**3GPP T****SG-RAN WG2 Meeting #116bis-electronic R2-220xxxx**

**Online, January 17th – January 25th, 2022**

**Agenda item: 8.1.3.2**

**Source: vivo**

**Title:** **Report of [AT116bis-e][025][MBS] CFR Case E (vivo)**

**Document for: Discussion and Decision**

# 1 Introduction

This contribution is aimed at reporting the discussion and results of the following email discussion:

* [AT116bis-e][025][MBS] CFR Case E (vivo)

Scope: Address support of CFR Case E (and other case of needed). Treat at least the proposals in R2-2201260. Can also take into account proposals from other papers.

Intended outcome: Report

Deadline: Thursday W1 for online CB

The discussion scope is to gather companies’ views on the Common Frequency Resource (CFR) related issues, taking the associated proposals in contributions [1]-[8] into account. Companies are invited to provide their views by January 19th (Wednesday), 2022, 12:00 UTC.

The detailed definition of CFR Case A/B/C/D/E by RAN1 can be accessed in Appendix 7.

# 2 Participants

|  |  |
| --- | --- |
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# 3 Discussion

## 3.1 Supporting CFR Case E from configuration aspect

In the previous RAN#94-e meeting, a warm discussion regarding the support of CFR Case E had been launched. The corresponding assumption and final agreement are given as follows [9],

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| --- |
| **Assumptions for RAN2 Reasonable impact: At least the following may be assumed for the support of Case E (and possibly other cases). These assumptions may need to be confirmed in the WG.**   1. The resources and their configuration, needed for camping, e.g. reception of CD SSB, paging etc (e.g. CORESET0), shall be the same regardless if the UE uses a MBS Broadcast CFR configuration or not, for Idle and/or Inactive mode. (i.e. no change) 2. The resources and their configuration for the access procedure including up to at least the exchange of the first two RRC messages (UL + DL) shall be the same regardless if the UE uses a MBS Broadcast CFR configuration or not. (i.e. no change) 3. If the UE needs to, the UE may indicate at transition to Connected, the need for a certain MBS Broadcast CFR configuration or equivalent indication, to assist gNB configuration for Connected mode. This is assumed supported by the already agreed MBS interest indication. 4. The Configuration restrictions / UE capabilities that determines which configuration(s) in Connected mode that allows a UE to receive MBS broadcast by CFR, is in principle not affected by additionally supporting Case E, e.g. shall not bring the the requirement of additional active BWP etc. Rather, network ensures the active BWP for RRC CONNECTED UE has the same SCS/CP as CFR and includes all RBs of the CFR so that UE can receive unicast and broadcast without BWP switching.   **Agreement:**  Support case E, under the assumption that configuration work is driven by RAN2 and RAN2 impact is reasonable (i.e. RAN2 may decide to not support it if issues surface during WG discussions) and it is expected to have zero RAN1 impact. |

In contributions [1]-[8], some detailed solutions to support CFR Case E (where the bandwidth of MBS broadcast CFR is larger than that of initial DL configured by *locationAndBandwidth* within SIB1) are proposed. For example, on one hand, contributions [1][3][6][7] propose that an MBS configured BWP/CFR should be defined by explicit bandwidth and location configuration (without reconfiguring the initial BWP nor defining a configured BWP). On the other hand, contribution [2] provides a different solution. Specifically, it is proposed that the SIBx can reconfigure the initial BWP with MBS broadcast CFR, with which the MBS broadcast UE would use the reconfigured initial BWP and supersede the original SIB1 configured initial BWP.

Based on the input from contributions, the rapporteur generally thinks RAN2 should make a down-selection between the following two options,

* **Opt 1:** Configuring a BWP (including MBS broadcast CFR configuration) or a CFR for MBS broadcast, which fully contains the CORESET#0 in the frequency domain.
* **Opt 2:** Configuring SIBx indicated initial BWP (containing MBS broadcast CFR) for MBS broadcast, which supersedes the SIB1 indicated initial BWP.

