TSG-RAN Working Group 4 meeting #102-ER4-22xyz

Electronic Meeting, 21th Feb – 3nd March 2022

**Source:** Ericsson

**Title:** WF on the RedCap RF

**Agenda item:** 10.20.2

**Document for:** Approval

# Introduction

During RAN4#102-E meeting a way-forward on RedCap UE is created based on the discussion in 1st round [1].

# Way-Forward

# Topic #1: Power class and UL architecture in RedCap in FR1

**Issue 1-1: Power class and TX architecture in FR1**

* Proposals:
  + Option 1: Agree below agreement from RAN4#101-bis-e

Issue 1-1-1: 1 PC3 UL TX architecture assumption

* WF
  + For TX architecture of 23 dBm PA

Issue 1-1-2: PC2 UL TX architecture assumption

* WF
  + 1 TX of 26 dBm PA in Rel-17 and 2 TX architecture is excluded in Rel-17

Issue 1-1-3: PC2 support for HD-FDD mode

* WF
  + PC2 support based on operator request
* Recommended WF
  + Option 1

Discussion:

Agreement: agree on Option 1.

**Issue 1-2: PC2 for HD-FDD**

* Proposals
  + Option 1: in FDD bands, when HD-FDD is used, to mitigate the UL duty cycle loss and poor antenna performance, support of 1Tx PC2 is further studied to provide rationale for operators’ request of such architecture. [Skyworks]
  + Option 2: TBA
* Recommended WF
* Same conclusion with issue 1-1

Discussion:

Agreement: agree on Option 1.

**Issue 1-3-1: TX-RX distance for UL/DL BWP configuration in FDD band for legacy eMBB NR UE**

* Proposals
  + Option 1: Yes, the issue is the same [Ericsson, Huawei]
  + Option 2: No, only for RedCap UE
  + Option 3: TBA
* Recommended WF
  + TBA

Discussion:

Huawei: this issue is not specific for RedCap UE. The normal UE may have the same problem. This issue can be handled in maintenance.

Ericsson: We can remind the group that this is issue for legacy. We would like to check if Option 1 is agreeable.

Mediatek: In Rel-15 there is no mandate for UE to configure the narrow bandwidth. Then the issue is more relevant to RedCap. At least we should address the problem for RedCap.

OPPO: What will happen if the existing Tx-Rx separate is not met? Does it mean the requirement cannot be met? If the requriement cannot be met, the clarification is needed.

Apple: we do not have strong view. In general we agree with Mediatek for redcap there is potential issue. From conformance testing point view, we only test the normal Tx-Rx separation.

Huawei: the Mediatek’s proposal cannot address the common problem.

T-Mobile: what does the requirements apply for the UE configured with wider channel bandwidth?

Apple: if UE is configured to gNB bandwidth, i.e., 40MHz, the REFSEN requirement should be based on 40MHz. We should consider the worst case.

**Issue 1-3-2: UL/DL BWP configuration and TX-RX distance**

* Proposals
  + Option 1: [MediaTek]
    - For FD-FDD, confirm that the UL/DL ARFCNs of RedCap UE UL/DL channel bandwidth configurations (where the channel BW is ≤20MHz) shall not contravene the existing Tx-Rx separation requirement defined for FDD bands in section 5.4.4 of 38.101-1. A note in the specifications may be useful to make this clear.
    - Discuss further the handling of the BWP vs UE channel bandwidth configuration for initial access, to ensure that this ambiguity for RedCap UEs is removed, and consider an LS to RAN2.
  + Option 2: BS deployment can’t be restricted considering below two options [Huawei]
    - a: Current spec can be kept. There is no REFSENS requirement for the case that UE Tx-Rx frequency separation for FDD bands between UL and DL BWPs is not equal to the default Tx-Rx frequency separation.
    - b: Current REFSENS requirements for FDD bands are also applicable to the case that UE Tx-Rx frequency separation between UL and DL BWPs is not equal to the default Tx-Rx frequency separation. However, some REFSENS exceptions can be specified for the specific FDD bands, channel bandwidths and Tx-Rx configurations
  + Option 3: Treat the RedCap in FDD band for configuration of UL/DL BWP the same as legacy NR UE. [Ericsson]
  + Option 4: TBA
* Recommended WF
* no discussion in 2nd round, focus in issue 1-3-1

