 2. As mentioned by Vivo, with a WA, we can address if any critical issue is identified related to any of the Configuration options. |
| 14 | TCT Mobile Limited | [TCL] OK. |
| 15 | China Telecommunications | [China Telecom] We support FL proposal. |
| 16 | Shenzhen YZF Network Technology | [OPPO] Agree with vivo, the proposal shall cover both option 1 and option 2. |
| 17 | ZTE Corporation | [ZTE] OK |

| Item | Company | Comments |
|------|------------------------------|--|
| 18 | Lenovo (Beijing) Ltd | Yes |
| 19 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 20 | Samsung Electronics Polska | [Samsung] We support it. |
| 21 | Nordic Semiconductor ASA | We support, but as for P2-1c, with a an update. Working assumption: 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 of <u>CORESET#0</u> for given SCS. |
| 22 | Nokia | [Nokia] OK with the proposal |
| 23 | Futurewei Technologies | Ok with an update <ul style="list-style-type: none"> • Remove the BWP#0 option in the main working assumption. • Remove the FFS because the working assumption is enough when we are almost all ok with the agreement. |
| 24 | Inter-Digital Communications | Yes. |

9 High Priority Proposal 3-1

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 8: 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. |
| 4 | ZTE Corporation | 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. We suggest to use the following proposal instead. 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. |
| 5 | HUAWEI Technologies Japan K.K. | Suggest modifications on Option 2 as <u>The scenario is allowed, but a separate initial UL BWP no wider than the RedCap UE maximum bandwidth is configured for RedCap UEs.</u> |
| 6 | vivo Communication Technology | We do not support option 1, and would be open to option 2 or 3. 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. |
| 7 | Nordic Semiconductor ASA | 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. |

| Item | Company | Comments |
|------|--------------------------------|---|
| 8 | Xiaomi Communications | Yes |
| 9 | Panasonic Corporation | Yes |
| 10 | Spreadtrum Communications | Yes. Option 2 is our preference. |
| 11 | China Mobile Com. Corporation | We support Option2. 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. |
| 12 | Shenzhen YZF Network Technolog | 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. |
| 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. 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. |

| Item | Company | Comments |
|------|----------------------------|--|
| 16 | Intel Corporation (UK) Ltd | <p>Options 3 or 2.</p> <p>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.</p> <p>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.</p> <p>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 |
| 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. | <p>[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.</p> <p>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.</p> |
| 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. |

| Item | Company | Comments |
|------|------------------------------|--|
| 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. |

10 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 9: Can Proposal 3-1a be agreed? If not, please explain why.

| Item | Company | Comments |
|-------------|--------------------------------|--|
| 1 | QUALCOMM JAPAN LLC. | [Qualcomm] Yes and we support Option 2. |
| 2 | Nordic Semiconductor ASA | Yes, Option 1 |
| 3 | CATT | [CATT] OK with the proposal. |
| 4 | LG Electronics Inc. | We are okay with this proposal. Option 2 is preferred. |
| 5 | vivo Communication Technology | [vivo] We prefer to make further progress by excluding option 1, this will make the consistent design between DL initial BWP and UL initial BWP |
| 6 | China Mobile Com. Corporation | [CMCC] Ok with this proposal. Option 2 is preferred. |
| 7 | China Telecommunications | [China Telecom] We are fine with this proposal and prefer Option 2. |
| 8 | SHARP Corporation | [Sharp] We are fine with the proposal. |
| 9 | Xiaomi Communications | [Xiaomi] Generally, we are OK with the proposal. If we want to go further, we would like to exclude opt.3 since this option would impose restriction on the normal UE |
| 10 | NEC Corporation | [NEC] OK to discuss these options. |
| 11 | Shenzhen YZF Network Technolog | [OPPO] Share similar view with vivo, Option 1 shall be excluded. DL and UL shall be aligned from the perspective whether a wider BWP than RedCap UE's bandwidth shall be allowed to be used. |
| 12 | Intel Corporation (UK) Ltd | [Intel] Options 3 or 2. Reasons as explained in response to Proposal 3-1. |
| 13 | Ericsson Inc. | [Ericsson] We are fine with the proposal. |

| Item | Company | Comments |
|------|---------------------------------------|---|
| 14 | Spread-trum Communi- cations | [SPRD] Supportive |
| 15 | NTT DO- COMO INC. | [DOCOMO] We support the proposal |
| 16 | Samsung Elec- tronics Polska | [Samsung] Fine with the proposal. |
| 17 | Panasonic Corpora- tion | [Panasonic] Support the proposal. |
| 18 | ZTE Cor- poration | [ZTE] We are fine with the Proposal and support Option 2. Since decision of options has impacts on several other related issues, we prefer to make downselection in this meeting |
| 19 | Futurewei Technolo- gies | As we stated, our preference is to down select between options 2 and 3 because the UL BWP cannot be larger than the maximum RedCap UE bandwidth. |

11 High Priority Proposal 3-1b

Most responses are fine with Proposal 3-1a, and there were no suggestions to clarify or modify the formulations in describing the options, but some responses wish to do further down selection already now. Based on the feedback, it is proposed to consider the same proposal again (i.e. Proposal 3-1b is the same as Proposal 3-1a).

High Priority Proposal 3-1b:

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

| Item | Company | Comments |
|------|--------------------------------|--|
| 1 | QUALCOMM JAPAN LLC. | [Qualcomm] Yes. We support option 2. |
| 2 | NTT DOCOMO INC. | [DOCOMO] We support the proposal. We think more discussion is necessary for the down selection as it depends on the discussion in Sections 5 and 6 in R1-2103823 |
| 3 | HUAWEI Technologies Japan K.K. | [Huawei] Would more prefer some level of down selection as the current proposal does not seem to be much progress compared to last meeting. But can be fine with the lead. |
| 4 | vivo Communication Technology | As we are still in the middle of the meeting, can we have a try to down-select to make more progress? Our 1st preference is option 2, then option 3, and we would like to exclude option 1 |
| 5 | WILUS Inc. | [WILUS] We support this proposal and we support option 1 or 2. |
| 6 | Ericsson Inc. | [Ericsson] We support the proposal. |
| 7 | CATT | [CATT] OK for the sake of progress. |
| 8 | NEC Corporation | [NEC] We support the proposal. |
| 9 | Spreadtrum Communications | [SPRD] Yes |
| 10 | China Mobile Com. Corporation | [CMCC] Yes. Option 2 is preferred. |
| 11 | LG Electronics Inc. | [LG] Yes. Option 2 is preferred. |
| 12 | Samsung Electronics Polska | [Samsung] We support option 1 or 2. And suggest to keep all three options for further study. |
| 13 | SHARP Corporation | [Sharp] We support the proposal. |
| 14 | Xiaomi Communications | [Xiaomi]: OK with current proposal and we prefer Option1 and Option 2 |

| Item | Company | Comments |
|------|---------------------------------|---|
| 15 | Intel Corporation (UK) Ltd | [Intel] Can accept the current proposal as an intermediate step. |
| 16 | TCT Mobile Limited | [TCL] We are fine with the proposal, and support option#1 or option#2. |
| 17 | China Telecommunications | [China Telecom] We support this proposal and prefer Option 2. |
| 18 | Shenzhen YZF Network Technology | [OPPO] Support this proposal and prefer option 2. |
| 19 | ZTE Corporation | [ZTE] Yes. Option 2 is preferred. It would be better to make down selection in this meeting. |
| 20 | Lenovo (Beijing) Ltd | Yes |
| 21 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 22 | Nordic Semiconductor ASA | Support and keep all options on the table. |
| 23 | Nokia | [Nokia] We are fine with the proposal. Our preference is Option 3. |
| 24 | Futurewei Technologies | Yes. Option 1 should be excluded and the focus is on options 2 and 3. |
| 25 | Inter-Digital Communications | Yes. |

12 High Priority Proposal 3-2

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

| Item | Company | Comments |
|------|--------------------------------|---|
| 1 | NTT DO-COMO INC. | Yes |
| 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 |

| Item | Company | Comments |
|------|---------------------------------|---|
| 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. |
| 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. |

| Item | Company | Comments |
|------|------------------------------|--|
| 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. |
| 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. |

13 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 12: Can Proposal 3-2a be agreed? If not, please explain why.

| Item | Company | Comments |
|------|--------------------------------|--|
| 1 | QUALCOMM JAPAN LLC. | [Qualcomm] Yes and we support Option 2. |
| 2 | Nordic Semiconductor ASA | Yes, Option 1 |
| 3 | CATT | [CATT] OK |
| 4 | LG Electronics Inc. | We are okay with this proposal. Option 2 is preferred. |
| 5 | vivo Communication Technology | [vivo] Same as 3-1a, we prefer to make further progress by excluding option 1, this will make the consistent design between DL initial BWP and UL initial BWP |
| 6 | China Mobile Com. Corporation | [CMCC] Ok with this proposal. Option 2 is preferred. |
| 7 | China Telecommunications | [China Telecom] The same view with Proposal 3-1a. We are fine with this proposal and prefer Option 2. |
| 8 | SHARP Corporation | [Sharp] We are fine with the proposal. |
| 9 | Xiaomi Communications | [Xiaomi] Generally, we are OK with the proposal. If we want to go further, we would like to exclude opt.3 since this option would impose restriction on the normal UE |
| 10 | NEC Corporation | [NEC] OK to discuss these options |
| 11 | Shenzhen YZF Network Technolog | [OPPO] Share similar view with vivo, Option 1 shall be excluded. DL and UL shall be aligned from the perspective whether a wider BWP than RedCap UE's bandwidth shall be allowed to be used. After initial access, RRC signaling can be used to configured a proper UL BWP for RedCap UEs. |

| Item | Company | Comments |
|------|----------------------------|--|
| 12 | Intel Corporation (UK) Ltd | [Intel] Yes, and we support Options 3 or 2 as explained in response to Proposals 3-1a and 3-2. |
| 13 | Ericsson Inc. | [Ericsson] We are fine with the proposal. |
| 14 | Spreadtrum Communications | [SPRD] Yes. Option 2 is our preference. |
| 15 | NTT DOCOMO INC. | [DOCOMO] We support the proposal |
| 16 | Samsung Electronics Polska | [Samsung] Fine with the propsoal. |
| 17 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 18 | ZTE Corporation | [ZTE] We are fine with the Proposal and support Option 2. Since decision of options has impacts on several other related issues, we prefer to make downselection in this meeting |
| 19 | Futurewei Technologies | As we stated, our preference is to down select between options 2 and 3 because the UL BWP cannot be larger than the maximum RedCap UE bandwidth. |

14 High Priority Proposal 3-2b

The situation for Proposal 3-2a (which concerns "after initial access") is similar as for Proposal 3-1a (which concerns "during initial access"), i.e. most responses are fine with Proposal 3-2a, and there were no suggestions to clarify or modify the formulations in describing the options, but some responses wish to do further down selection already now. Based on the feedback, it is proposed to consider the same proposal again (i.e. Proposal 3-2b is the same as Proposal 3-2a).

High Priority Proposal 3-2b:

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

| Item | Company | Comments |
|------|-------------------------------|--|
| 1 | QUALCOMM JAPAN LLC. | [Qualcomm] Yes. We support Option 2. |
| 2 | NTT DOCOMO INC. | [DOCOMO] We support the proposal |
| 3 | vivo Communication Technology | As we are still in the middle of the meeting, can we have a try to down-select to make more progress? Our 1st preference is option 2, then option 3, and we would like to exclude option 1 |
| 4 | WILUS Inc. | [WILUS] We support this proposal. |
| 5 | Ericsson Inc. | [Ericsson] We support the proposal. |
| 6 | CATT | [CATT] OK for the sake of progress. |
| 7 | NEC Corporation | [NEC] We support the proposal. |
| 8 | Spreadtrum Communications | [SPRD] Yes |
| 9 | LG Electronics Inc. | [LG] Yes. We prefer Option 2. |
| 10 | Samsung Electronics Polska | [Samsung] We are fine with the proposal, and suggest further study and downselect in later meeting. |
| 11 | SHARP Corporation | [Sharp] We support the proposal. |
| 12 | Xiaomi Communications | [Xiaomi]: OK with current proposal and we prefer Option 1 and Option 2 |
| 13 | Intel Corporation (UK) Ltd | [Intel] Can accept the current proposal as an intermediate step. |
| 14 | China Telecommunications | [China Telecom] We support this proposal and prefer Option 2. |
| 15 | ZTE Corporation | [ZTE] Yes. Option 2 is preferred. It would be better to make down selection in this meeting. |

| Item | Company | Comments |
|------|--------------------------------|---|
| 16 | Shenzhen YZF Network Technolog | [OPPO] support this proposal and prefer option 2 |
| 17 | Lenovo (Beijing) Ltd | Yes |
| 18 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 19 | Nordic Semiconductor ASA | Support and keep all options on the table. |
| 20 | Nokia | [Nokia] We are fine with the proposal. Our preference is Option 3. |
| 21 | Futurewei Technologies | Yes. Option 1 should be excluded and the focus is on options 2 and 3. |
| 22 | Inter-Digital Communications | Yes. |

15 Medium Priority Question 4-1

Medium Priority Question 4-1:

Should configuration of additional CORESET for scheduling of Msg2 and/or Msg4 and/or Paging and/or SI for RedCap UEs be supported? Please provide a motivation for your answer.

Feedback Form 14: Please provide your answer to Question 4-1.

| Item | Company | Comments |
|------|--------------------------------|--|
| 1 | QUALCOMM JAPAN LLC. | [Qualcomm] Configuring additional CORESET for the broadcast PDCCH/PDSCH helps with traffic offloading of RedCap UE, but increases the system overhead. We are ok to further discuss this proposal. |
| 2 | NTT DOCOMO INC. | [DOCOMO] We share the view with Qualcomm and we are OK to further discuss the functionality |
| 3 | HUAWEI Technologies Japan K.K. | [Huawei] this could be a low priority for this release |

| Item | Company | Comments |
|------|-------------------------------|---|
| 4 | Ericsson Inc. | <p>[Ericsson] CORESET #0 can be congested with both RedCap and non-RedCap UEs specially as the number of UEs in the network increases overtime. Having an additional CORESET which is not confined within the CORESET #0 bandwidth (i.e., at least partially non-overlapping in frequency domain) can be useful for offloading purposes. However, there is a constraint on introducing such additional CORESET due the RedCap bandwidth limitation.</p> <p>We think it's too early to say a configuration of additional CORESET for scheduling of Msg2 and/or Msg4 and/or Paging for RedCap UEs "should" be supported. But if there is a simple solution without much specification impacts, we are open to consider it for Rel-17.</p> |
| 5 | CATT | <p>[CATT] Not yet. The current specification already supports configuring additional CORESET for the purpose of RACH/Paging, etc. The only difference is that whether 'RedCap-dedicated common CORESET' is introduced on top of the current scheme. To us, there is no urgent demand to support this design at this early release with unclear benefit, as has been pointed out by Huawei.</p> |
| 6 | vivo Communication Technology | <p>We would like to clarify if the additional CORESET for broadcast is configured within the initial BWP shared by redcap and non-redcap UEs, or it can be configured within the separate initial DL BWP specific for redcap UEs as being considered as in Proposal 2-1c?</p> |
| 7 | Spreadtrum Communications | <p>[SPRD] We can further discuss it</p> |
| 8 | LG Electronics Inc. | <p>[LG] Yes. As Ericsson mentioned, we also think the CORESET#0 can be congested with the introduction of RedCap UEs sharing the same CORESET#0 with non-RedCap UEs. In this case, the additional CORESET for broadcast for RedCap not limited to the initial DL BWP shared with non-RedCap UEs should also be considered.</p> |
| 9 | Samsung Electronics Polska | <p>[Samsung]</p> <p>We support to further study it.</p> <p>We like to further clarify that, this additional CORESET for RedCap can be different from the additional CORESET for non-RedCap UE, which additional from CORESET #0.</p> <p>In addition, we like to further study whether it is allowed to be out side of CORESET #0 BW.</p> |
| 10 | Xiaomi Communications | <p>[Xiaomi]: From the perspective of offloading, we don't see strong need. But we think whether additional CORESET for scheduling of these broadcast information also depends on the configuration of separate or additional initial DL BWP for Redcap during initial access as described in the FFS bullet in proposal 2-1c. If separate initial DL BWP is configured for Redcap during initial access, there is potential need for additional CORESET for Msg.2/Msg.2 at least.</p> <p>So we suggest to keep this item for further study</p> |

| Item | Company | Comments |
|------|---------------------------------|--|
| 11 | ZTE Corporation | [ZTE] Additional CORESET for scheduling of Msg2 and/or Msg4 and/or Paging is beneficial for traffic offloading and UE's power saving. |
| 12 | Lenovo (Beijing) Ltd | Prefer to have further study on additional CORESET. This is also related with if separated initial DL BWP is configured for RedCap. If configured, there is anyway an additional CORESET for scheduling Msg2/Msg4, etc. for RedCap UEs. |
| 13 | Panasonic Corporation | [Panasonic] Yes, we propose to allow the network operation with the additional CORESET for RedCap. For example, when the DL BWP is expected to be congested and/or the system bandwidth is larger, additional CORESET can be configured and the DL channels can be separated. By this, more scheduling flexibility can be obtained. Compared with using separated initial DL BWP, additional CORESET with shared BWP can result in less resource overhead. |
| 14 | Shenzhen YZF Network Technology | [OPPO] Can be considered to provide large system capacity to support some scenarios such as ISWN. |
| 15 | Nokia | [Nokia] We don't see the need for the additional CORESET, especially since separate DL BWP is being considered. Therefore we don't support this proposal. |
| 16 | Futurewei Technologies | We have a similar view as Nokia |
| 17 | Inter-Digital Communications | We support to further study this. |