**Q1: Which option do companies prefer for the support of CFR Case E?**

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| --- | --- | --- |
| **Company** | **Preferred option** | **Detailed comments** |
| Huawei, HiSilicon | Opt 1, but only support configuring a CFR, i.e. no additional BWP needed | Only an additional CFR bandwidth configuration is needed, and other aspects (e.g. how the UE adapts its receiver to the CFR) can be left to UE implementation, i.e. no more specification impacts expected.  This concept would be similar to the multicast CFR which is associated with a dedicated BWP. For this case E, the additional configured CFR is associated with the initial BWP. |
| MediaTek | Opt 1, but only support configuring a CFR, i.e. no additional BWP needed | We have the same understanding as Huawei |
| CATT | Opt 1,and a broadcast specific BWP is needed | It is necessary to define a broadcast specific BWP to contain the broadcast CFR. According to the definition of case E, the broadcast CFR of case E is different than initial BWP. Besides, a CFR should be within a BWP, as defined in RAN1 MBS CR. |
| TD Tech, Chengdu TD Tech | Option 1 | If CASE E is configured with IE BWP, the same SCS and CP type as CORESET 0/initial DL BWP are used for CASE E should be assumed.  It’s better to configure the CFR of CASE E type with SIB x or MCCH.  If MCCH and MTCH use the same CFR of CASE E type, SIB x is used to configure the CFR of CASE E type. If MCCH and MTCH use different CFRs, MCCH is used to configure the CFR of CASE E type. We sugget the CFR for MCCH is fixed to the initial DL BWP for SIB x. |
| Nokia | Opt 1, Easier to define a BWP for MBS | CFR is just a terminology that is same as release 15 BWP. There is no need to make things unnecessarily complex in RAN2 trying to define. Thus it seems way simpler to try to keep BWP terminology as all the existing parameters refer to BWP instead of “CFR” e.g. CORESET/searchspace configuration. |
| Sony | Opt 1, as a BWP | We prefer to reuse the BWP terminology. |
| Samsung | Opt 1, but only support configuring a CFR, i.e. no additional BWP needed | CFR association with the initial BWP is sufficient, i.e. CFR covering the initial BWP. |
| Ericsson | Opt 1, only configuring a CFR, i.e. no Case E specific BWP needed | As RAN1 specifications define CFR (instead of using a BWP definition), it seems better to align and configure the CFR by CFR frequency range, PDCCH-config and PDSCH-config, in line with RAN1 agreements. . A Case E CFR may or may not be associated with an identically sized BWP, but we do not see that this serves any purpose. There is no added technical functionality by also defining a BWP having the same characteristics as the Case E CFR. Only if specification consistency would require such a BWP would it need to be defined. Otherwise, it is simpler/better to just define a Case E CFR, without associated BWP. When the UE is in RRC CONNECTED, the broadcast CFR becomes a CFR within the active BWP, similar to the multicast CFR. |
| Qualcomm | Option 1, and a broadcast configured BWP | Same view as CATT, Nokia. |
| Futurewei | Opt 1, but only support configuring a CFR as the BWP for broadcast | Have the similar view as above companies. The CFR configuration should follow the RAN1 definition to make sure its association with initial BWP. |
| Apple | Opt 1, but only support configuring a CFR, i.e. no additional BWP needed | We have the same understanding as Huawei. |
| Spreadtrum | Option1, and a broadcast specific BWP is needed | We also prefer to reuse the BWP terminology to make it simple. |
| OPPO | Option 1, | We do not understand what is the difference between BWP and CFR excpt name. we can use the BWP and no need to introduce new concept or new name in RAN2 text. |
| LGE | Opt 1, but only support configuring a CFR, i.e. no additional BWP needed | RAN1 defines CFR instead of using BWP definition for MBS. Unless there is a clear reason to define a new BWP that is used in IDLE/INACTIVE from RAN2 perspective, we should align the terminology with RAN1. |
| Lenovo, Motorola Mobility | Option 1, but only support configuring a CFR, i.e. no additional BWP needed | It is simpler to define a CFR configuration to cover all cases, without associated initial BWP/ CORESET 0. For example, the existing BWP IE can be reused for CFR configuration, which can cover all cases and is future proof:  BWP ::= SEQUENCE {  locationAndBandwidth INTEGER (0..37949),  subcarrierSpacing SubcarrierSpacing,  cyclicPrefix ENUMERATED { extended } OPTIONAL -- Need R  } |
| ZTE | Option 1, only a CFR is needed. | same understanding as Huawei & Ericsson. Commonality with multicast shall be pursued. And the maximum flexibility shall be allowed to let UE adapt its receiver to the CFR (even for different services). |
| vivo | Option 1 | Regarding the preference on BWP or CFR, frankly, from the UE implementation point of view, there is no essential difference (i.e. the UE adjusts the reception bandwidth based on the same parameter configured within either BWP or CFR configuration) and it is simply a modeling issue. Although we think using the BWP framework is more spontaneous and natural (following the general NR principle that all transmission and reception related configuration is within BWP domain), we are okay to follow the CFR mothed if it is the majority view. |
| Intel | Option 2 | Compared with Option 1, Option 2 has the benefit to avoid the MBS service interruption during RRC state transition, since UE does not switch to initial DL BWP in SIB1 where UE cannot receive MBS transmissions in wider bandwdith.  During state transition, there is no issue when gNB assumes initial BWP in SIB1 (since gNB is not aware whether UE is receiving MBS or not during initial access procedure) while UE uses initial DL BWP as defined in SIBx. The reason is that initial DL BWP in SIBx contains BW of initial DL BWP in SIB1, and also contains CORSET#0. There is no frequency resource mismatch issue as well. In addition, it is also reasonable to assume that the UE which requires a wider CFR would also require a wider initial BWP to continue receiving broadcast and it does not have any additional power consumption issues. |
| Xiaomi | Opt 1, but only support configuring a CFR, i.e. no additional BWP needed | Agree with Huawei, as this is more aligned with the multicast CFR, and avoids the BWP switching. |