Company feedback on WF for Topic #1:

Issue 1-1 comments:

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| --- | --- |
| **Company** | **Comments on 1-1** |
| Sony | Agree to WF proposals |
| OPPO | Ok with WF |
|  |  |

Issue 1-2 comments:

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| **Company** | **Comments on 1-2** |
| Sony | Agree to WF proposal. Further discuss “Option 1” in Rel-18. |
| Skyworks | Should this be captured in RedCap R18 objectives then? |
| Apple | Option 1 |
| ZTE | Agree with WF proposal |
| OPPO | Ok with WF |
| Vivo | Agree with WF |

Issue 1-3-1 comments:

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| **Company** | **Comments on 1-3-1** |
| MediaTek | We need some clarification on what Option 1 means, as it is extremely vague and could mean anything.  So if a UE is configured with a DL BWP equivalent to 20MHz (e.g. 106 RBs), then we would expect that the UL BWP should be located such that the centre frequency of UL and DL BWP have a distance of “default Tx-Rx separation” for the band (i.e. 190MHz for n1). The Rx sensitivity requirements in section 7 would be according to the 20MHz channel bandwidth and under the condition that the default Tx-Rx separation is applied for the given test parameters.  Therefore, it would seem acceptable to add a statement to indicate in section 7.3I that “*For RedCap UE, Rx sensitivity requirements only apply for channel bandwidths up to and including 20MHz, and under the condition that the default Tx-Rx separation between the used UL/DL UE channel bandwidth is applied as specified in clause 5.4.4, for the corresponding band.*” |
| Apple | The Tx-Rx distance in FDD bands for legacy eMBB NR UE is the nominal duplex spacing specified in Table 5.4.4-1 unless asymmetric UL/DL channel BWs are specified for the band. For RedCap UE, as the gNB channel BW may be different from UE channel BW, there is no guarantee that the RedCap UE Tx-Rx distance in FDD bands is always the same as nominal duplex spacing. |
| Huawei | Option 1.  For eMBB NR UE, the case also exist that the gNB channel BW may be larger than the supported maximum UE channel BW. |
| ZTE | Option 1. |
| OPPO | Option 1, agree that this scenario might be happen also in normal NR UE, however, it might still be helpful to consider the MTK proposed clarification wording for the REFSENS requirements if there is issues. |

Issue 1-3-2 comments:

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| **Company** | **Comments on 1-3-2** |
| MediaTek | This issue would have been useful to discuss as it has more detail and ensures that we are all talking about the same thing with Issue 1-3-1. |
| Huawei | Option 3 |
| OPPO | For clarification of Option 1, if RedCap UE UL/DL channel bandwidth configurations has larger or smaller distance comparing to existing Tx-Rx separation then what will happen? Requirements will not be met or others? |