16 High Priority Proposal 4-2

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

| Item | Company | Comments |
|------|------------------|----------|
| 1 | NTT DO-COMO INC. | Yes |

| Item | Company | Comments |
|------|--------------------------------|--|
| 2 | QUALCOMM 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. |
| 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. |

| Item | Company | Comments |
|------|------------------------------|--|
| 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. |
| 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., ü Frequency selective gain ü Better scheduling flexibility ü Less UE memory and BWP switching operation |
| 24 | Lenovo (Beijing) Ltd | [Lenovo, Motorola Mobility] Yes |
| 25 | Inter-Digital Communications | Yes. |

17 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 16: Can Proposal 4-2a be agreed? If not, please explain why.

| Item | Company | Comments |
|------|-------------------------------|--|
| 1 | QUAL-COMM JAPAN LLC. | [Qualcomm] Yes |
| 2 | Nordic Semiconductor ASA | No. The benefits from operation in BWP corresponding to full gNB carrier have been summarized by Samsung. Same can be achieved with multiple non-overlapping BWPs, but on expense of complexity of BWP switching. Moreover, reception on only a part of BWP is already supported in R16. |
| 3 | CATT | [CATT] OK |
| 4 | ZTE Corporation | [ZTE] Yes |
| 5 | LG Electronics Inc. | We are okay with the proposal. |
| 6 | vivo Communication Technology | [vivo]We support the proposal |
| 7 | China Mobile Com. Corporation | [CMCC] Yes |
| 8 | China Telecommunications | [China Telecom] We support FL proposal. |
| 9 | Xiaomi Communications | [Xiaomi] OK |
| 10 | NEC Corporation | [NEC] Yes |

| Item | Company | Comments |
|------|--------------------------------|--|
| 11 | Shenzhen YZF Network Technolog | [OPPO] agree |
| 12 | HUAWEI Technologies Japan K.K. | [Huawei] Support |
| 13 | Intel Corporation (UK) Ltd | [Intel] Yes, we support the proposal. |
| 14 | Ericsson Inc. | [Ericsson] We are fine with the proposed working assumption. We do want to point out as a consequence of this working assumption, a potential FFS would be whether BWP operation without restriction needs to be a mandatory feature for RedCap UEs. |
| 15 | Spreadtrum Communications | [SPRD] Yes |
| 16 | NTT DO-COMO INC. | [DOCOMO] We support the proposal |
| 17 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 18 | SHARP Corporation | [Sharp] We support the proposal. |
| 19 | Futurewei Technologies | Yes for the working assumption. |

18 High Priority Proposal 4-3

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 17: Can Proposal 4-3 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. |
| 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. |
| 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. |

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

19 High Priority Proposal 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 Proposal 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 18: Can Proposal 4-3a be agreed? If not, please explain why.

| Item | Company | Comments |
|------|-------------------------------|---|
| 1 | QUAL-COMM JAPAN LLC. | [Qualcomm] Yes |
| 2 | Nordic Semiconductor ASA | Same comment as for 4-2a |
| 3 | CATT | [CATT] OK |
| 4 | ZTE Corporation | [ZTE] Yes |
| 5 | LG Electronics Inc. | We are okay with this proposal. |
| 6 | vivo Communication Technology | [vivo]We support the proposal |
| 7 | China Mobile Com. Corporation | Yes. |
| 8 | China Telecommunications | [China Telecom] The same view with Proposal 4-2a. We support FL proposal. |
| 9 | Xiaomi Communications | [Xiaomi] OK |
| 10 | NEC Corporation | [NEC] Yes |

| Item | Company | Comments |
|------|---------------------------------|---|
| 11 | Shenzhen YZF Network Technology | [OPPO] Agree |
| 12 | HUAWEI Technologies Japan K.K. | [Huawei] Support |
| 13 | Intel Corporation (UK) Ltd | [Intel] Yes, we support the proposal. |
| 14 | Ericsson Inc. | [Ericsson] We are fine with the proposed working assumption. |
| 15 | Spreadtrum Communications | [SPRD] Yes |
| 16 | NTT DOCOMO INC. | [DOCOMO] We support the proposal |
| 17 | Samsung Electronics Polska | [Samsung] If UE is allowed to operated in a wider initial UL BWP, we don't see the need to restrict for non-initial UL BWP. We suggest to postpone the discuss after downselection of propsal 3-2. |
| 18 | Panasonic Corporation | [Panasonic] Support the proposal. |
| 19 | SHARP Corporation | [Sharp] We support the proposal. |
| 20 | Futurewei Technologies | Yes for the working assumption |

20 High Priority Proposal 4-4

Proposals 4-2a and 4-3a were discussed on the RAN1 email reflector. Based on one comment (from Qualcomm), the proposals were revised to replace "the UE maximum bandwidth" with "the maximum bandwidth of the RedCap UE". Another company (Nordic Semiconductor) proposed to add a sub-bullet stating that the "baseline RedCap UE type/category capability is the one defined by FG 6-1, other features FG 6-x are optional for RedCap UE type", at least for FR1. Based on the comments, the following proposal can be considered, where the DL BWP and UL BWP cases have been combined into a single proposal.

High Priority Proposal 4-4:

Working assumption: A RedCap UE cannot be configured with a non-initial (DL or

UL) BWP (i.e., a BWP with a non-zero index) wider than the maximum bandwidth of the RedCap UE.

- At least for FR1, baseline RedCap UE type/category capability is the one defined by FG 6-1, other features FG 6-x are optional for RedCap UE type.

Feedback Form 19: Can Proposal 4-4 be agreed? If not, please explain why.

| Item | Company | Comments |
|------|--------------------------------|--|
| 1 | QUAL-COMM JAPAN LLC. | [Qualcomm] Yes, we support this proposal. |
| 2 | vivo Communication Technology | we are fine with the proposal |
| 3 | HUAWEI Technologies Japan K.K. | [Huawei] The sub-bullet is too broad as FG6-x include many features that have been explicitly out of scope. |
| 4 | Intel Corporation (UK) Ltd | [Intel] We are fine with the proposal. To address the concern from Huawei, perhaps we could rephrase the last part to indicate that it can be discussed further as to whether all FG 6-x features may be available to RedCap UEs or not. So, something like the following could be considered: "... other features FG 6-x may be optional for RedCap UE type (FFS details)". |
| 5 | NEC Corporation | [NEC] We are fine with the proposal. The sub-bullet point could be modified as e.g. "other features FG 6-x applicable to RecCap type type are optional for RedCap UE type" |
| 6 | NTT DO-COMO INC. | [DOCOMO] We are not sure why the sub-bullet is related to the main bullet but don't object if modified as "At least for FR1, baseline RedCap UE type/ category capability is the one defined by FG 6-1, other features FG 6-x are optional for RedCap UE type. " There is no "category" for RedCap UEs. It is still unclear which FG6-x is applicable to RedCap UEs, so it is safer way to delete the sentence. |
| 7 | CATT | [CATT] Fine with the direction. We share similar views as NEC and Docomo. May be the sub-bullet can be revised as <ul style="list-style-type: none"> • At least for FR1, baseline RedCap UE type/category capability is the one defined by FG 6-1, other features FG 6-x, if applicable, are optional for RedCap UE type. |
| 8 | TCT Mobile Limited | [TCL] We are fine with the proposal. |

| Item | Company | Comments |
|------|-------------------------------|--|
| 9 | Samsung Electronics Polska | [Samsung] Fine with the proposal. And prefer DCM's suggestion. |
| 10 | ZTE Corporation | [ZTE] We are fine with the main bullet but quite not sure why we need to add the subbullet. What is the intention? |
| 11 | LG Electronics Inc. | [LG] We support the modification suggested by DOCOMO. If it is unclear yet which one is applicable to RedCap, then we don't know whether it should be optional or mandatory. |
| 12 | Nordic Semiconductor ASA | [Nordic] Huawei has a good point, 6-X contains also e.g. CA features which are not applicable already based on plenary decision. DCM wording is good. |
| 13 | Panasonic Corporation | [Panasonic] Support the main bullet. Regarding the sub-bullet, our interpretation of "other feature FG 6-x" is "all other FGs in FG 6-x except FG 6-1". If so, we are ok. |
| 14 | China Mobile Com. Corporation | [CMCC] We are fine with the proposal. |
| 15 | Inter-Digital Communications | Yes. |
| 16 | Nokia | [Nokia] We support this proposal |
| 17 | Ericsson Inc. | We support DCM's version of the proposal. |
| 18 | Futurewei Technologies | We support the top level working assumption. With the sub-bullet, we are unclear why it is added at this stage. Our general opinion is that any discussions about a specific feature should be held when all relevant features are examined for RedCap UEs. Feature FG 6-1 should definitely be considered for RedCap UEs, but not at this moment. |

21 High Priority Proposal 4-4a

Since some concerns were raised regarding the sub-bullet in Proposal 4-4, perhaps the following updated proposal can be considered, where the sub-bullet has been updated according to the suggestion in the feedback from DCM.

High Priority Proposal 4-4a:

Working assumption: A RedCap UE cannot be configured with a non-initial (DL or

UL) BWP (i.e., a BWP with a non-zero index) wider than the maximum bandwidth of the RedCap UE.

- At least for FR1, baseline RedCap UE type capability is the one defined by FG 6-1.

Feedback Form 20: Can Proposal 4-4a be agreed? If not, please explain why.

| Item | Company | Comments |
|------|--------------------------------|---|
| 1 | Intel Corporation (UK) Ltd | [Intel] Support the proposal. |
| 2 | QUALCOMM JAPAN LLC. | [Qualcomm] Yes |
| 3 | Spreadtrum Communications | [SPRD] Basically support. For the subbullet, does the wording "baseline" mean "mandatory"? If so, currently FG6-1 is already mandatory. We suggest revision "RedCap UE type capability is the one defined by FG 6-1, which is mandatory" |
| 4 | Ericsson Inc. | [Ericsson] Yes |
| 5 | NEC Corporation | [NEC] We are fine with the proposal. |
| 6 | CATT | [CATT] We are fine with the proposal. |
| 7 | HUAWEI Technologies Japan K.K. | [Huawei, HiSilicon] Fine with the main bullet but still uncomfortable for the sub-bullet. It is not clear why FR1 is the focus as 6-1 applies to both FR as mandatory FG without capability signally. It cannot be changed in FR2 unless the proponent is considering another baseline for FR2. Further, if then we start with a question asking what is the baseline capability for RedCap UE type in FR1, we wouldn't say it is FG-6-1; in our view, it is 20Mhz UE bandwidth. Seeing Spreadtrum comments it seems a valid concern, right. With this, to still try to leave something preferred by the proponent for the sub-bullet and also considering the FG6-1a would be somehow a certainly needed FG, we could replace the sub-bullet as: FG6-1 and FG6-1a is supported by a UE report/defined as RedCap UE type. |
| 8 | China Telecommunications | [China Telecom] We are fine with FL proposal. |
| 9 | Panasonic Corporation | [Panasonic] Support the FL proposal. Spreadtrum's revision is also acceptable as it seems clearer. |

| Item | Company | Comments |
|------|--|--|
| 10 | vivo Communication Technology | we are fine with the FL proposal |
| 11 | NTT DO- COMO INC. | [DOCOMO] We are fine with the proposal |
| 12 | Xiaomi Communi- cations | [Xiaomi] We are not sure about the relationship between the main proposal and the subbullet proposal. And also think it is too early to discuss which capability is mandatory and which capability is optional. But for progress, we can live with current proposal. And we also think the revision from Spreadtrum could make the proposal more clear. |
| 13 | Nordic Semicon- ductor ASA | We can compromise for this proposal, given that the sub-bullet is kept |
| 14 | Nordic Semicon- ductor ASA | Regarding Huawei comment, we definitely cannot agree on FG6-1a being baseline capability for RedCap UE, we are fine to keep it FFS for now though. |
| 15 | China Mo- bile Com. Corpora- tion | [CMCC] We are fine with the proposal. |
| 16 | SHARP Corpora- tion | [Sharp] We are fine with the FL proposal. |
| 17 | ZTE Cor- poration | [ZTE] We are fine with the main bullet. But want to clarify what is the relationship between the main bullet and the subbullet? It seems the subbullet can also put under other proposals. |
| 18 | Futurewei Technolo- gies | We are fine with the main bullet. As we indicated we would prefer to discuss feature 6-1 when other features are being discussed. For clarification purposes, to keep the proposal self-contained, a description of FG 6-1 should be added. Some examples include (reusing text from 38.822) <ul style="list-style-type: none"> • Feature name: “Basic BWP operation with restriction” or • based from the notes: “This feature should be mandatory without capability signalling for at least BWPs which is the same as the set of specified channel BW. UE-specific RRC configured DL/UL BWP can have the same or different numerology from the initial active DL/UL BWP” |

22 High Priority Proposal 4-4b

Based on the feedback to Proposal 4-4a, the following updated proposal can be considered, where the sub-bullet has been modified.

High Priority Proposal 4-4b:

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

- **At least for FR1, FG 6-1 ("Basic BWP operation with restriction" as described in TR 38.822) is used as a starting point for the RedCap UE type capability.**

23 Medium Priority Question 5-5

RAN1#104e agreed to study how to enable/support that a RACH occasion associated with the best SSB falls within the RedCap UE bandwidth. The identified benefits and drawbacks for each of the studied options have been summarized in FLS1 in R1-2103823.

Medium Priority Question 5-5:

In order to facilitate a converged understanding, companies are invited to comment on the benefits and drawbacks for each option (starting with the benefits and drawback identified in R1-2103823), in particular regarding how each option can be designed to overcome/minimize the identified drawbacks of the option.