**Summary:**

## 3.2 Supporting other CFR cases from configuration aspect

The next question that comes to us is whether the down-selected option can be also applied for the other CFR cases (e.g. CFR Case C), which is raised in contributions [5][7].

For CFR Case A (where the location and bandwidth of MBS broadcast CFR is the same as CORESET#0), the legacy NR framework is sufficient (i.e. the RRC IDLE and INACTIVE UE always assume the location and bandwidth of the initial DL BWP are the same as that of CORESET#0). No further enhancement is needed, as concluded in the RAN1 discussion.

For CFR case C (where the bandwidth of MBS broadcast CFR is the same as that of initial DL configured by *locationAndBandwidth* within SIB1, having a larger size than CORESET#0), frankly, it can be regarded as CFR case E if the bandwidth of MBS broadcast CFR is set to the same value as that of initial DL configured by SIB1. From the RAN2 configuration point of view, the rapporteur assumes that the signaling configuration and spec impacts for supporting CFR cases (e.g. case C and case E) are the same.

Companies are invited to provide their views on the following question.

**Q2: Do companies agree that the same mechanism (e.g. signaling configuration) can be used for both CFR Case E and CFR Case C?**

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| **Company** | **Yes/No/Comments** | **Detailed comments** | |
| Huawei, HiSilicon | Not necessary | For Case C, the configuration of *locationAndBandwidth* for the initial BWP is already available in SIB1, but for Case E, this *locationAndBandwidth* configuration should be additionally configured and can be absent if Case A or C is selected by the network. | |
| MediaTek | Unsure | We assume there should be additional configuration (e.g. *locationAndBandwidth*) within SIBx for case E in order to configure a bit large BW for this type of CFR | |
| CATT | No | For Case C,the CFR is contained in initial BWP,which is not the case for case E | |
| TD Tech, Chengdu TD Tech | Yes | From our understanding, the same indication method is used to configure the CFR of CASE A, the CFR of CASE C and the CFR of CASE E. For example, MCCH is used to configure the CFR for broadcast sessions. If the CFR of CASE A/C is used, only an indicator on MCCH is used to indicate th CFR for broadcast sessions is CASE A/C. No extra information is needed. If the CFR of CASE E is used, the indicator is used to indicate the CFR for broadcast sessions is CASE E. An extra IE is used to configure the CFR of CASE E, where the extra IE provides the start CRB of the CFR and the bandwidth of the CFR.  If MCCH and MTCH have the same CFR of CASE E, SIB x can be used to configure the CFR of CASE E. | |
| Nokia | Yes | It seems simplest just ot have exactly same signaling regardless of which case C/D/E is being used by network. It seems arbitrary complexity trying to make them look different. For all cases *locationAndBandwith* should be present for MBS– possibly absence could implicitly mean to use some other field value e.g. existing SIB1 *locationAndBandwidth.* But even this seems just ASN.1 coding issue. | |
| Sony | Yes | Case E and C could have the same design. | |
| Samsung | Yes | We think Case C can be considered as a special case of Case E from configuration perspective. Agree with HW that *locationAndBandwidth* configuration should be additionally configured and can be absent if Case A or C is selected by the network. | |