# Topic #2: RedCap UE operating bands

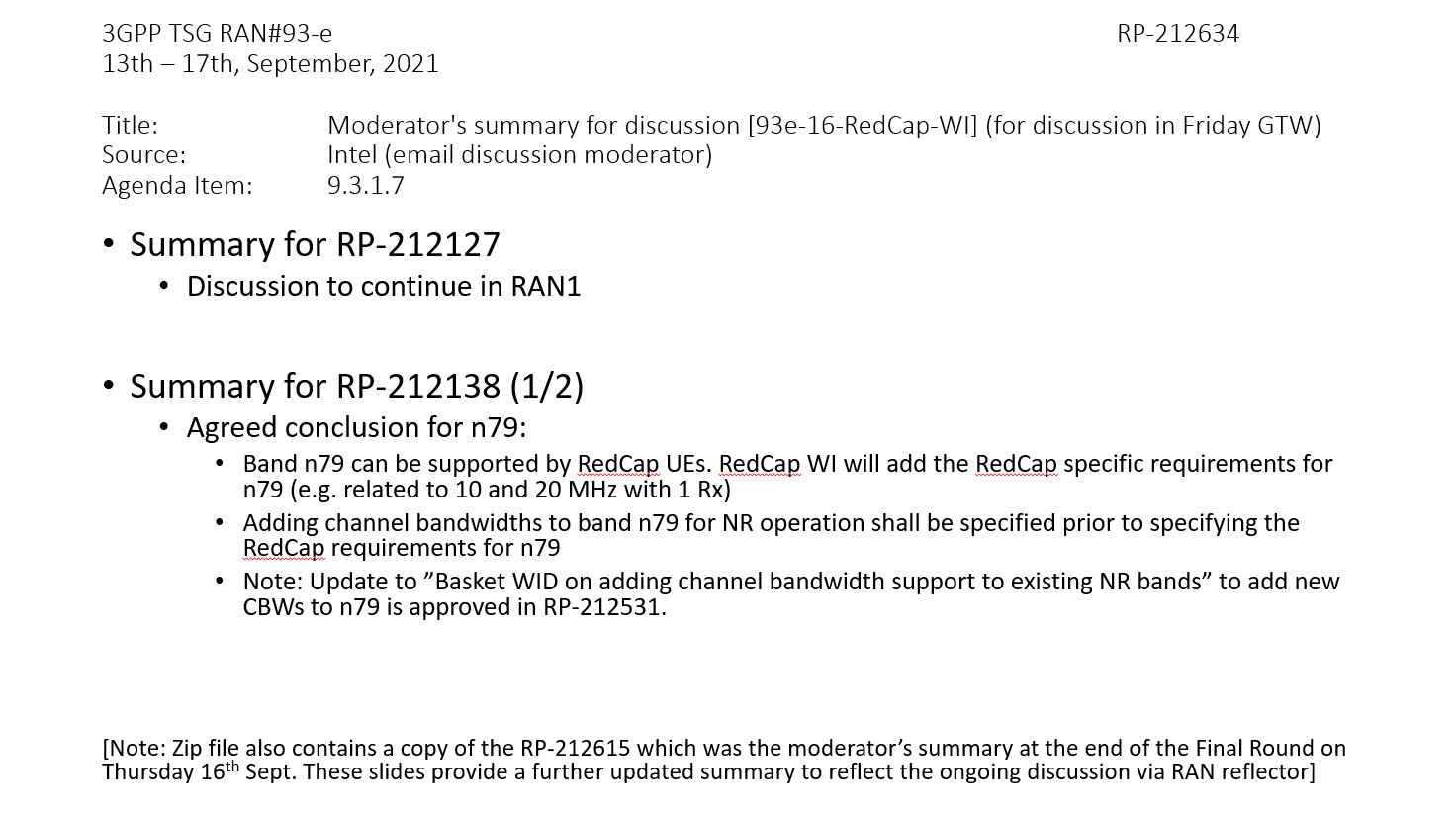
**Issue 2-1-1: n79**

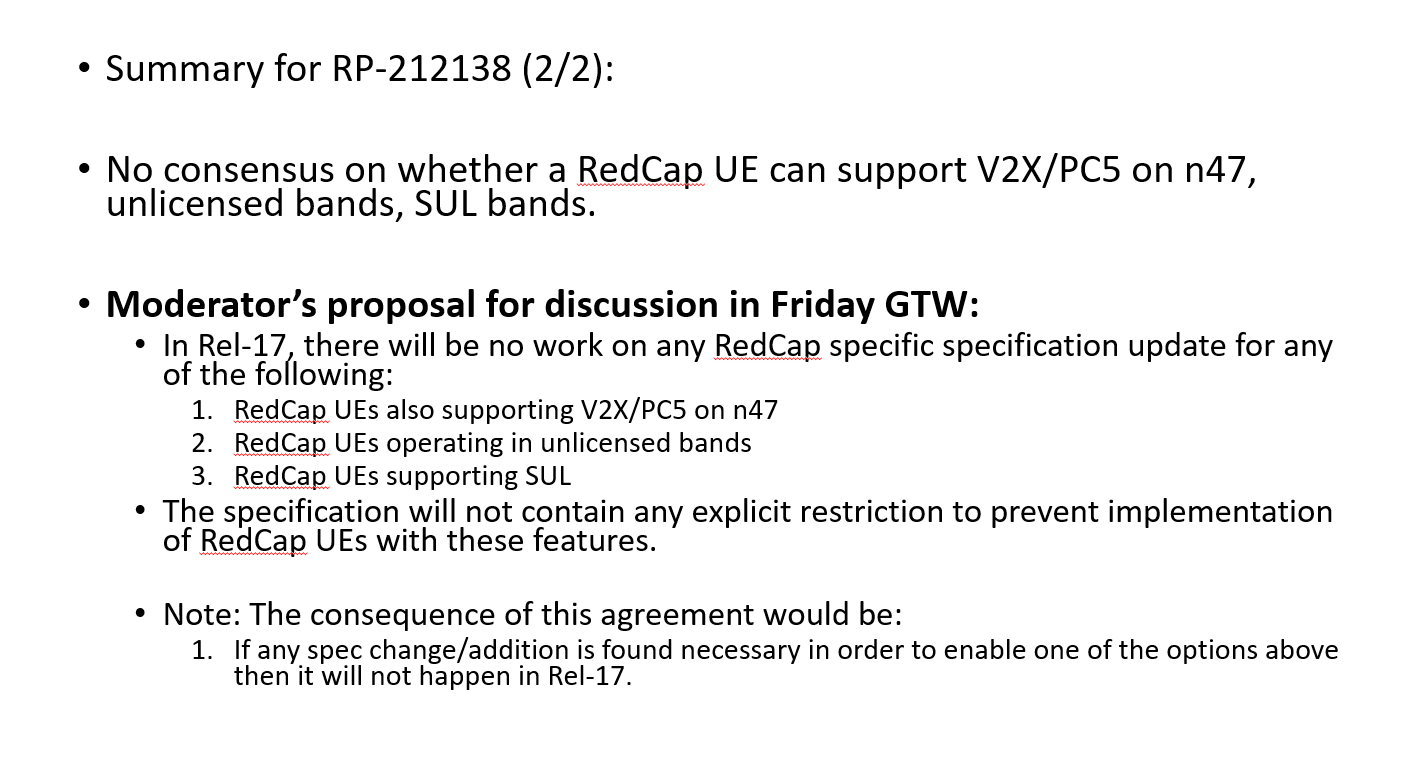
* Proposals
* Option 1: Delay n79 till RAN1 LS response agreed.
* Option 2: specify n79 [ZTE]

Recommended WF

*No discussion needed. Add n79 with bracket in the CR directly in FR1.*

Agreement: Add n79 with bracket in the CR directly in FR1





RAN#94e

Decision were reached on RedCap: t*here will be no further specification work in REL-17 related to SUL, V2X and NRU bands for RedCap UEs, which can be supported as agreed at RAN#93e. Previous agreement of RP-212634 is clear enough.*

**Issue 2-1-2-1: n46, n96 and n47**

*For v2x and unlicensed band*

*Candidate options:*

* *Option 1: Study the requirements impacts in Rel-18 timeframe and, if no protocol spec impact compared to Rel-17 spec is identified, then consider to specify those requirements in Rel-18 specs with Release-independence from Rel-17*
* *Option 2: TBA*

*Recommendations for 2nd round:*

* *Discussion two options*

Discussion:

Ericsson: this is separate discussion. The proponent is fine to study the requirement in Rel-18.

Huawei:

CMCC: from our perspective, can we conclude the study impact in RAN4 in WG level?

Ericsson: we have this band for discussion. We did not go anywhere. We need clarify the operator request in a release independent way. It is important to capture the operator wishes. In RAN4 in Rel-17 we do not spend any time to study this band. If operator still wants the band to be supported, RAN4 needs …

Skyworks: I do not see how RAN4 can make decision if RAN cannot decide it.

CMCC: Does it mean those features are precluded in Rel-17? That is not aligned with Rel-17. We should make more general.