Feedback Form 21: Please provide your answer to Question 5-5.

| Item | Company | Comments |
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| 1 | Qualcomm CDMA Technologies | [Qualcomm] For FR2, we are generally fine with the benefits and drawbacks of the options in R1-2103823. We would like to add additional concern for option 4: For FR2, the number of beam may be significant and having dedicated ROs for RedCap (in addition to those for non-RedCap) may lead to significant resource usages for ROs for both system, which is undesirable. |
| 2 | QUALCOMM JAPAN LLC. | [Qualcomm] We support this proposal. Thanks for the coordination of FL and the constructive comments of all participating companies ! |

| Item | Company | Comments |
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| 3 | QUAL-COMM JAPAN LLC. | <p>[Qualcomm2] Regarding option 2, we think the initial UL BWP for RedCap UE can be nested within the initial UL BWP of non-RedCap UE. As a result, the resource utilization efficiency can be improved, regardless the number of RedCap UEs is small or large. Besides, it can support Option 4 as well. Therefore, we suggest to add the following benefits to Option 2:</p> <ul style="list-style-type: none"> • can be combined with dedicated PRACH configurations for RedCap UE • can be nested within the initial UL BWP of non-RedCap UE to improve the resource utilization efficiency |
| 4 | QUAL-COMM JAPAN LLC. | <p>[Qualcomm2] It occurs to us there is an ambiguity regarding the definition of BWP. That is, whether the RF-retuning changes the BWP id. Therefore, we think Option 2 could be clarified as "separate initial UL BWP(s) for RedCap UE without RF retuning for RO selection."</p> |
| 5 | vivo Communication Technology | <p>we prefer option 2 and many of its claimed drawback can be mitigated with proper design</p> <ul style="list-style-type: none"> · The initial UL BWP and the initial DL BWP may have different central frequencies. Does not follow the current BWP design principle for unpaired spectrum thus it complicates the UE's implementation. [4, 17] [Can be solved if there will be also separate initial DL BWP for Redcap UEs on the same center frequency] · Increased gNB processing for PRACH. [5, 11] [Can be reduced if the initial UL BWP for redcap can be configured to be nested within the initial UL BWP for non-redcap UEs] · May cause higher specification impact. [7] [We think Solutions which requires RF retuning would cause more spec impact, e.g. RAN4] · Risk of PUSCH/PRACH resource fragmentation [11, 16, 25] [there is no PRACH resource fragmentation if nested configuration is used] · Some resource utilization efficiency loss since normal UE and RedCap devices may not share certain channels or resources. [17] [We actually think this provides a benefit, or flexibility, if the UL initial BWP is congested] · New configuration for SIB is needed. Need additional indication (either implicitly or explicitly) [25, 28, 31] · Additional resources for RedCap UEs may be needed. [25] · Even if the number of RedCap UEs is quite small, the gNB would always configure more than one initial UL BWP, which can be burden at network side. [31] [again, nested configuration can solve this issue] <p>Option 3 could be the default option if nothing else can be agreed..</p> |
| 6 | TCT Mobile Limited | <p>[TCL] The new proposed option shouldn't be excluded in the discussion.</p> |

| Item | Company | Comments |
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| 7 | Samsung Electronics Polska | <p>[Samsung]</p> <p>If we go for <u>option 1</u> (i.e., The scenario is allowed, and a RedCap UE can use the same UL BWP) of the agreement for UL BWP, for this question, we think option 1 (Proper RF-retuning) and option 4 (dedicated RO configurations) can be considered.</p> <p>Benefit:</p> <p>Option 1: Shared RO with legacy, no restriction of gNB configuration, avoid resource fragmentation, etc. ==> we agree with the benefit summarized in FL summary.</p> <p>Option 4: Indication of RedCap UE with dedicated RO.</p> <p>We think above option1 and option 4 can be configured by gNB.</p> <p>If we go for <u>option 2</u> (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), we think it directly lead option 2 (Option 2: Separate initial UL BWP(s) for RedCap UEs).</p> <p>If we go for <u>option 3</u> (Option 3: The scenario is not allowed, and a RedCap UE is not expected to operate in an initial UL BWP wider than the RedCap UE maximum bandwidth), all RO will fall into RedCap BW. And whether separated RO configuration (option 4) is needed, can be up to gNB, for early indication, if supported.</p> |
| 8 | ZTE Corporation | <p>[ZTE]</p> <p>For Option 1, it also has following drawbacks:</p> <ol style="list-style-type: none"> 1) frequent RF-retuning may be unavoidable. Therefore, more power consumption would be expected for RedCap UEs. 2) RF-retuning would increase the UE implementation complexity. <p>For Option 2, we show similar views as Qualcomm on two benefits proposed by Qualcomm.</p> |

| Item | Company | Comments |
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| 9 | CATT | <p>[CATT] We are aware of that the pros and cons of the options listed in R1-2103823 are more or less subjective (e.g. whether one option has higher specification impact or how serious the flexibility is sacrificed) or conditional (e.g. one option only has obvious advantage with a specific cell BW). Not sure this input helps out the gridlock, but we can try by focusing on the essential aspects only.</p> <p>From our view, the preference is Option 2 > Option 1 Option 4 > Option 3.</p> <p>Option 3 (gNB configuration) is of course workable and a baseline (if unfortunately no other option is agreed). Limiting the configuration more or less has impact on legacy UEs. Though it is not directly conflicted with the WID (Coexistence with non-RedCap UEs is to be ensured), it is hard to say that not against the WID spirit, since non-RedCap UE will be impacted.</p> <p>Option 4 (dedicated RACH configuration) is introducing additional UL resource cost for RedCap UE. These may not be an issue in FDD. But for TDD, with popular TDD configuration such as DDDSU, this additional cost is non-negligible. On the other hand, if RedCap-dedicated ROs is overlapped with non-RedCap ROs, it is likely the SSB-to-RO mapping is not the same and the gNB blind detection will be complicated.</p> <p>Option 1 (RF retuning) seems no specification impact on the surface and no additional UL resource cost. But we have doubts in the feasibility of RAR delay, and something further like whether RedCap UE can share the same Msg2 PDSCH with non-RedCap UE. We also feel anxious if Option 1 is adopted, then the Msg3 PUSCH/Msg4 PUCCH case will be handled in the same way, which causes more serious troubles than PRACH (as least for PUCCH) and not acceptable for us.</p> <p>Option 2 (Separate initial UL BWP(s)) may have the same problem in Option 4, but it can also tackle the out-of-range issue of Msg3/Msg4 at the same time. But to be fair, Option 2 contains sub-options that different with each other. It is hard to analyse all the pros and cons one by one.</p> |
| 10 | NTT DO-COMO INC. | <p>[DOCOMO]</p> <p><u>Option 1</u>: The drawback comes mainly from RF-retuning time, which definitely needs RAN4 feedback on the applicable values. In addition, it should be discussed whether to allow RedCap UEs to transmit a PRACH outside the initial UL BWP (if it is not wider than the maximum RedCap UE BW), or to adjust the initial UL BWP to include the UE BW after RF-retuning (either adjusting the center frequency or the BW)</p> <p><u>Option 2</u>: vivo's comment address the drawbacks. Also, allowing deferent center frequencies between initial DL/UL BWPs for RedCap UEs can be an alternative way, while RF retuning would be necessary in this case.</p> <p><u>Option 3</u>: This option does not have any spec update, and hence, the drawbacks still remain</p> <p><u>Option 4</u>: This option can be regarded as a subset of Option 2, and hence, similar to Option 2, the drawbacks can be addressed by nested configuration of ROs</p> |

| Item | Company | Comments |
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| 11 | Panasonic Corporation | <p>We think this issue is highly related to the agreement below, so the down-selection on the initial UL BWP scenario below can be addressed before the discussion on RO issue.</p> <p>Agreement: 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 among the following options in RAN1#105-e</p> <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 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 expected to operate in an initial UL BWP wider than the RedCap UE maximum bandwidth. <p>For example, for the scenario that the initial UL BWP is shared, and it has common PRACH configuration for RedCap and non-RedCap, option 1 or 3 on RO would be needed. Or, for the scenario that separate initial UL BWP is used, option 2 and 4 on RO would be needed.</p> |

| Item | Company | Comments |
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| 12 | Nordic Semiconductor ASA | <p>[Nordic]</p> <p>I think that FL did a good job of summarizing companies observations, but as pointed out by CATT those are often subjective. :)</p> <p>We should focus on KPIs and compare options and provide conclusions</p> <p>Extra overhead in SIB1: Option 2 > Option 4 > Option 1/Option 3</p> <p>This because whole BWP needs more signaling than a set of separate RACH/PUCCH-config in ASN.1 (See below)</p> <p>Legacy RO-config/PUCCH-config reuse: The best reuse is for Option 1. The second best is Option 3, because compared to Option 1 gNB must allocate ROs to 20MHz. Option 2 and Option 4 are the worst here, but could be used by gNB together with Option 1 and 3 only if needed and only in some scenarios.</p> <p>Specification impact: Is not significant for any Option, but is zero for Option 3</p> <p>gNB Flexibility for scheduling MSG3/MSG4-ACK: With Option 1, gNB can operate RedCap UE almost as legacy one (perhaps up to hopping)</p> <p>We noticed that many companies making a horror out of RF retuning in terms of delay and power consumption:</p> <p>Delay: <u>1-2 symbols for retuning is an insignificant delay, but agree makes trouble to hopping</u></p> <p>Power consumption: When HD-FDD UE decides to make initial access, it may keep DL RF at the same spot during whole initial access (SSB overlaps with CORESET#0 in FR1), and UE activates UL RF at the desired PRACH location. For Option 2/Option4/Option3 UE would expect MSG3/MSG4-ACK in the same BWP/RB-set as PRACH, for Option 1, one/two UL RF retune is needed during initial access.</p> <p>Given above, we think</p> <ul style="list-style-type: none"> • Option 3 should be supported, it is always choice of gNB in some scenarios to operate RedCap as legacy + down-select from for wide carrier operations <ul style="list-style-type: none"> – Option 1 <ul style="list-style-type: none"> * choose if gNB flexibility is main KPI – Option 4 in configured RB-set(s), which achieves the same as Option 2, but at least pusch-config/ BWP genericParameters does not need to be configured and can be inherited from non-RedCap initial UL BWP <ul style="list-style-type: none"> * choose if retuning should be minimized and if initial access capacity needs to be grown by gNB in future <p>For reference, I provide R15 content of SIB1 BWP content</p> <pre> BWP-UplinkCommon ::= SEQUENCE { genericParameters BWP, rach-ConfigCommon SetupRelease { RACH-ConfigCommon } pusch-ConfigCommon SetupRelease { PUSCH-ConfigCommon } pucch-ConfigCommon SetupRelease { PUCCH-ConfigCommon } </pre> |

| Item | Company | Comments |
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| 13 | China Mobile Com. Corporation | [CMCC] We prefer option 2 and we agree that many of its drawback can be mitigated with the design mentioned by vivo. Regarding the resource utilization efficiency loss since normal UE and RedCap devices may not share certain channels or resources [17], we think this may be a benefit. If the separate initial BWP and initial BWP does not overlap, separate initial UL BWP has additional benefit for access capacity extension and traffic offloading, which is useful when the number of access UEs is large. |
| 14 | LG Electronics Inc. | [LG] We would like to note that Option 1 (RF-retuning) has a feasibility issue for PUSCH/PUCCH case as we explained in response to Question 6-5. Even if we adopt Option 1 for the RO case, we will probably have to choose another option for the PUSCH/PUCCH case. Option 2 has a great support from many companies and is single solution for both RO and PUSCH/PUCCH case which should be captured as one of the benefits. |

| Item | Company | Comments |
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| 15 | Ericsson Inc. | <p data-bbox="421 264 544 293">[Ericsson]</p> <p data-bbox="421 300 1062 329">Option 1: Proper RF-retuning for RedCap:</p> <p data-bbox="421 336 1425 365">Among the identified benefits, the most important ones are highlighted below.</p> <ul data-bbox="461 405 1425 589" style="list-style-type: none"> <li data-bbox="461 405 1425 465">• Allows the RedCap devices and the normal UEs to share the same initial UL BWP and PRACH resource. <li data-bbox="461 499 1086 528">• Uplink resource fragmentation can be avoided. <li data-bbox="461 562 906 591">• No impact on non-RedCap UEs. <p data-bbox="421 629 1425 658">Among the identified drawbacks, the most important ones are discussed below.</p> <ul data-bbox="461 696 1425 1395" style="list-style-type: none"> <li data-bbox="461 696 1425 797">• A new timing relationship between PRACH and RAR (msg2) which shall take the retuning time into account. May need to consider additional delay for starting RAR window. This may increase access latency. <ul data-bbox="525 835 1425 896" style="list-style-type: none"> <li data-bbox="525 835 1425 896">– Comment: a few symbols additional delay during initial access can be acceptable. <li data-bbox="461 943 1425 1043">• Frequent RF-retuning may be unavoidable. Therefore, more power consumption would be expected for RedCap UEs. In addition, such RF-retuning would significantly increase the UE implementation complexity. <ul data-bbox="525 1081 1425 1395" style="list-style-type: none"> <li data-bbox="525 1081 1425 1395">– Comment: RF retuning does not need be done frequently in this case and may not be even needed in most cases. RF retuning is a common behaviour for LTE-M UEs and it does not prevent LTE-M UEs from having low UE complexity and achieving good energy efficiency. Furthermore already today, the UE may need to do RF retuning for transmitting PRACH. For example, if the RA procedure is initiated, but there are no PRACH occasions configured for the active BWP, the UE may need to switch to the initial BWP to transmit PRACH. <p data-bbox="421 1435 1246 1464">Option 2: Separate initial UL BWP(s) for RedCap UEs</p> <p data-bbox="421 1471 1425 1500">Among the identified benefits, the most important ones are highlighted below.</p> <ul data-bbox="461 1538 1425 1700" style="list-style-type: none"> <li data-bbox="461 1538 1129 1568">• Mostly compatible with existing BWP framework <li data-bbox="461 1601 1425 1700">• Also enable/support that PUCCH (for Msg4/[MsgB] HARQ feedback) and/or PUSCH (for Msg3/[MsgA]) transmissions fall within the RedCap UE bandwidth during initial access <p data-bbox="421 1738 1425 1767">Among the identified drawbacks, the most important ones are discussed below.</p> <ul data-bbox="461 1805 1425 2231" style="list-style-type: none"> <li data-bbox="461 1805 1425 1977">• Risk of PUSCH resource fragmentation: Creating a smaller UL BWP within a larger UL carrier bandwidth results in PUSCH resource fragmentation due to PUCCH frequency hopping that is currently required to be enabled for initial access. This has a pronounced impact on non-RedCap UEs. <ul data-bbox="525 2016 1425 2076" style="list-style-type: none"> <li data-bbox="525 2016 1425 2076">– Remedy: allow the network to disable PUCCH frequency hopping during initial access. <li data-bbox="461 2123 1425 2231">• The initial UL BWP and the initial DL BWP may have different central frequencies. Does not follow the current BWP design principle for unpaired spectrum thus it complicates the UE's implementation. The |