| Ericsson | Yes (can)  No (should not) | Addition of *locationAndBandwidth* is needed. Agree w Huawei’s initial points on absence. Fundamentally, since Case E supports any CFR size it can support frequency resources identical to the Case C CFR (identical to SIB1-configured initial BWP). This means that the same mechanism *can* be used. However, when Case C CFR is used, this would require unnecessary configuration overhead (duplication). This is because the relevant *locationAndBandwidth* is already available in SIB1. A natural solution could be that when SIB1 configures the initial BWP the absence of the *locationAndBandwidth* in SIBx implies that Case C is used but if *locationAndBandwidth* is present in SIBx any Case E CFR size can be used according to *locationAndBandwidth* in SIBx. |
| Qualcomm | Yes | Same view as Nokia. | |
| Futurewei | Yes | There are common configuration for all the cases. For certain case specific parameters their presence could be optional. | |
| Apple | Yes | Agree with HW that *locationAndBandwidth* configuration can be absent for case A or case C. | |
| Spreadtrum | Yes | A broadcast specific BWP configured via SIBx can be used for all the cases. The broadcast specific BWP is identical to the DL initial BWP in case C. | |
| OPPO | No | The same BWP bandwidth is used for MBS and initial BWP in case C and no need to configure BWP location and bandwidth. But in case E, all information for BWP configuration are required.  Furthermore, UE will consider the cell as barred if the UE does not support initial BWP bandwidth. If case UE is support, how to define the UE bar behaviour? | |
| LGE | Yes | Case C can be considered as a special case of Case E from configuration perspective. | |
| Lenovo, Motorola Mobility | Yes | It is simpler to define a CFR configuration to cover all cases, without associated initial BWP/ CORESET 0. For example, the existing BWP IE can be reused for CFR configuration, which can cover all cases and is future proof:  BWP ::= SEQUENCE {  locationAndBandwidth INTEGER (0..37949),  subcarrierSpacing SubcarrierSpacing,  cyclicPrefix ENUMERATED { extended } OPTIONAL -- Need R  } | |
| ZTE | Yes | We should strive to have a common design. | |
| vivo | Comments | From the signaling configuration aspect, we think the location and bandwidth configuration shall be explicitly indicated for Case E. For case C, the field *locationAndBandwidth* is already indicated in SIB1, then there is no need to configure *locationAndBandwidth* within the MBS broadcast configuration. And the UE can apply the parameter in SIB1 to determine the CFR configuration. For case A, in fact, it is a specific case of Case C with *locationAndBandwidth* in SIB1 indicating the same bandwidth of CORESET#0. In conclusion, we propose,  **The field *locationAndBandwith* within the CFR configuration is only needed for Case E.** | |
| Intel | Yes | Same signalling design can be used for both Case E and Case C, i.e. configuring SIBx indicated initial BWP, which supersedes the SIB1 indicated initial BWP (as in Option 2 of Question 1). | |
| Xiaomi | Yes, but | We prefer a common design for CFR in RAN2 signaling. However if other cases causes some impacts in PHY, we may need to avoid such cases. | |

**Summary:**

## 3.3 Other remaining issues

Last but not least, companies can provide their comments on the remaining issues for the support of CFR Case E/C for RRC IDLE/INACTIVE UEs, if they are not covered by this discussion.