Huawei: we have concern on the Ericsson proposal. If it is related to Rel-18, it should be discussed in RAN. We should honor the agreement in RAN. RAN agree that those features should not be precluded but no work in Rel-17. “If feasible” does it mean that we should first evaluate? I am not sure if such issue is helpful to complete the Rel-17 work.

Qualcomm: you should list SUL band first in WID and then work on the requirement.

Mediatek: there is no intention to specify anything. I do not see the problem here. We prefer Option 1.

OPPO: RAN way forward provides different interpretion for different companies. I wonder if RAN agreement provided enough room for companies. RAN is the right place to discuss the issue.

Huawei: there are two assumptions. If supporting SUL has clear spec impact, it means no vendor will implement. If supporting features has not clear spec impact, it means that vendor can implement. Company has freedom to implement the features. But we cannot restrict company not to implement features.

CMCC: If we see the report of RAN#93e, the conclusion is that moderator proposal is endorsed.

Xiaomi: what is the impact to the spec? No company provided the impact. There is no list of band. And in WID, there is clear saying that one band.

Mediatek: The impact was never discussed. RAN does not want to spend time.

Qualcomm: looking at the WID, it does say focusing on the single band at the time.

**Issue 2-1-2-2: SUL band**

*For SUL band*

*Candidate options:*

* *Option 1:* *Study the requirements impacts in Rel-18 timeframe and, if no protocol spec* *compared to Rel-17 spec is identified, then consider to specify those requirements in Rel-18 specs with Release-independence from Rel-17*
* *Option 2: Following RAN plenary’s agreement in RP-212634, the specification will not contain any restriction to prevent implementation of RedCap UEs with SUL feature.*
* *Option 3: TBA*

*Recommendations for 2nd round:*

* *Discussion above options*

Discussion:

Agreement:

CR feedback:

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| **CR/TP number** | **Comments collection** |
| Revised **[R4-2205278](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip)** | Company A |
| Company B |
| Ericsson: “For power class 3” may be rewording to “ For Redcap UE supporting power class 3” |
|  |
| Revised **[R4-2205601](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205601.zip)** | Skyworks: the notes should be reworked, there is no reason to use voided notes and Notes should be reordered and checked for relevance for RedCap |
| CMCC: we don’t agree with this band list table since it violates the RAN plenary agreements. |
| Huawei: We don’t agree this CR. As we commented in the 1st round, what this CR specified restrict the SUL implementation for RedCap UE. We can’t specify a band list without SUL bands to restrict the implementation of SUL feature for RedCap UE. |

Company feedback on WF for Topic #2:

Issue 2-1-1 comments:

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| --- | --- |
| **Company** | **Comments on 2-1-1** |
| Sony | Agree to WF proposal |
| MediaTek | Agree to WF proposal |
| Qualcomm | RAN1 has agreed on addressing the issue for backward compatibility with regards to CORSET values. The LS reply will be sent to RAN4 next meeting, so n79 can be added. |
| Skyworks | Since RAN1 has agreed to work on backward compatibility n79 can be introduced |
| Huawei | n79 can be included. |
| ZTE | RAN1 have already achieved the agreements on the backward compatibility, so n79 can be added. |
| OPPO | Ok with WF. |
| CMCC | Support WF |

Issue 2-1-2-1 comments:

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| **Company** | **Comments on** 2-1-2-1 |
| Sony | Could be brought up in Rel-18 |
| MediaTek | Okay to consider in Rel-18 in general, but it would be a RAN plenary final decision on whether to add this to RedCap Rel-18 WI scope. |
| Qualcomm | No consensus was reached at Plenary. The WI core objective must be updated to include the focus on other modes of operation such as unlicensed and SUL for release 18. |
| Skyworks | We are fine to discuss the applicability of those unlicensed bands for R18 in RAN |
| Apple | We are fine to consider them in Rel-18. |
| Huawei | I disagree with option 1. This option 1 is not aligned with RAN plenary’s agreement in RP-212634.  I don’t know why moderator insist this Rel-18 WI discussion in working group at the stage that we are busy with completion of Rel-17 WI. As other companies point out, it should be discussed in RAN plenary instead of RAN4.  Besides, I didn’t see any contributions in this meeting include this proposal, but moderator just include it to discuss based on his favor. |
| CBN | We don’t support option 1. |
| OPPO | Regarding V2X and SUL, fundamentally it needs to be understood whether there is requirement impact or not. If no impact is justified then in our view there is no need to restrict these bands from supporting in Rel-17. |
| Ericsson | We have facts below in RAN4:   * RAN4 did not study/verify the v2x, unlicensed band, and related requirement on RedCap UE * Operators want v2x, unlicensed band to be supported on RedCap UE in Rel-17 in release independent way.   As operator wants the band to be supported in RedCap, I think it is reasonable to discuss how RAN4 treat this based on the facts above. This is option 1. This option 1 is mainly to address the operator concern. |
| CMCC | We do not support option1 since RAN plenary guidance is to not spend any time on these features, and not preclude UE implementing them. |