| Item | Company | Comments |
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| 16 | Intel Corporation (UK) Ltd | <p>[Intel] In the following we respond to the apparent "drawbacks" cited for Options 2 and 3. Although this question is about PRACH only, there seem to be observations that go beyond just PRACH transmissions, and in this regard, there seems to be quite some overlap between the points in Question 5.5 and Question 6.5.</p> <p><i>(Apologies for a 'tdoc-length' response (the question demanded such :-))</i>.</p> <p>Option 2 – Responses to identified “Drawbacks”:</p> <ul style="list-style-type: none"> · <i>The initial UL BWP and the initial DL BWP may have different central frequencies. Does not follow the current BWP design principle for unpaired spectrum thus it complicates the UE's implementation. [4, 17]</i> o [Intel] The current BWP design principle for unpaired spectrum to aligned DL/UL BWPs with same index is to avoid impact from excessive retuning between DL and UL whenever we have DL-UL switches and vice-versa. However, prior to RRC connection setup, the numbers of DL and UL switches are very limited and well-defined (as part of the RA procedure), and the impact from additional frequency retuning gaps that may be needed between DL and UL would have negligible (if at all any) impact as the retuning times can be easily accommodated as part of timing relationships between Messages for the RA procedure. In this regard, it should be noted that the same issue with frequency retuning between DL and UL applies to Option 1 as well. Lastly, the option of separate/additional configuration of DL BWP #0 with aligned center frequency with UL BWP #0 of RedCap UEs can also be an available option to address this, although such is not really necessary and should not be mandated for the NW. · <i>Increased gNB processing for PRACH. [5, 11]</i> o [Intel] This would be no different compared to FDM-ed ROs, and the overall dimensioning and whether ROs in two UL BWPs may have time-overlaps (and how many of such) is entirely up to gNB implementation. · <i>May cause higher specification impact. [7]</i> o [Intel] Other than Option 3, spec impact would be comparable for Options 1, 2, and 4. · <i>Risk of PUSCH/PRACH resource fragmentation [11, 16, 25]</i> o [Intel] This can be addressed in multiple ways, including avoiding overlaps between non-RedCap and RedCap UL BWPs, disabling some or all of FH for RedCap transmissions, etc. For cases wherein overlaps between UL BWP #0 for RedCap and non-RedCap UEs cannot be avoided, the impact can be minimized with appropriately locating the separate UL BWP #0 for RedCap UEs w.r.t. non-RedCap UL BWP #0. Considering UL transmissions that are typically power limited, 20 MHz/100 MHz in FR1/FR2 respectively implies very little impact in practice for a significant majority of non-RedCap UEs; only peak rates, that too only in certain slots/allocations may be impacted. Lastly, the overall impact from resource fragmentation would be limited since the number of UL transmissions from a RedCap UE in Idle/Inactive modes are very limited. · <i>Some resource utilization efficiency loss since normal UE and RedCap devices may not share certain channels or resources. [17]</i> o [Intel] This observation seems to be generic (beyond PRACH). In this regard, considering the amount of UL transmissions possible in Idle/inactive modes, the impact from such resource utilization efficiency would be negligible in practice. Even for Option 1, the resources may not always be shared between RedCap and non-RedCap UEs due to the need to accommodate retuning times, etc. · <i>New configuration for SIB is needed. Need additional indication (either implicitly or explicitly) [25, 28, 31]</i> o [Intel] Separate configuration of UL BWP #0 for RedCap UEs will |

| Item | Company | Comments |
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| 17 | Spread- trum Communi- cations | <p>[SPRD] Thanks for FL's great effort to summarize the Pros and Cons for the four options. They reflect most companies' view. From above discussion, we agree with ZTE to add the power/cost(complexity) issue for Option 1 (RF retuning). We should really care about it in UE implementation.</p> <p>Some companies compare RedCap to LTE MTC, as LTE MTC support RF hopping. But in our view, LTE MTC has objective of coverage enhancement and specifies both repetition and RF-based hopping. RedCap has no objective of coverage recovery and repetition is more reliable scheme than RF-based hopping. Baseband-based PUCCH/PUSCH hopping in 6 PRBs has low gain LTE MTC, but baseband-based PUCCH/PUSCH hopping in 100 PRBs has enough gain for NR RedCap, especially small data traffic for RedCap UE. Further, RF retuning is more feasible for LTE MTC with single-beam and CRS, because LTE MTC UE can stabilize RF quickly after RF retuning. But, with multi-beam and periodic SSB, RedCap UE may stabilize RF no so quickly after RF retuning.</p> <p>We also agree with vivo's response to drawbacks for Option 2 (separate initial UL BWP).</p> |
| 18 | HUAWEI Technolo- gies Japan K.K. | <p>[Huawei, HiSilicon] It seems the comments are missing the targeted options: some are referring to the agreed options for RACH vs SSB and some are referring to the one about whether allowing this scenarios under specific conditions...</p> <p>In our view, referring to the options given by "Study further how to enable/-support that a RACH occasion associated with the best SSB falls within the RedCap UE bandwidth":</p> <ul style="list-style-type: none"> • as long as centre frequencies change is required, there is no critical difference among a RF-retuning within a larger BWP, a BWP retuning, or a BWP switch. Any of the drawback of one option is the the same for the other two, but just overcome in some sense with other KPI which however can be applied to all options. For example, some companies consider there is performance loss for a faster RF retuning by puncturing some symbols, while due to large delay of BWP switch gap it is possible to not puncture symbols... no strange! clearly a BWP RF retuning or any RF retuning can also be defined without puncturing any symbols and those symbols are taken into account by a shorter scheduling gap. The performance impact of using legacy BWP switch with slot level gap in terms of overhead increment and efficiency reduction can also be huge, different from eMBB UEs because sometimes the switch is not necessary for eMBB - can be configured with a larger BWP, but not possible for RedCap. • Support multipleBWP for UE during initial access, triggering based BWP switch is the real advanced UE features. BWP retuning or RF retuning with a shorter gap is neither legacy BWP switching, nor an advanced feature. For companies questioning how retuning is different from a BWP switch - can we ask RAN4 to clarify this. If your answer is they are the same, why it is being objected; if your answer is they are different, claiming it as an advanced UE feature compared to BWP switch is indeed subjective... |

| Item | Company | Comments |
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| 19 | Futurewei Technologies | <p>The effort to capture the benefits and disadvantages of each option was huge and will be useful in the preparations for next meeting. Here we would like to expand on one point brought up in our paper R1-2102778 where we proposed to confirm that RACH occasions (and even RACH preambles, especially when early identification is not configured) can be shared between RedCap and non-RedCap UEs. It seems obvious that this should be possible for Option 3 where RedCap UEs and non-RedCap UEs have the same bandwidth (and BWPs), and even with Option 2 when the BWPs for non-RedCap and RedCap UEs are overlapping. To not be able to share in the overlapping case is a waste of resources. However, we see some companies view Option 2 as precluding the sharing of RACH occasions / preambles.</p> <p>So we suggest to confirm/agree that RedCap UEs can share RACH occasions / preambles defined for non-RedCap UEs.</p> |
| 20 | Shenzhen YZF Network Technolog | <p>[OPPO] We prefer option 1. For option 2, it is difficult to align the same center frequency for initial DL BWP and that of initial UL BWP. If the network vendor and operator can accept option 3/4, we can also live with them.</p> |

| Item | Company | Comments |
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| 21 | Intel Corporation (UK) Ltd | <p><i>(Earlier "long feedback" split into multiple comments)</i></p> <p>[Intel_1]</p> <p>In the following we respond to the apparent "drawbacks" cited for Options 2 and 3. Although this question is about PRACH only, there seem to be observations that go beyond just PRACH transmissions, and in this regard, there seems to be quite some overlap between the points in Question 5.5 and Question 6.5. <i>(Apologies for a 'tdoc-length' response (the question demanded such :-))</i>.</p> <p>Option 2 – Responses to identified “Drawbacks”:</p> <ul style="list-style-type: none"> · <i>The initial UL BWP and the initial DL BWP may have different central frequencies. Does not follow the current BWP design principle for unpaired spectrum thus it complicates the UE's implementation. [4, 17]</i> o [Intel] The current BWP design principle for unpaired spectrum to aligned DL/UL BWPs with same index is to avoid impact from excessive retuning between DL and UL whenever we have DL-UL switches and vice-versa. However, prior to RRC connection setup, the numbers of DL and UL switches are very limited and well-defined (as part of the RA procedure), and the impact from additional frequency retuning gaps that may be needed between DL and UL would have negligible (if at all any) impact as the retuning times can be easily accommodated as part of timing relationships between Messages for the RA procedure. In this regard, it should be noted that the same issue with frequency retuning between DL and UL applies to Option 1 as well. Lastly, the option of separate/additional configuration of DL BWP #0 with aligned center frequency with UL BWP #0 of RedCap UEs can also be an available option to address this, although such is not really necessary and should not be mandated for the NW. · <i>Increased gNB processing for PRACH. [5, 11]</i> o [Intel] This would be no different compared to FDM-ed ROs, and the overall dimensioning and whether ROs in two UL BWPs may have time-overlaps (and how many of such) is entirely up to gNB implementation. · <i>May cause higher specification impact. [7]</i> o [Intel] Other than Option 3, spec impact would be comparable for Options 1, 2, and 4. · <i>Risk of PUSCH/PRACH resource fragmentation [11, 16, 25]</i> |

| Item | Company | Comments |
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| 22 | Intel Corporation (UK) Ltd | <p><i>(Earlier "long feedback" split into multiple comments)</i></p> <p>[Intel_2]</p> <p>...Continued from above ...</p> <p><i>Risk of PUSCH/PRACH resource fragmentation [11, 16, 25]</i></p> <ul style="list-style-type: none"> o [Intel] This can be addressed in multiple ways, including avoiding overlaps between non-RedCap and RedCap UL BWPs, disabling some or all of FH for RedCap transmissions, etc. For cases wherein overlaps between UL BWP #0 for RedCap and non-RedCap UEs cannot be avoided, the impact can be minimized with appropriately locating the separate UL BWP #0 for RedCap UEs w.r.t. non-RedCap UL BWP #0. Considering UL transmissions that are typically power limited, 20 MHz/100 MHz in FR1/FR2 respectively implies very little impact in practice for a significant majority of non-RedCap UEs; only peak rates, that too only in certain slots/allocations may be impacted. Lastly, the overall impact from resource fragmentation would be limited since the number of UL transmissions from a RedCap UE in Idle/Inactive modes are very limited. · <i>Some resource utilization efficiency loss since normal UE and RedCap devices may not share certain channels or resources. [17]</i> o [Intel] This observation seems to be generic (beyond PRACH). In this regard, considering the amount of UL transmissions possible in Idle/inactive modes, the impact from such resource utilization efficiency would be negligible in practice. Even for Option 1, the resources may not always be shared between RedCap and non-RedCap UEs due to the need to accommodate retuning times, etc. · <i>New configuration for SIB is needed. Need additional indication (either implicitly or explicitly) [25, 28, 31]</i> o [Intel] Separate configuration of UL BWP #0 for RedCap UEs will be up to gNB configuration and the potential increase in SIB signaling OH can be taken into consideration by the gNB in determining the overall trade-off. Further, the signaling for the separate UL BWP #0 configuration can be optimized as well if deemed justified. · <i>Additional resources for RedCap UEs may be needed. [25]</i> o [Intel] If number of UEs increases or if the loading in the cell increases, more resources may be need to avoid resource blocking, and it would be similar to Options 1 or 4. Note that even for Option 1, there will be non-negligible loss in UL resources to accommodate retuning gaps for UL transmissions within a slot duration. · <i>Even if the number of RedCap UEs is quite small, the gNB would always configure more than one initial UL BWP, which can be burden at network side. [31]</i> o [Intel] The "burden" is unsubstantiated here. It is up to gNB how it intends to operate the system considering the trade-offs involved. gNB behavior is not being mandated. |

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| 23 | Intel Corporation (UK) Ltd | <p><i>(Earlier "long feedback" split into multiple comments)</i> [Intel_3] ...Continued from above ...</p> <p>Option 3 – Responses to identified “Drawbacks”</p> <ul style="list-style-type: none"> · <i>The flexibility of the network configuration for legacy UE is impacted. PRACH configuration for normal UEs will be restricted by the maximum RedCap UE bandwidth. May increase the probability of the random-access collisions [4, 5, 13, 14, 16, 17, 25, 28, 31, 32]</i> o [Intel] Any adverse impact from the apparent restrictions to non-RedCap UEs for UL BWP #0 configuration is not expected to be significant considering that this is only for Idle/Inactive modes when the UL transmissions are very limited and well-defined. Further, with 20 MHz BW for FR1 and 100 MHz BW in FR2, the impact from such constraints to control plane latency would be minimal and non-existent in most typical configurations/use-cases. The gNB has full flexibility to configure ROs; given a deployment, the best trade-off between RACH collisions and increased RACH OH can be managed by the gNB without any significant impact to non-RedCap UEs for their initial access. <ul style="list-style-type: none"> · <i>Putting restrictions on gNB implementation or specification. [7]</i> o [Intel] A restriction is not an issue if it does not lead to any significant operational challenges or performance loss. <ul style="list-style-type: none"> · <i>May cause inflexibility or fragmentation of PUSCH resources. [9]</i> o [Intel] Overall impact would be minimal considering very limited UL transmissions in Idle/Inactive modes. Further, this is not new for NR. It can be up to gNB to appropriately position the UL BWP #0 relative to UL carrier to minimize impact. Considering UL transmissions that are typically power limited, 20 MHz/100 MHz in FR1/FR2 respectively implies very little impact in practice for a significant majority of non-RedCap UEs; only peak rates, that too only in certain slots/allocations may be impacted. <ul style="list-style-type: none"> · <i>Potential impact on PRACH capacity if restrictions are applied. [11]</i> o [Intel] Same comment as in response to first “drawback”. <ul style="list-style-type: none"> · <i>gNB configuration and proper scheduling can provide a certain degree of assistance, but not all. [15]</i> o [Intel] This seems to be an opinion. |

| Item | Company | Comments |
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| 24 | Ericsson Inc. | <p data-bbox="421 268 1238 300"><i>(Earlier "long feedback" split into multiple comments)</i></p> <p data-bbox="421 304 555 336">[Ericsson2]</p> <p data-bbox="421 340 1244 371">Option 2: Separate initial UL BWP(s) for RedCap UEs</p> <p data-bbox="421 376 1426 407">Among the identified benefits, the most important ones are highlighted below.</p> <ul data-bbox="459 443 1426 604" style="list-style-type: none"> <li data-bbox="459 443 1129 474">• Mostly compatible with existing BWP framework <li data-bbox="459 501 1426 604">• Also enable/support that PUCCH (for Msg4/[MsgB] HARQ feedback) and/or PUSCH (for Msg3/[MsgA]) transmissions fall within the RedCap UE bandwidth during initial access <p data-bbox="421 640 1426 672">Among the identified drawbacks, the most important ones are discussed below.</p> <ul data-bbox="459 707 1426 1648" style="list-style-type: none"> <li data-bbox="459 707 1426 985">• Risk of PUSCH resource fragmentation: Creating a smaller UL BWP within a larger UL carrier bandwidth results in PUSCH resource fragmentation due to PUCCH frequency hopping that is currently required to be enabled for initial access. This has a pronounced impact on non-RedCap UEs. <ul data-bbox="523 922 1426 985" style="list-style-type: none"> <li data-bbox="523 922 1426 985">– Remedy: allow the network to disable PUCCH frequency hopping during initial access. <li data-bbox="459 1021 1426 1370">• The initial UL BWP and the initial DL BWP may have different central frequencies. Does not follow the current BWP design principle for unpaired spectrum thus it complicates the UE's implementation. The constrains on the feasible locations of RedCap UL BWP may still result in the PUSCH resource fragmentation issue mentioned above even if PUCCH frequency hopping is not enabled.. <ul data-bbox="523 1272 1426 1370" style="list-style-type: none"> <li data-bbox="523 1272 1426 1370">– Remedy: Allow frequency retuning between DL and UL BWP during initial access. This is similar to how a HD RedCap UE operates in an FDD band. <li data-bbox="459 1406 1426 1550">• Increased gNB processing for PRACH. <ul data-bbox="523 1478 1426 1550" style="list-style-type: none"> <li data-bbox="523 1478 1426 1550">– Remedy: Use shared ROs as much as possible between non-RedCap and RedCap UEs <li data-bbox="459 1585 1426 1648">• Even if the number of RedCap UEs is quite small, the gNB would always have to configure more than one initial UL BWP. |