**Q3: Are there any additional comments on the remaining issues?**

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| **Company** | **Yes/No** | **Detailed comments** |
| TD Tech, Chengdu TD Tech |  | From gNB pointi of view, a CFR of CASE E type is enough. But in order to reduce the power consumption in UE, from UE point of view, the CFR is configured per broadcast session. |
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**Summary:**

# 5 Conclusion

The contribution is summarized with proposals as follows,

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# 6 Reference

1. R2-2200234, Open Issues on Broadcast Service Continuity, CATT, CBN.
2. R2-2200356, Miscellaneous MBS L3 open issues, Intel Corporation.
3. R2-2200532, NR MBS control signaling aspects, Qualcomm Inc.
4. R2-2200577, Service continuity for broadcast mode, TD Tech, Chengdu TD Tech.
5. R2-2200759, MII and BWP related configuration, Lenovo, Motorola Mobility.
6. R2-2200818, Discussion on RRC parameters for MCCH and MTCH, Huawei, HiSilicon.
7. R2-2201260, Supporting CFR Case E for RRC IDLE and INACTIVE UE, vivo.
8. R2-2201413, RAN1 related issues in NR MBS, ZTE, Sanechips.
9. Draft RAN94-e Meeting Report EOM.

# 7 Appendix

For RRC\_IDLEand RRC\_INACTIVE UEs, for broadcast reception, further study the following cases of a configured/defined specific common frequency resource (CFR) for group-common PDCCH/PDSCH, and identify which case(s) will be supported:

* [Case E] the case where a CFR is defined based on a configured BWP.
  + In particular, study the following:
    - whether a configured BWP for MBS is needed or not.
    - whether BWP switching is needed or not.
  + In this study, the configured BWP has the following properties:
    - The configured BWP is different than the initial BWP where the frequency resources of this initial BWP are configured smaller than the full carrier bandwidth.
    - The CFR has the frequency resources identical to the configured BWP.
    - The configured BWP needs to fully contain the initial BWP in frequency domain and has the same SCS and CP as the initial BWP.
  + Note: The configured BWP is not larger than the carrier bandwidth.
* the case where the initial BWP fully contains the CFR in the frequency domain.
  + In this study the following sub-cases are considered:
    - [Case B] A CFR with smaller size than the initial BWP, where the initial BWP has the same frequency resources as CORESET0. In this case the CFR has the frequency resources confined within the initial BWP and have the same SCS and CP as the initial BWP.
    - [Case D] A CFR with smaller size than the initial BWP, where the initial BWP has the frequency resources configured by SIB1. In this case the CFR has the frequency resources confined within the initial BWP and have the same SCS and CP as the initial BWP.
  + In particular, study the following:
    - Whether the considered two options with a CFR with smaller size than the initial BWP are needed or not for MBS.
* the case where the initial BWP has same size as the CFR in the frequency domain.
  + In this study the following two sub-cases are considered:
    - [Case A] A CFR with the same size as the initial BWP, where the initial BWP has the same frequency resources as CORESET0. In this case the CFR has the same frequency resources and same SCS and CP as the initial BWP.
    - [Case C] A CFR with same size as the initial BWP, where the initial BWP has the frequency resources configured by SIB1. In this case the CFR has the same frequency resources and same SCS and CP as the initial BWP.
  + In particular, study the following:
    - Whether the considered two options with a CFR with the same size as the initial BWP are needed or not for MBS.