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| 25 | Ericsson Inc. | <p data-bbox="421 268 1238 300"><i>(Earlier "long feedback" split into multiple comments)</i></p> <p data-bbox="421 304 555 336">[Ericsson3]</p> <p data-bbox="421 340 1430 443">Option 3: gNB configuration (e.g., restrictions on existing PRACH configurations, or FDM-ed ROs, or always restricting the initial UL BWP to within RedCap UE bandwidth)</p> <p data-bbox="421 448 1423 479">Among the identified benefits, the most important ones are highlighted below.</p> <ul data-bbox="459 515 1430 904" style="list-style-type: none"> <li data-bbox="459 515 1430 582">• gNB does not configure initial BWP that is beyond the maximum UE bandwidth. Therefore, this issue will not occur. <li data-bbox="459 609 887 640">• Minimum specification impact. <li data-bbox="459 667 1430 734">• RedCap UEs can share RACH occasions with legacy UEs. The configuration of initial access for non-RedCap UEs can be reused. <li data-bbox="459 761 1430 904">• Considering that access latency may not be an issue for RedCap UEs, the impact from multiplexing some of the ROs in time (rather than in frequency) may not have a significant impact on access latency for RedCap use-cases. <p data-bbox="421 940 1423 972">Among the identified drawbacks, the most important ones are discussed below.</p> <ul data-bbox="459 1008 1430 1361" style="list-style-type: none"> <li data-bbox="459 1008 1430 1151">• The flexibility of the network configuration for legacy UE is impacted. PRACH configuration for normal UEs will be restricted by the maximum RedCap UE bandwidth. May increase the probability of the random-access collisions. <ul data-bbox="523 1187 1430 1361" style="list-style-type: none"> <li data-bbox="523 1187 1430 1361">– Comment: The impact on legacy UEs is not expected to be significant. For example, sufficient capacity can still be achieved with less than 8 FDM-ed RACH occasions (e.g., 4 FDM-ed RACH occasions). Furthermore, multiplexing in the time domain can be used to increase PRACH capacity. |

| Item | Company | Comments |
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| 26 | Ericsson Inc. | <p><i>(Earlier "long feedback" split into multiple comments)</i> [Ericsson4]</p> <p>Option 4: Dedicated PRACH configurations (e.g., ROs) for RedCap UEs</p> <p>Among the identified benefits, the most important ones are highlighted below.</p> <ul style="list-style-type: none"> • Early identification support by dedicated resource configuration. • Few impacts on RedCap UEs. No/few impact on non-RedCap UEs. • Flexible configuration. <p>Among the identified drawbacks, the most important ones are discussed below.</p> <ul style="list-style-type: none"> • May complicate the gNB's resource allocation and the resource utilization efficiency may degrade since Redcap UE and legacy UE can't share the same PRACH resources. • Increase the overhead due to additional resources allocated for the dedicated ROs for RedCap • Potential increase in gNB PRACH processing load. • Even if the number of RedCap UEs is small, the gNB would always have to configure dedicated ROs. |

24 Medium Priority Question 6-5

RAN1#104e agreed to study whether and how to enable/support that PUCCH (for Msg4/[MsgB] HARQ feedback) and/or PUSCH (for Msg3/[MsgA]) transmissions fall within the RedCap UE bandwidth during initial access. The identified benefits and drawbacks for each of the studied options have been summarized in FLS1 in R1-2103823.

Medium Priority Question 6-5:

In order to facilitate a converged understanding, companies are invited to comment on the benefits and drawbacks for each option (starting with the benefits and drawback identified in R1-2103823), in particular regarding how each option can be designed to overcome/minimize the identified drawbacks of the option.

Feedback Form 22: Please provide your answer to Question 6-5.

| Item | Company | Comments |
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| 1 | QUAL-COMM JAPAN LLC. | [Qualcomm] It occurs to us there is an ambiguity regarding the definition of BWP. That is, whether the RF-retuning changes the BWP id. Therefore, we think Option 2 could be clarified as "separate initial UL BWP(s) for RedCap UE without RF retuning for PUSCH/PUCCH transmission." |

| Item | Company | Comments |
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| 2 | vivo Communication Technology | <p>Similaras question 5-5, we prefer option 2 ”Separate initial UL BWP(s) for RedCap”. Option 4 is considered as the default if nothing else can be agreed</p> <ul style="list-style-type: none"> · The central frequency of initial UL BWP is different with that of the initial DL BWP; Hence, this option will also complicate UE’s implementation significantly. [4] [no such issue if seperate DL initial BWP for redcap UEs are also specified and configured] · Higher specification impact than other options. [7] [we think the RF retuning option has higher overall spec impact] · Risk of uplink (e.g., PUSCH) resource fragmentation. Negative impact on the resource utilization efficiency of the non-RedCap UEs [11, 16, 22, 25, 28] · Has some constraints on frequency hopping and position of BWP if PUSCH resource fragmentation needs to be avoided. [11] [The UL resource fragmentation issue, if exists, is not different from current network when differnt UEs are configured with differnt BWP sizes, proper configuration of BWP location, or diable frequency hopping, etc could be used to solve the issue by implementation] · How to maintain same centre frequency in the DL BWP and UL BWP in TDD case requires careful study. [17] [this is the same as the 1st bullet above] · Require early identification. [19] [not necessarilly, netowrk can broadcast one or more redcap specific initial UL BWP, and it is up to nework whether to use this as a tool to identify redcap UEs] · New configuration for SIB is needed. [25, 28] [this is a natrual spec impact, but not sure it is considered as a drawback.] · Additional resources for RedCap UEs may be needed. [25] [whether and how many redcap specific initial BWP is configured is totally controlled by the NW based on the need] |
| 3 | Samsung Electronics Polska | <p>[Samsung]</p> <p>Similar as our comment for 5-5. it depends on which option we choose on whether wider BWP is supported.</p> <p>If we go for <u>option 1</u> (i.e., The scenario is allowed, and a RedCap UE can use the same UL BWP) of the agreement for UL BWP, for this question, we think option 1 (Proper RF-retuning) can be considered.</p> <p>Benifit: We agree with the benifit listed in FL summary.</p> <p>If we go for <u>option 2</u> (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), we think it directly lead option 2 (Option 2: Separate initial UL BWP(s) for RedCap UEs).</p> <p>If we go for <u>option 3</u> (Option 3: The scenario is not allowed, and a RedCap UE is not expected to operate in an initial UL BWP wider than the RedCap UE maximum bandwidth), we don’t have this issue.</p> |

| Item | Company | Comments |
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| 4 | ZTE Corporation | [ZTE] Regarding the drawbacks of Option 2 listed in R1-2103823, we don't agree Option 2 has higher specification impact than other options and may have more serious risk of resource fragmentation. |
| 5 | CATT | [CATT] Similar to our answer in Question 5-5, we focus on the essential aspects here. From our view, the preference is Option 3 = Option 2 > Option 4 > Option 1. Option 1 (RF retuning) unlike the RO case, RF retuning is not acceptable to us, due to the mess performance degradation of PUCCH, which is even worse than Option 4. Option 4 (gNB configuration) can be the baseline, of course. In addition, we doubt that the only way is still to configure the 'common' initial UL BWP within the maximum RedCap UE case. Note that, disabling the frequency hopping of PUCCH is not supported currently. Option 2 (Separate initial UL BWP(s)) can also tackle the out-of-range issue of RO at the same time. But similar to our answer in Question 5-5, some of the sub-options may potentially have some risk, e.g. indicating mis-alignment of centre frequency of initial DL BWP and initial UL BWP, but hard to tell unless analysed one by one. Option 3 (Separate configuration/ interpretation) seems workable, but is unnecessary if the out-of-range issue of RO is already tackled by Option 2. |
| 6 | NTT DO-COMO INC. | [DOCOMO] <u>Option 1:</u> The drawback comes mainly from RF-retuning time, which definitely needs RAN4 feedback on the applicable values. <u>Option 2:</u> Same comment as Question 5-5 <u>Option 3:</u> This option can be regarded as a subset of Option 2, and hence, similar to Option 2, the drawbacks can be addressed by nested configuration of PUCCH/PUSCH to some extent, while flexibility is limited <u>Option 4:</u> This option does not have any spec update, and hence, the drawbacks still remain |
| 7 | Panasonic Corporation | [Panasonic] The same comment as one for Question 5-5. |
| 8 | Nordic Semiconductor ASA | What we summarized in 5-5 includes also MSG4 HARQ-ACK. In our Opinion, MSG3 PUSCH-config can be reused from non-RedCap initial UL BWP (to minimized signalling overhead) and to minimize retuning, could be restricted to RB-set in which UE transmitted PRACH. |

| Item | Company | Comments |
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| 9 | China Mobile Com. Corporation | <p>[CMCC] Similar to our comment to Question 5-5, we prefer option 2. Regarding the initial UL BWP and the initial DL BWP may have different central frequencies in TDD case [4, 17], as mentioned by vivo, this is not a problem if a separate initial DL BWP is configured with the same central frequency as separate initial UL BWP.</p> <p>Regarding higher specification impact [7], we think the spec effort can be simplified with separate BWP (BW smaller than maximum bandwidth of RedCap), when the initial UL BWP is wider than the maximum RedCap UE bandwidth. For RF retuning, the influence of retuning gap needs to be considered and the orthogonality of RedCap PUCCH will be destroyed with some symbols being dropped, when they multiplex with non-Redcap UEs and FH is enabled, so more spec handling is desired. For the solution of dedicated configuration/indication or a different interpretation for the same configuration/indication for RedCap, gNB can realize the same purpose by configuring separate BWP with bandwidth smaller than maximum RedCap UE bandwidth, and reusing the framework of BWP, therefore the spec effect can be reduced.</p> |
| 10 | LG Electronics Inc. | <p>[LG] As the title of Option 1 in R1-2103823 implies, the Option 1 (RF-retuning) has a feasibility issue especially for PUCCH for Msg4 HARQ feedback. Depending on the RF-retuning time, even if it is 1 or 2 symbols, some of the PUCCH formats cannot be used during initial access. It takes quite some time to check the feasibility of Option 1 as it involves RAN4 feedback and then we need a second round of discussions to seek the solutions. We think this is a serious drawback of Option 1 for PUSCH and PUCCH, but not an issue for PRACH. Other than that, we think pros and cons are well captured in R1-2103823. We support Option 2 and Option 3. In addition to the claimed benefits so far, Option 2 can be a single solution for both Question 5-5 and 6-5 which is good. Option 3 has the least impact on non-RedCap UEs without restrictions on gNB configuration.</p> <p>For Option 4, there has been concerns on not supporting or putting restrictions on some of the network configurations with BWP#0 configuration option 2 which should be captured as a drawback.</p> |

| Item | Company | Comments |
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| 11 | Ericsson Inc. | <p data-bbox="418 264 544 297">[Ericsson]</p> <p data-bbox="418 302 1230 336">Option 1: Proper RF-retuning for RedCap (if feasible)</p> <p data-bbox="418 340 1425 374">Among the identified benefits, the most important ones are highlighted below.</p> <ul data-bbox="459 405 1425 595" style="list-style-type: none"> <li data-bbox="459 405 1425 472">• Allows the RedCap devices and the normal UEs to share the same initial UL BWP and no need to restrict the configuration of the initial UL BWP. <li data-bbox="459 504 1090 537">• Uplink resource fragmentation can be avoided. <li data-bbox="459 568 906 602">• No impact on non-RedCap UEs. <p data-bbox="418 633 1425 667">Among the identified drawbacks, the most important ones are discussed below.</p> <ul data-bbox="459 698 1425 1218" style="list-style-type: none"> <li data-bbox="459 698 1425 981">• Frequent RF-retuning may be unavoidable. Therefore, more power consumption would be expected for RedCap UEs. In addition, such RF-retuning would significantly increase the UE implementation complexity. <ul data-bbox="523 837 1425 981" style="list-style-type: none"> <li data-bbox="523 837 1425 981">– Comment: RF retuning does not need be done frequently in this case and may not be even needed in most cases. RF retuning is a common behaviour for LTE-M UEs and it does not prevent LTE-M UEs from having low UE complexity and achieving good energy efficiency. <li data-bbox="459 1012 1425 1218">• Performance loss caused by RF retuning time due to loss of a certain number of symbols and loss of orthogonality between time-domain orthogonal cover codes (OCC) used for PUCCH. <ul data-bbox="523 1155 1425 1218" style="list-style-type: none"> <li data-bbox="523 1155 1425 1218">– Remedy: PUCCH enhancements need to be introduced for RedCap UEs <p data-bbox="418 1256 1246 1290">Option 2: Separate initial UL BWP(s) for RedCap UEs</p> <p data-bbox="418 1294 1425 1328">Among the identified benefits, the most important ones are highlighted below.</p> <ul data-bbox="459 1359 1147 1451" style="list-style-type: none"> <li data-bbox="459 1359 1147 1393">• Mostly compatible with existing BWP framework <li data-bbox="459 1424 1147 1458">• Also address the out-of-range issue of the best RO. <p data-bbox="418 1489 1425 1523">Among the identified drawbacks, the most important ones are discussed below.</p> <ul data-bbox="459 1554 1425 2186" style="list-style-type: none"> <li data-bbox="459 1554 1425 1836">• Risk of PUSCH resource fragmentation: Creating a smaller UL BWP within a larger UL carrier bandwidth results in PUSCH resource fragmentation due to PUCCH frequency hopping that is currently required to be enabled for initial access. This has a pronounced impact on non-RedCap UEs. <ul data-bbox="523 1769 1425 1836" style="list-style-type: none"> <li data-bbox="523 1769 1425 1836">– Remedy: allow the network to disable PUCCH frequency hopping during initial access. <li data-bbox="459 1868 1425 2186">• The initial UL BWP and the initial DL BWP may have different central frequencies. Does not follow the current BWP design principle for unpaired spectrum thus it complicates the UE's implementation. The constrains on the feasible locations of RedCap UL BWP may still result in the PUSCH resource fragmentation issue mentioned above even if PUCCH frequency hopping is not enabled.. <ul data-bbox="523 2123 1425 2186" style="list-style-type: none"> <li data-bbox="523 2123 1425 2186">– Remedy: Allow frequency retuning between DL and UL BWP. This is similar to how a HD RedCap UE operates in an FDD band. <p data-bbox="459 2217 1425 2240">• Even if the number of RedCap UEs is quite small, the gNB would always</p> |

| Item | Company | Comments |
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| 12 | Intel Corporation (UK) Ltd | <p>[Intel] In the following we respond to the apparent "drawbacks" cited for Options 2 and 4, and some responses to the apparent "benefits" cited for Option 1.</p> <p><i>(Apologies for a 'tdoc-length' response (the question demanded such :-)).</i></p> <p>Option 2 – Responses to identified “Drawbacks”</p> <ul style="list-style-type: none"> · <i>The central frequency of initial UL BWP is different with that of the initial DL BWP; Hence, this option will also complicate UE’s implementation significantly. [4]</i> o [Intel] See response to Question 5.5. · <i>Higher specification impact than other options. [7]</i> o [Intel] Spec impact is likely the highest for Option 1 and lowest for Option 3, with Options 2 and 4 in the middle. · <i>Risk of uplink (e.g., PUSCH) resource fragmentation. Negative impact on the resource utilization efficiency of the non-RedCap UEs [11, 16, 22, 25, 28]</i> o [Intel] See responses to Question 5.5. · <i>Has some constraints on frequency hopping and position of BWP if PUSCH resource fragmentation needs to be avoided. [11]</i> o [Intel] The impact from such would be minimal considering very limited UL transmission instances when in Idle/Inactive modes. · <i>How to maintain same centre frequency in the DL BWP and UL BWP in TDD case requires careful study. [17]</i> o [Intel] As explained in response to Q 5.5, it is NOT necessary to maintain same centre frequency between DL and UL BWPs in Idle/Inactive modes since such link direction switches are rather limited and well-defined. Overall impact same as for Option 1 and possibly also Option 4 (depending on exact solution for Option 4). · <i>Require early identification. [19]</i> o [Intel] Up to gNB configuration; and early identification feature will anyway be supported to distinguish RedCap and non-RedCap UEs. · <i>New configuration for SIB is needed. [25, 28]</i> o [Intel] See response to Question 5.5. · <i>Additional resources for RedCap UEs may be needed. [25]</i> o [Intel] See response to Question 5.5. <p>Option 4 – Responses to identified “Drawbacks”</p> <ul style="list-style-type: none"> · <i>Impact on the non-RedCap UE. [5, 11, 12, 14, 16, 17, 19, 23, 25, 32]</i> o [Intel] See response to Question 5.5. In short, overall impact to non-RedCap UE’s UL scheduling would be very limited due to very limited amount of UL transmissions possible in Idle/Inactive modes. · <i>Although no PUSCH resource fragmentation within the BWP, there might be fragmentation over the entire carrier bandwidth. [11]</i> o [Intel] Nothing new compared to Rel-15; depends on gNB configuration. Impact can be minimized as discussed in response to Question 5.5. · <i>gNB configuration and proper scheduling can provide a certain degree of assistance, but not all. [15]</i> o [Intel] This seems to be an opinion. · <i>Require early identification. [19]</i> o [Intel] Not necessarily. <p>Option 1 – Responses to some of the identified “Benefits”</p> <ul style="list-style-type: none"> · <i>No specification impacts. [7]</i> o [Intel] Not true due to the need to accommodate frequency retuning gaps. · <i>Allow PUCCH resource sharing between non-Redcap and Redcap UEs during initial access and may benefit from the scheduling flexibility and</i> |

| Item | Company | Comments |
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| 13 | Spread- trum Communi- cations | <p>[SPRD] Thanks for FL's great efforts to summarize Pros and Cons of the four options. They reflect most companies view. Simiarly as we commented for RACH (Question 5-5), the power/cost(complexity) are inefficient at RedUE UE side for Option 1 (RF retuining). As well as we mentioned in comments for RACH (Question 5-5), the design for LTE MTC UE cannot be applied to that for RedCap UE, due to different WID objectives, different PRBs number in baseband, different PHY characteristics for RF stablization.</p> <p>We agree with vivo's response to drawbacks for Option 2 (separate initial UL BWP).</p> <p>We also agree with CMCC/LG's concern on PUCCH pattern and performance, due to lack of several symbols.</p> |
| 14 | Shen- zhen YZF Network Technolog | <p>[OPPO] if the center frequency for initial DL BWP and initial UL BWP can be aligned with option 2. we can support option 2.</p> |

| Item | Company | Comments |
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| 15 | Intel Corporation (UK) Ltd | <p><i>(Earlier "long feedback" split into multiple comments)</i></p> <p>[Intel_1]</p> <p>In the following we respond to the apparent "drawbacks" cited for Options 2 and 4, and some responses to the apparent "benefits" cited for Option 1. <i>(Apologies for a 'tdoc-length' response (the question demanded such :-)).</i></p> <p>Option 2 – Responses to identified “Drawbacks”</p> <ul style="list-style-type: none"> · <i>The central frequency of initial UL BWP is different with that of the initial DL BWP; Hence, this option will also complicate UE’s implementation significantly. [4]</i> o [Intel] See response to Question 5.5. · <i>Higher specification impact than other options. [7]</i> o [Intel] Spec impact is likely the highest for Option 1 and lowest for Option 3, with Options 2 and 4 in the middle. · <i>Risk of uplink (e.g., PUSCH) resource fragmentation. Negative impact on the resource utilization efficiency of the non-RedCap UEs [11, 16, 22, 25, 28]</i> o [Intel] See responses to Question 5.5. · <i>Has some constraints on frequency hopping and position of BWP if PUSCH resource fragmentation needs to be avoided. [11]</i> o [Intel] The impact from such would be minimal considering very limited UL transmission instances when in Idle/Inactive modes. · <i>How to maintain same centre frequency in the DL BWP and UL BWP in TDD case requires careful study. [17]</i> o [Intel] As explained in response to Q 5.5, it is NOT necessary to maintain same centre frequency between DL and UL BWPs in Idle/Inactive modes since such link direction switches are rather limited and well-defined. Overall impact same as for Option 1 and possibly also Option 4 (depending on exact solution for Option 4). · <i>Require early identification. [19]</i> o [Intel] Up to gNB configuration; and early identification feature will anyway be supported to distinguish RedCap and non-RedCap UEs. · <i>New configuration for SIB is needed. [25, 28]</i> o [Intel] See response to Question 5.5. · <i>Additional resources for RedCap UEs may be needed. [25]</i> o [Intel] See response to Question 5.5. |

| Item | Com-pany | Comments |
|------|----------------------------|---|
| 16 | Intel Corporation (UK) Ltd | <p><i>(Earlier "long feedback" split into multiple comments)</i> [Intel_2] ... Continued from above ...</p> <p>Option 4 – Responses to identified “Drawbacks”</p> <ul style="list-style-type: none"> · <i>Impact on the non-RedCap UE. [5, 11, 12, 14, 16, 17, 19, 23, 25, 32]</i> o [Intel] See response to Question 5.5. In short, overall impact to non-RedCap UE’s UL scheduling would be very limited due to very limited amount of UL transmissions possible in Idle/Inactive modes. · <i>Although no PUSCH resource fragmentation within the BWP, there might be fragmentation over the entire carrier bandwidth. [11]</i> o [Intel] Nothing new compared to Rel-15; depends on gNB configuration. Impact can be minimized as discussed in response to Question 5.5. · <i>gNB configuration and proper scheduling can provide a certain degree of assistance, but not all. [15]</i> o [Intel] This seems to be an opinion. · <i>Require early identification. [19]</i> o [Intel] Not necessarily. |
| 17 | Intel Corporation (UK) Ltd | <p><i>(Earlier "long feedback" split into multiple comments)</i> [Intel_3] ... Continued from above ...</p> <p>Option 1 – Responses to some of the identified “Benefits”</p> <ul style="list-style-type: none"> · <i>No specification impacts. [7]</i> o [Intel] Not true due to the need to accommodate frequency retuning gaps. · <i>Allow PUCCH resource sharing between non-Redcap and Redcap UEs during initial access and may benefit from the scheduling flexibility and spectrum efficiency perspective. [19]</i> o [Intel] Not true in general due to the need to accommodate frequency retuning gaps. · <i>Can be combined with some modification of uplink transmission rules and disable frequency hopping of uplink transmissions. [21]</i> o [Intel] Not clear how/why this is a “benefit” – this is basically saying Option 3 can be combined with Option 1, but such is also possible for Options 2 and 4. · <i>No impact on resource utilization. [25]</i> o [Intel] Not true due to the need to accommodate frequency retuning gaps. · <i>No impact on non-RedCap UEs. [25]</i> o [Intel] Not true. There can certainly be impact to non-RedCap UEs since RedCap UEs need to be allocated with longer PUSCH/PUCCH durations and frequency retuning gaps. · <i>No additional signalling. [28]</i> o [Intel] Not guaranteed; separate configuration of PUSCH and PUCCH may still be needed to accommodate appropriate PUSCH TDRA/PUCCH resources, etc. to accommodate retuning times. |

| Item | Company | Comments |
|------|---------------|--|
| 18 | Ericsson Inc. | <p data-bbox="421 268 1238 300"><i>(Earlier "long feedback" split into multiple comments)</i></p> <p data-bbox="421 304 555 336">[Ericsson2]</p> <p data-bbox="421 340 1244 371">Option 2: Separate initial UL BWP(s) for RedCap UEs</p> <p data-bbox="421 376 1425 407">Among the identified benefits, the most important ones are highlighted below.</p> <ul data-bbox="459 443 1145 533" style="list-style-type: none"> <li data-bbox="459 443 1145 474">• Mostly compatible with existing BWP framework <li data-bbox="459 501 1145 533">• Also address the out-of-range issue of the best RO. <p data-bbox="421 568 1425 600">Among the identified drawbacks, the most important ones are discussed below.</p> <ul data-bbox="459 636 1425 1370" style="list-style-type: none"> <li data-bbox="459 636 1425 922">• Risk of PUSCH resource fragmentation: Creating a smaller UL BWP within a larger UL carrier bandwidth results in PUSCH resource fragmentation due to PUCCH frequency hopping that is currently required to be enabled for initial access. This has a pronounced impact on non-RedCap UEs. <ul data-bbox="523 851 1425 922" style="list-style-type: none"> <li data-bbox="523 851 1425 922">– Remedy: allow the network to disable PUCCH frequency hopping during initial access. <li data-bbox="459 958 1425 1272">• The initial UL BWP and the initial DL BWP may have different central frequencies. Does not follow the current BWP design principle for unpaired spectrum thus it complicates the UE's implementation. The constrains on the feasible locations of RedCap UL BWP may still result in the PUSCH resource fragmentation issue mentioned above even if PUCCH frequency hopping is not enabled.. <ul data-bbox="523 1200 1425 1272" style="list-style-type: none"> <li data-bbox="523 1200 1425 1272">– Remedy: Allow frequency retuning between DL and UL BWP. This is similar to how a HD RedCap UE operates in an FDD band. <li data-bbox="459 1308 1425 1370">• Even if the number of RedCap UEs is quite small, the gNB would always have to configure more than one initial UL BWP. |

| Item | Company | Comments |
|------|---------------|---|
| 19 | Ericsson Inc. | <p><i>(Earlier "long feedback" split into multiple comments)</i> [Ericsson3] Option 3: Separate PUCCH/Msg3/[MsgA] PUSCH configuration/indication or a different interpretation for the same configuration/indication for RedCap (e.g., disabled frequency hopping or different frequency hopping) Among the identified benefits, the most important ones are highlighted below.</p> <ul style="list-style-type: none"> • Low specification impact. Feasible and simple solution. • Early identification support by dedicated resource configuration. • Few impacts on RedCap UEs. No/few impact on non-RedCap UEs. <p>Among the identified drawbacks, the most important ones are discussed below.</p> <ul style="list-style-type: none"> • Loss of frequency hopping gain. <ul style="list-style-type: none"> – Remedy: If necessary, this be compensated by longer PUCCH/-PUSCH or time repetition. |
| 20 | Ericsson Inc. | <p><i>(Earlier "long feedback" split into multiple comments)</i> [Ericsson4] Option 4: gNB configuration (e.g., always restricting the initial UL BWP to within RedCap UE bandwidth, or restrictions on the frequency location and the amount of scheduled resource for Msg4/[MsgB] HARQ feedback and Msg3/[MsgA] PUSCH) Among the identified benefits, the most important ones are highlighted below.</p> <ul style="list-style-type: none"> • gNB does not configure initial BWP that is beyond the maximum UE bandwidth. Therefore, this issue will not occur. • Minimum specification impact. • RedCap and non-RedCap UEs can share the same initial UL BWP and the configuration of initial access for non-RedCap UEs can be reused. <p>Among the identified drawbacks, the most important ones are discussed below.</p> <ul style="list-style-type: none"> • The flexibility of the network configuration for legacy UE is impacted. The initial UL BWP configuration for normal UEs will be restricted by the maximum RedCap UE bandwidth. • Although no PUSCH resource fragmentation within the BWP, there might be fragmentation over the entire carrier bandwidth. |

25 Medium Priority Question 7-1

Medium Priority Question 7-1:

What mechanism(s), if any, should be supported in terms of fast BWP switching, BWP retuning, or BWP hopping?

- Option 1: No faster BWP switching or hopping mechanisms are introduced for RedCap UEs.
- Option 2: Fast switching between BWPs is introduced, e.g. with only changed centre frequency and/or other constraints.
- Option 3: BWP retuning or hopping (for a single BWP) is introduced.
- Option 4: Other mechanism(s), please describe.

Feedback Form 23: Please provide your answer to Question 7-1.

| Item | Company | Comments |
|------|----------------------------|---|
| 1 | QUAL-COMM JAPAN LLC. | <p>[Qualcomm] Before companies reply to this question, may we ask the FL to clarify the intention of this proposal and answer the following questions at least for FR1 ?</p> <p>(1) Will the BWP switching/retuning/hopping lead to intra/inter slot frequency hopping of PDSCH or PDCCH ? If so, can it be used for DL coverage enhancement of RedCap UE in FR1 ?</p> <p>(2) Compared with Type 1 and Type 2 BWP switch delay specified for non-RedCap UE (Table 8.6.2-1, TS 38.133), how "faster" the BWP switching timeline is expected for a RedCap UE in FR1 ?</p> <p>(3) What are the differences between BWP switching, BWP retuning and BWP hopping ?</p> <p>(4) Is there an intention to change the definition of BWP (e.g. starting RB, length, etc.) for R17 RedCap UE ?</p> <p>(5) Will the BWP switching/retuning/hopping mechanism apply to a R17 non-RedCap UE as well ?</p> <p>(6) How to avoid the potential collisions with semi-static DL or UL scheduling (e.g. SSB, PRACH, SPS, CG), if UE needs to transmit or receive immediately after the "fast" switching/hopping/retuning based on "RRC configuration" ?</p> <p>(7) If a RedCap UE (not latency sensitive) is not required to transmit or receive immediately after the "fast" switching/hopping/retuning, why not re-using the DCI-based switching timeline supported by non-RedCap UE ?</p> <p>(8) Have we studied the impacts on UE power consumption during R17 RedCap SI ?</p> |
| 2 | Qualcomm CDMA Technologies | <p>[Qualcomm] The following comments are FR2-specific.</p> <p>We support options 2 and 3.</p> <p>In our paper, we have discussed several other options as well, but they can be discusses later once the basic concepts are resolved.</p> |
| 3 | NTT DO-COMO INC. | <p>[DOCOMO] We are open to further discuss Options 2 and 3.</p> |

| Item | Company | Comments |
|------|--------------------------------|---|
| 4 | HUAWEI Technologies Japan K.K. | [Huawei] We think RAN1 is not be able to make decision before inquiring with RAN4 on this issue. For example, one of QC quesitons about how "fast" is expected - that is RAN4 expertise, and the key difference among options actually can only be answered by RAN4. If the answers are really expected, LS should be constructed. |
| 5 | Ericsson Inc. | [Ericsson] We need more time to analyse the values of these different Options. We think a RAN4 guidance on the delays of BWP switching and retuning can be helpful. We are fine with keeping all these Options for now. |
| 6 | vivo Communication Technology | We think it is not proper to discuss this question due to concerns from both technical and procedure perspective <u>Technical concerns:</u> 1) For DL BWP, we almost agreed already that initial and non-initial BWP can not exceed redcap UE BW capability, then what is the point to discuss further the BWP hopping? 2) For UL BWP, we have showed in our paper R1-2102529 that UL BWP hopping cannot bring meaningful gain but actually loss due to the cost of RF retuning time. 3) Regarding faster BWP switching, as we commented multiple times before, what is the motivation to persue a faster BWP switching for redcap UEs than non-redcap UEs? <u>Procedure concerns</u> 1) There has been no conclusion/recommendation from the study item, and no corresponding WID objective tasked RAN1 to work on faster BWP hopping or swtiching in Redcap WI. Question 7-1 is beyond the WID scope and should not be discussed 2) Even if there is a desire to work on faster BWP hopping or swtiching, it should be discussed in a more generic way covering non-redcap UEs and should be discussed in RAN plenary first. |
| 7 | CATT | [CATT] We have similar confusion as Qualcomm Japan's Question (3). What are the differences between BWP switching, BWP retuning and BWP hopping? Or, are they the same thing with different terminologies, invented by companies seperately? Besides, we would like to understand the motivation of the proposal first. |
| 8 | QUALCOMM JAPAN LLC. | [Qualcomm] In reply to Huawei's question of how "fast", it could be modeled hypothetically as the symbol-level RF tuning gap in simulation, as shown by the LLS results of Vivo. In addition, the LLS and SLS results of Vivo, Nokia and QC (FR1) have modeled RedCap UEs with 1 RX and/or 1 TX. All these results indicated marginal gain (assuming RF tuning gap =0) or performance loss (if symbol-level tuning gap is considered). We'd like to recommend proponents of "fast" retuning to simulate the performance of RedCap UE first (e.g. 1 RX, 1 TX), before proposing it as a candidate solution. |

| Item | Company | Comments |
|------|---------------------------------|---|
| 9 | LG Electronics Inc. | [LG] Option 1 is preferred. We are open to further investigate, but up to now none of the mechanisms seems to have been justified enough to be supported. For Option 1. we don't think saying just hopping mechanism is not enough. So, the following clarification is suggested for Option 1. Option 1: No faster BWP switching or hopping mechanisms requiring RF retuning are introduced for RedCap UEs. |
| 10 | Spreadtrum Communications | [SPRD] Agree with QC, the definition of "BWP retuning" and "BWP hopping" should be provided first. For faster BWP switch, we still think they are candidate scheme for coverage recovery and the benefit essentially is coverage improvement. Currently, coverage recovery is out of scope. If the coverage improvement is valid to discuss, we think the other candidate scheme, e.g. repetition, may be easier to implement and may have higher gain. We have concern on power consumption, if faster BWP switch is introduced for RedCap UE. Option 1 is our preference. |
| 11 | Xiaomi Communications | [Xiaomi]: Firstly, We are not sure about the relationship between the question and option 1. It seems option 1 is not the mechanism related fast switching. Secondly, for the terminology of BWP switching, BWP retuning or BWP hopping, we would like the FL to provide more description to avoid different understanding of these mechanisms. Based on our current understanding, our first priority is option 2. and we are open to study option 3. |
| 12 | ZTE Corporation | [ZTE] Fast BWP switching, BWP retuning, or BWP hopping are not within the RedCap WID scope. Not sure why reduced capability UEs need to consider such advanced features beyond non-RedCap UEs. |
| 13 | Lenovo (Beijing) Ltd | We are open to discuss the listed options. |
| 14 | Panasonic Corporation | [Panasonic] We support the Option 2, but we are open to study the others based on the reply from RAN4. |
| 15 | Samsung Electronics Polska | [Samsung] The summary can be a starting point for further study. But option 3 might need more clarification and study. |
| 16 | Shenzhen YZF Network Technology | [OPPO] we support Option 2 and option 3. Since RedCap UE may be configured with very narrow BWP for power saving. BWP switching or BWP hopping is beneficial to get frequency hopping for such cases. |

| Item | Company | Comments |
|------|--------------------------|---|
| 17 | Nordic Semiconductor ASA | <p>Option 4 is clearly "RF retuning within a BWP larger than RedCap maximum channel BW (20MHz)".</p> <p>FL asked a good question. With what was said above, we agree that Option 3 is something new, the same as Option 4 would be. Thus we are fine to study those, to see pros and cons.</p> <p>Otherwise, if companies want to minimize specification effort, we can agree that RedCap support R15 BWP framework and corresponding capabilities and then there is no need to send LS and create more work for us and RAN4.</p> <ul style="list-style-type: none"> • i.e. FG6-1 is mandatory and rest optional |
| 18 | Nokia | [Nokia] We are fine with the proposal. Our preference is Option 1. |
| 19 | Futurewei Technologies | <p>Before we discuss 'fast', we should have an understanding of what the current expected speed for these operations is.</p> <p>We are not clear what is the difference between BWP center frequency change and BWP retuning.</p> <p>In any case, the current BWP framework is the baseline for operation if we do not make any other agreements.</p> |

26 High Priority Question 8-1

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 24: Please provide your answer to Question 8-1.

| Item | Company | Comments |
|------|----------------------|---|
| 1 | NTT DO-COMO INC. | <p>Yes, we are supportive to send an LS.</p> <p>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.</p> |
| 2 | QUAL-COMM JAPAN LLC. | <p>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.</p> |

| Item | Company | Comments |
|------|--------------------------------|--|
| 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. | <p>1. Our proposal may not be correctly reflected in the background information so we suggest to modify the below as</p> <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 or location switching of a BWP, having same or restricted configurations but different centre frequencies <p>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.</p> <p>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.</p> |
| 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. |
| 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 |

| Item | Company | Comments |
|------|--------------------------------|---|
| 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. |
| 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). |

| Item | Company | Comments |
|------|------------------------------|---|
| 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. |

27 High Priority Question 8-2

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 25: 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. |
| 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. |

| Item | Company | Comments |
|------|---------------------------------|--|
| 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 |
| 10 | Shenzhen YZF Network Technology | 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. |

| Item | Company | Comments |
|------|-------------------------------|--|
| 12 | Qualcomm CDMA Technologies | <p>[Qualcomm] Yes for FR2.</p> <p>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:</p> <ol style="list-style-type: none"> 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. | <p>[Ericsson] Y.</p> <p>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.</p> <p>In the LS, we can ask RAN4 to assume that the only things that change are the center frequency and possibly bandwidth as well.</p> |
| 14 | Intel Corporation (UK) Ltd | <p>[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.</p> |
| 15 | Intel Corporation (UK) Ltd | <p>[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.</p> |
| 16 | vivo Communication Technology | <p>[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.</p> |
| 17 | Nokia | <p>[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.</p> |

| Item | Company | Comments |
|------|------------------------------|--|
| 18 | China Telecommunications | [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 Electronics 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 Electronics 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 | QUALCOMM 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 ? |
| 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. |

28 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 26: Can Proposal 8-3 be agreed? If not, please explain why and/or propose potential revisions.

| Item | Company | Comments |
|------|----------------------|---|
| 1 | QUAL-COMM JAPAN LLC. | [Qualcomm] We have concerns for the spec impacts of faster BWP switching and RF retuning in FR1. As pointed out by us and other companies, there is no clear benefit to introduce such a mechanism/procedure in FR1, which is not supported by non-RedCap UEs. As summarized by the FL, there is no clear consensus regarding whether there is a need to send an LS to RAN4. Therefore, we don't think it is necessary to discuss Proposal 8-3 further at this meeting. |

| Item | Company | Comments |
|------|-------------------------------|---|
| 2 | Qualcomm CDMA Technologies | <p>[Qualcomm] For FR2, we support sending the LS to RAN4 to better understand the switching/hopping design options. We think that it helps us make a better more educated decision.</p> <p>For FR2, we have some comments on the proposal as written above in 8-3:</p> <ul style="list-style-type: none"> • Can we add the case that "all" configurations (including BW and SCS) is the same before and after the switch... i.e., no need for UE to newly program Phy/MAC. • The maximum frequency change is 80 MHz for FR1 and 300 {x1, x2, x3} MHz for FR2 <ul style="list-style-type: none"> – {x1, x2, x3}: can be left for RAN4 to decide or e.g., {25, 50, 100, 300} – the idea is: 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) |
| 3 | Nordic Semiconductor ASA | <p>Update needed for Case 4: RF retuning within an UL/DL BWP.</p> <p>And some clarification on BWP switching would be needed, since BWP switching is not just RF retuning, the majority part of BWP switching delay comes from adapting RRC parameters. Moreover, by RAN1 definition, BWP switching cannot be smaller than 1 slot.</p> |
| 4 | Fujitsu Limited | If an LS is sent to RAN4, then it would be good to indicate the RF bandwidth value(s) of interest. |
| 5 | CATT | [CATT] As concluded by FL, there is no clear consensus regarding whether there is a need to send an LS to RAN4. Maybe it is better to tackle other issues first. |
| 6 | LG Electronics Inc. | Agree with CATT. We also agree with the FL declaring no clear consensus reached on the needs for sending LS. That should be the conclusion for now. |
| 7 | vivo Communication Technology | <p>[vivo]We do NOT agree with the proposal, due to the following reasons</p> <ol style="list-style-type: none"> 1) There is clearly no concensus in RAN1 regarding the necessity or benefit of RF retuning or fast BWP swtiching. 2) It is still unclear to us why we are discussing a even faster BWP swtiching than non-redcap UEs. If some generic BWP swtiching enhancement is to be discussed, it should not be in Redcap WI. 3) Concern on the RAN4 TU and work load if such a long list of question are ask without even common understanding in RAN1 what are the use cases. |

| Item | Company | Comments |
|------|--------------------------------|---|
| 8 | China Telecommunications | [China Telecom] Based on the feedback, there is no clear consensus regarding whether there is a need to send an LS to RAN4. Maybe we can wait until achieving consensus on RF retuning related aspects. |
| 9 | Xiaomi Communications | We support to send LS to RAN4, we see some benefits in achieving frequency selective/diversity gain by inter-BWP operation. So, we need some guidance from RAN4 to further identify whether these kinds of solutions are really workable. |
| 10 | QUALCOMM JAPAN LLC. | [Qualcomm2] We also want to comment that the faster BWP switching/hopping can happen on both DL and UL in FR1. However, frequency hopping in DL is not supported in NR R15/16. |
| 11 | Shenzhen YZF Network Technolog | [OPPO] we support this proposal. At least case 1/2/3 can be further considered. |
| 12 | HUAWEI Technologies Japan K.K. | [Huawei] we support this proposal. We don't know how RAN1 can further proceed if without RAN4 further guidance. |
| 13 | Intel Corporation (UK) Ltd | <p>[Intel] We would be supportive to send an LS. However, a few updates would be necessary in our view (perhaps can be fine-tuned further once we agree to send an LS):</p> <ul style="list-style-type: none"> • Cases 1 and 2 can be combined into one. With the updated conditions as described in the following bullet, we do not see a reason to separate/distinguish between Cases 1 and 2. • Under the conditions, combine the first and third bullets and modify as follows to make things clear for RAN4: <ul style="list-style-type: none"> – "For DL/UL BWP switching, only the center frequencies of the old and new (DL/UL) BWPs are different while all other configurations are assumed to be the same, including SCS, RF BW, and all other configurations that are provided on a per-BWP basis". |
| 14 | Ericsson Inc. | [Ericsson] We support an LS to RAN4. The response from RAN4 will be helpful to RAN1 when certain potential solutions are discussed in RAN1. |
| 15 | Panasonic Corporation | <p>[Panasonic] We are supportive to send an LS. We propose that QCL type-A/D is also assumed before and after the RF retuning for the cases 1/2/4 so that AGC/AFC is assumed to be omitted. Therefore, we propose to add the following as an assumption:</p> <ul style="list-style-type: none"> • <u>QCL type-A/D is assumed</u> before and after the RF retuning for the cases 1/2/4. <p>We are also fine with the Intel's proposal that cases 1 and 2 are combined. We do not see the difference between them if the same BW, the same SCS and QCL is assumed.</p> |

| Item | Company | Comments |
|------|----------------------------|---|
| 16 | NTT DO-COMO INC. | [DOCOMO] We are supportive to send an LS and share the view with Ericsson |
| 17 | Samsung Electronics Polska | [Samsung] Agree to send LS to RAN 4. Several comments and clarification questions: what is the different between case 1 and case 2 Does it mean no restriction of frequency location? if so, we can make it clearer. For Case 4, we like to also add RF retuning within a DL BWP, since we might only agree on working assumption. In case it cannot be confirmed, the answer will be useful. For assumption: We like to add "assuming from the same gNB and/or same QCL". The intention is to avoid AGC adjustment during BWP switching, which is about 200us based on our understanding. However, we think this is not necessary if the DL signal is assumed to be transmitted from same gNB and frequency ranges of BWPs for RedCap is just sub-set of frequency range of non-RedCap UEs. Alternatively we can describe the scenario and ask RAN 4 whether the AGC adjustment can be avoid. In addition, we like to further clarify that this is for DCI based BWP switching other than RRC BWP based, since there are seperated requirement in RAN 4 spec. |
| 18 | ZTE Corporation | [ZTE] There is no concensus in RAN1 on the benefit of RF retuning or fast BWP swtiching. It would be better to wait until RAN1 has decision on these issues. Considering the reduced capability of RedCap UEs, we need to ask RAN4 is whether existing BWP switching time can be reused for RedCap UEs. |
| 19 | Futurewei Technologies | okay for the LS |

29 High Priority Proposal 8-3a

Most responses are fine with Proposal 8-3, but a few responses expressed that the LS should be sent later or not at all, and one company expressed that they want to ask the question for FR2 but not for FR1.

Three responses discussed whether Cases 1 and 2 can be combined into a single case. Case 1 is about switching between different BWPs, whereas Case 2 is about changing the frequency location for one BWP, so they are not the same conceptually.

Based on the feedback, the following proposal can be considered, where it has been clarified in Case 1 that the BWP switching is DCI-based rather than RRC-based (based on feedback in one response), Case 4 has been extended to cover both DL BWP and UL BWP (based on feedback in two responses), the maximum UE RF bandwidths have been stated (based on feedback in one response) and it has been clarified that it is only the centre frequency that changes (based on feedback in several responses).

High Priority Proposal 8-3a:

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

- **Case 1: RF retuning for DCI-based (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 a (DL/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 UE RF bandwidth is 20 MHz for FR1 and 100 MHz for FR2, and 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, i.e. it is only the centre frequency that changes.**
- **The RF retuning may take place during initial access or after initial access.**

**Feedback Form 27: Can Proposal 8-3a be agreed?
If not, please explain why and/or propose potential revisions.**

| Item | Company | Comments |
|-------------|----------------------------|---|
| 1 | QUAL-COMM JAPAN LLC. | [Qualcomm] Based on companies' reply in the last two rounds for FR1, there are many unanswered questions in RAN1, especially the spec impacts. As pointed out by the FL before the previous round of discussion, there is no clear consensus to send such an LS to RAN4. In the last round of discussion, there are more companies objecting to sending LS to RAN4 before we get a better understanding for the spec impacts, as well as the pros/cons of RF retuning. Therefore, we think it is not necessary to continue the discussion for Proposal 8-3a at this meeting. |
| 2 | Qualcomm CDMA Technologies | [Qualcomm] The following comments are FR2-specific. We support sending the LS. However, we have the following comments: <ul style="list-style-type: none">• The proposal as stated may not seem to cover RRC-based switching (may be the intention of case 2 is RRC, but not so clear)• One intention is to find a range of frequency switch ranges that the switching time is faster. The above statement about max 300 MHz may cover this, but we suggest to clarify in the actual LS text• Although the maximum UE bandwidth for FR2 is 100 MHz, we may need to consider smaller BWs (e.g., 20 MHz) |

| Item | Company | Comments |
|------|--------------------------------|---|
| 3 | NTT DO-COMO INC. | [DOCOMO] We are supportive to send an LS. The response from RAN4 will be helpful to RAN1 when certain potential solutions are discussed in RAN1, e.g. whether to support Case1-based solution or Case2-based one. |
| 4 | HUAWEI Technologies Japan K.K. | [Huawei] Support |
| 5 | HUAWEI Technologies Japan K.K. | And exactly agree with Docomo |
| 6 | Ericsson Inc. | [Ericsson] Agree with DOCOMO as well. |
| 7 | vivo Communication Technology | As we commented for Question 7-1, 1)There is no use case/benefit for RF retuning within a BWP (larger than redcap UE BW capability), and there is no SI recommendation to specify this. 2) The discussion of faster BWP switching for redcap UEs is beyond the WID scope and technically we could not understand why do companies pursue a faster BWP switching than non-redcap UE. Therefore we cannot agree with the LS. |
| 8 | Spreadtrum Communications | [SPRD] Agree with vivo. If the use case is unclear in RAN1 for RF retuning in a BWP or faster BWP switch, there is no need to send LS to RAN4. Not only RF retuning time should be consider, but also cost and power consumption of RF should be consider. These features add new complex on top on legacy UE. |
| 9 | Xiaomi Communications | [Xiaomi] we share the same view with DOCOMO |
| 10 | Intel Corporation (UK) Ltd | [Intel] We can accept this, but would suggest to slightly update the third bullet under assumptions to say " The RF bandwidth, and SCS, and RRC configurations (for Cases 1 and 2) can be assumed to be the same ... ", since such assumption can have material impact in reducing the application delay for the "new BWP" configuration parameters, applicable to Cases 1 and 2. |

| Item | Company | Comments |
|------|--------------------------------|---|
| 11 | LG Electronics Inc. | <p>[LG] We share the same view with vivo and Spreadtrum. The performance loss caused by not receiving/transmitting during the switching time, the power consumption, and the specification impact should be taken into account. The only parts that we could agree given the RF retuning can be supported without (or with only minor) specification impact are as follows:</p> <p>whether there is room to reduce the delay under the following assumptions:</p> <ul style="list-style-type: none"> • The RF retuning takes place between two frequency locations with different centre frequencies. • The RF bandwidth and SCS can be assumed to be the same before and after the RF retuning, i.e. it is only the centre frequency that changes. • The RF retuning may take place during initial access or after initial access. <p>The Cases related to BWP switching needs more time to discuss in RAN1 and for that reason should be deleted.</p> |
| 12 | Shenzhen YZF Network Technolog | [OPPO] Support |
| 13 | CATT | <p>[CATT] Though we are not objecting the proposal, we are not optimistic to receive feedback from RAN4 in a short time, considering the heavy RAN4 workload and such a long list of cases.</p> <p>If an LS is sent, we suggest to focus on only a few critical issues. For example, Case 1 is conditional with the assumption that a RedCap UE supports DCI-based BWP switching, and Case 4 is also conditional with the assumption that a DL/UL BWP can be larger than the maximum RedCap UE bandwidth. To us, these cases are not essential, and even have not been agreed yet, which may not help the discussion.</p> <p>Last, we think Case 3 is not clear enough. It seems overlapping with Case 2. If not mis-understood, Case 3 can be revised more clear:</p> <p><u>Case 3: RF retuning between DL BWP and UL BWP belonging to a BWP pair and assumed with-in different centre frequencies in TDD bands.</u></p> |
| 14 | Panasonic Corporation | [Panasonic] Support the proposal. |

| Item | Company | Comments |
|------|----------------------------|---|
| 15 | Samsung Electronics Polska | <p>[Samsung] We general support to send LS to RAN 4. However, the proposal need some update:</p> <p>First of all, for case 1 and Case 2, we need to ask RAN 4 about BWP switching time other than RF retuning time, where DCI-based BWP switching time include PDCCH decoding time. But PDCCH decoding time may not needed for Case 3 and Case 4.</p> <p>For case 2, we think it need to be clarified whether this is DCI based, or RRC based. In our understanding, it is DCI based.</p> <p>For other assumption, we'd like to add”</p> <p>The DL received signaling amplitude before and after RF retuning can be assumed to not change much, i.g., AGC adjustment is not necessary.</p> <p>In our understanding, current BWP switching time includes at least three parts: PDCCH decoding, RF retuning, and AGC adjustment. If RedCap UE is hopping between a wider frequency range, no matter due BWP switching or other reason, if the wider DL is for non-RedCap UE, RedCap may not need to adjust AGC.</p> |
| 16 | ZTE Corporation | <p>There has no agreement on the support of BWP retuning to another frequency location and RF retuning within a (DL/UL) BWP in RAN1. Considering the heavy workload of RAN4, we think Case 2 and Case 4 should not be included in the LS.</p> <p>For Case 3, we want to clarify if RF retuning between DL BWP and UL BWP in different centre frequencies is for TDD bands?</p> <p>For ”whether there is room to reduce the delay under the following assumptions”, 'reduce the delay' is not clear. What is the reference value?</p> <p>We think the critical issue RAN1 needs to ask RAN4 is whether existing BWP switching time defined for legacy NR UEs is sufficient for RedCap UEs based on the assumption that the maximum UE RF bandwidth is 20 MHz for FR1 and 100 MHz for FR2, and the maximum frequency change is 80 MHz for FR1 and 300 MHz for FR2.</p> |
| 17 | Nordic Semiconductor ASA | <p>We do not agree that there is no benefit for RF retuning within wide BWP. It was clearly stated as part of discussion in 4-1</p> <ul style="list-style-type: none"> • Frequency selective gain • Better scheuling flexibility • Less UE memory and BWP switching operation <p>Again, RF retuning within BWP should be compared with enhanced BWP switching between multiple dedicated BWPs to be on the fair side.</p> |
| 18 | Nokia | <p>[Nokia] We are not supportive of this LS since we do not see the benefits of the techniques mentioned.</p> |

| Item | Company | Comments |
|------|------------------------|---|
| 19 | Futurewei Technologies | <p>If we send an LS to RAN4,</p> <ul style="list-style-type: none"> • 'RF retuning delay' should use the RAN4 term 'RF switching time' throughout • Remove case 4: as clear from 8-1, many companies were not clear about retuning within a BWP <p>We are also unclear about the distinction between retuning to another frequency (case 2) and retuning in different center frequency (case 3)</p> |

30 High Priority Proposal 8-3b

Most responses are fine with Proposal 8-3a, but a few responses expressed that the LS should be sent later or not at all, and one company expressed that they want to ask the question for FR2 but not for FR1.

Based on the feedback, the following proposal can be considered, where the LS question to RAN4 has been rephrased in an attempt to clarify the question and assumptions and to address some of the concerns expressed in some of the comments.

High Priority Proposal 8-3b:

Send an LS to ask RAN4 about RF switching time for the following cases which are being discussed in RAN1:

- Case 1: RF switching for (DL or UL) BWP switching
- Case 2: RF switching for (DL or UL) BWP retuning to another frequency location
- Case 3: RF switching between DL BWP and UL BWP belonging to a BWP pair with different centre frequencies in TDD bands
- Case 4: RF switching within a (DL or UL) BWP

and whether it would be feasible to maintain the same RF switching times for RedCap UEs as currently specified for non-RedCap UEs or even reduce the RF switching times for RedCap UEs under the following assumptions with manageable impacts (to e.g. device cost, power consumption, and specifications):

- The RF switching takes place between two frequency locations with different centre frequencies.
- The maximum UE RF bandwidth is 20 MHz for FR1 and 100 MHz for FR2, and the frequency change is up to 80 MHz for FR1 and up to 300 MHz for FR2.
- BWP switching is DCI-based or timer-based, not RRC-based.

- The RF bandwidth, SCS, QCL, and RRC configuration can be assumed to be the same before and after the RF switching, i.e. it is only the centre frequency that changes.
- The RF switching may take place during initial access or after initial access.

**Feedback Form 28: Can Proposal 8-3b be agreed?
If not, please explain why and/or propose potential revisions.**

| Item | Company | Comments |
|------|--------------------------------|--|
| 1 | Qualcomm CDMA Technologies | [Qualcomm] For FR2, we agree with the proposal. |
| 2 | QUALCOMM JAPAN LLC. | [Qualcomm] No, we cannot agree to this proposal at least for FR1. (1) As mentioned by Qualcomm and other companies, it is unclear why a RedCap UE needs to support such an enhanced capability not available to R15/R16/R17 non-RedCap UEs. (2) The spec impacts of RF switching have not been discussed yet in RAN1 and RAN2. For example, if the BWP id stays the same during the course of RF switching, that is a fundamental change of the BWP definition, which needs to be discussed in RAN2 and possibly at RAN plenary as well. The potential spec impacts on HARQ procedures, measurements and power consumption also need to be discussed in RAN1 and RAN2 first, before sending an LS to RAN4. (3) A more appropriate AI to discuss whether BWP/RF switching should be supported is R17 coverage enhancement WI. (4) Considering the workload of RAN4 and the limited discussion in RAN1/RAN2, we don't see a need for the LS. |
| 3 | vivo Communication Technology | We do not see much difference compared to the previous proposal. so our comments and objection still hold |
| 4 | HUAWEI Technologies Japan K.K. | [Huawei] We are supportive on the LS and if can be helpful for companies having concern, we suggest to remove all the cases. We only need to ask RAN4 starting from whether it would be feasible to maintain the same RF switching times for RedCap UEs as currently specified for non-RedCap UEs or even reduce the RF switching times for RedCap UEs to e.g. close to LTE eMTC RF retuning under the <u>certain following</u> assumptions with manageable impacts.. we are open with or without the specific assumptions captured in the LS, if agreeable. |
| 5 | Intel Corporation (UK) Ltd | [Intel] We support the proposal. We can also try the route suggested by Huawei to remove listing the cases, and also support adding the reference/example of LTE eMTC RF retuning. |

| Item | Company | Comments |
|------|--------------------------|--|
| 6 | NTT DO-COMO INC. | [DOCOMO] We support the proposal, and also fine to limit the cases as suggested by Huawei/Intel. |
| 7 | LG Electronics Inc. | [LG] We also don't see much difference from the last version. So, there is no reason to say okay for this. As a compromise, we could only live with the modifications from Huawei. The cases related to BWP switching should all be removed. |
| 8 | ZTE Corporation | [ZTE] We also don't see much difference from last version and cannot agree proposal 8-3b. We show similar view as Huawei to remove all the cases and use the following wording: Send an LS to ask RAN4 would it be feasible to maintain the same RF switching times for RedCap UEs as currently specified for non-RedCap UEs or even reduce the RF switching times for RedCap UEs under the following assumptions with manageable impacts (to e.g. device cost, power consumption, and specifications): |
| 9 | CATT | [CATT] Huawei and ZTE's version seems more aligned with our views, i.e. make the LS less complicated. |
| 10 | Panasonic Corporation | [Panasonic] support the proposal. |
| 11 | Nordic Semiconductor ASA | We prefer FL proposal. Except we do not understand how below sub-bullet impacts RF retuning. It should be removed, as it would only confuse RAN4 folks. BWP switching is DCI-based or timer-based, not RRC-based. |
| 12 | Ericsson Inc. | [Ericsson] We are fine with the proposal. We are also fine with the Huawei/Intel/ZTE proposals and with the suggested revision from Nordic Semiconductor. |
| 13 | Futurewei Technologies | The FL proposal addressed several comments from the previous version. However, we do not support this proposal. Switching within a BWP (case 4) is unclear/not needed because all resources within a BWP are available to a UE. If we proceed with an LS, we prefer the approach of removing the cases, as proposed by several companies. |

31 High Priority Proposal 8-3c

Based on suggestions in the feedback to Proposal 8-3b, the following updated proposal can be considered, where the list of cases and one of the bullets in the list of assumptions have been removed.

High Priority Proposal 8-3c:

Send an LS to ask RAN4 whether it would be feasible to maintain the same RF

switching times for RedCap UEs as currently specified for non-RedCap UEs or even reduce the RF switching times for RedCap UEs under the following assumptions with manageable impacts (to e.g. device cost, power consumption, and specifications):

- The RF switching takes place between two frequency locations with different centre frequencies.
- The maximum UE RF bandwidth is 20 MHz for FR1 and 100 MHz for FR2, and the frequency change is up to 80 MHz for FR1 and up to 300 MHz for FR2.
- The RF bandwidth, SCS, QCL, and RRC configuration can be assumed to be the same before and after the RF switching, i.e. it is only the centre frequency that changes.
- The RF switching may take place during initial access or after initial access.

**Feedback Form 29: Can Proposal 8-3c be agreed?
If not, please explain why and/or propose potential revisions.**

| Item | Company | Comments |
|------|----------------------------|---|
| 1 | Qualcomm CDMA Technologies | [Qualcomm] For FR2, we support this. However, we still prefer to add in this proposal (or may be in the exact text in the LS) the option of preconfigured switch (timer-based and not DCI-based). |
| 2 | Intel Corporation (UK) Ltd | [Intel] We support the proposal. |
| 3 | QUALCOMM JAPAN LLC. | [Qualcomm] Again, we don't support RAN1 to send such an LS to RAN4 before we understand the differences between "new RF switching mechanism for RedCap UE" and "BWP switching mechanism applicable to non-RedCap UE." So far, we have not discussed the spec impacts, device cost and power consumption of reducing the RF switching time. Therefore, we don't think it is a fair assumption that they are "manageable," at least for FR1. Some additional comments on our side (recap): (1) As mentioned by Qualcomm and other companies, it is unclear why a RedCap UE needs to support such an enhanced capability not available to R15/R16/R17 non-RedCap UEs. (2) The spec impacts of RF switching have not been discussed yet in RAN1 and RAN2. For example, if the BWP id stays the same during the course of RF switching, that is a fundamental change of the BWP definition, which needs to be discussed in RAN2 and possibly at RAN plenary as well. The potential spec impacts on HARQ procedures, measurements and power consumption also need to be discussed in RAN1 and RAN2 first, before sending an LS to RAN4. (3) A more appropriate AI to discuss whether BWP/RF switching should be supported is R17 coverage enhancement WI. (4) Considering the workload of RAN4 and the limited discussion by RAN1/RAN2, we don't see a need for the LS. |

| Item | Company | Comments |
|------|--------------------------------|---|
| 4 | Spreadtrum Communications | [SPRD] We fully agree the comments from QUALCOMM JAPAN LLC . Before we have consensus on RF retuning, it is not necessary to send LS to RAN4. For now, we have no consensus on the motivation of RF retuning, coverage recovery or just more resource utilized or others... For example, if we have no consensus on RF retuning granularity, RAN4 may not have the answer of RF retuning time. Further, in our view, RF retuning time is not the sole key point to solve RO, Msg3 and Msg4-HARQ-ACK outside the RedCap UE bandwidth, and some other aspects are also key points, e.g. system impact, power/cost impact at UE. |
| 5 | HUAWEI Technologies Japan K.K. | [Huawei, HiSilicon] Support |
| 6 | CATT | [CATT] OK. |
| 7 | Panasonic Corporation | [Panasonic] Support the FL proposal. |
| 8 | vivo Communication Technology | The RAN1 discussion on this topic is not sufficient so it is very unclear what is the context of RF switching time, is it the new RF switching within a single BWP larger than UE BW capability, or it is just the switching between two BWPs. If it is former case, there has been no common understanding in RAN1 such operation is beneficial or needed for Redcap UEs, RAN1 should continue the technical debate. If it is the latter case, as commented multiple times before, it is not the right place to discuss BWP switching delay enhancement in Redcap WI. Therefore, we think the RAN1 discussion is not sufficient and without necessary information the RAN4 discussion will be very inefficient. So no LS shall be sent in this meeting. |
| 9 | NTT DO-COMO INC. | [DOCOMO] We support the proposal. As commented before, the response from RAN4 will be helpful to RAN1 when certain potential solutions are discussed in RAN1 |
| 10 | Xiaomi Communications | [Xiaomi] We support this proposal. In our view, some potential solutions highly depend on the RF switching time. So RAN4's guidance is helpful to identify whether these solutions are workable or how much gain can be achieved in the realistic case. |
| 11 | SHARP Corporation | [Sharp] We support the FL proposal. |

| Item | Company | Comments |
|------|------------------------|--|
| 12 | ZTE Corporation | [ZTE] We are supportive of FL proposal 8-3c. Just want to clarify if assumption "The RF bandwidth, SCS, QCL, and RRC configuration can be assumed to be the same before and after the RF switching, i.e. it is only the centre frequency that changes. " is only related to "reduce the RF switching times". If Yes, it would be better to clearly state that. |
| 13 | Ericsson Inc. | [Ericsson] We are fine with the FL proposal. |
| 14 | Futurewei Technologies | Since the cases were deleted, we should make it clear in the preamble that we are discussing BWP-related RF switching times. |

32 High Priority Proposal 8-3d

High Priority Proposal 8-3d:

Agree the LS to RAN4 on RF switching time in R1-2104046.

https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Inbox/R1-2104046.zip

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