Issue 2-1-2-2 comments:

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| **Company** | **Comments on** 2-1-2-2 |
| Sony | Respect the plenary agreement. However, this doesn’t preclude Option 1. |
| MediaTek | Okay to consider in Rel-18 in general, but it would be a RAN plenary final decision on whether to add this to RedCap Rel-18 WI scope.  Option 2 is not acceptable to us. The referred text related to RAN plenary agreement only highlights one part of the plenary agreement and does not give the full picture. So, like Sony, we do not think that Option 1 contradicts the RAN plenary agreement. Our view is not specific to SUL on this. |
| Qualcomm | No consensus was reached at Plenary. The WI core objective must be updated to include the focus on other modes of operation such as unlicensed and SUL for release 18. |
| Skyworks | We are fine to discuss the applicability of those SUL bands for R18 in RAN |
| Apple | We are fine to consider them in Rel-18. |
| Huawei | Firstly, we should honor RAN plenary’s agreement.  Secondly, I disagree with option 1. This option 1 is not aligned with RAN plenary’s agreement in RP-212634.  I don’t know why moderator insist this Rel-18 WI discussion in working group at the stage that we are busy with completion of Rel-17 WI. As other companies point out, it should be discussed in RAN plenary instead of RAN4.  Besides, I didn’t see any contributions in this meeting include this proposal, but moderator just include it to discuss based on his favor. |
| CBN | We don’t support option 1. |
| OPPO | Regarding SUL bands, our understanding is there is no requirement impact, therefore in our view there is no need to restrict these bands from supporting in Rel-17. |
| vivo | • Option 2. We prefer respect RAN plenary decision. |
| Ericsson | We have facts below in RAN4:   * RAN4 did not study /verify the SUL band, and related requirement on RedCap UE * Operators want SUL band to be supported on RedCap UE in Rel-17 in release independent way.   As operator wants the band to be supported in RedCap, I think it is reasonable to discuss how RAN4 treat this based on the facts above. This is option 1. This option 1 is mainly to address the operator concern. |
| CMCC | We prefer option 2. Option 2 is also aligned with RAN plenary decision. |

# Topic #3: REFSENS, UL configuration , Dual-mode HD-FDD for RedCap UE in FR1

**Issue 3-1-1-1:** *For band n1, n18, n24, n70, the tightening of REFSENS for HD-FDD is*

*Candidate options:*

* *Option1 : 0 dB*
* *Option 2: 0.2 dB*

*Recommendations WF:*

* *Option 1*

Agreement: Agree on Option 1.

**Issue 3-1-1-2:** *For band n1, n18, n24, n70, the tightening of REFSENS for HD-FDD is*

*For n91, n92, n93, and n94, the tightening of REFSENS for HD-FDD is*

*Candidate options:*

* *Option1 : 0 dB*
* *Option 2: 0.2 dB*

*Recommendations WF:*

* *Option1*

Agreement: Agree on Option 1.

**Issue 3-1-1-3:** *For framework of HD-FDD REFSESN, discuss further if additional note is need in CR.*

*Candidate options:*

* *Option1 : HD-FDD REFSENS for channel BW wider than 5 MHz can be calculated by REFSENS(5MHz) + 10log10(n x NRB/25), where NRB is the maximum transmission bandwidth configuration with n=1 for 15kHz SCS and n=2 for 30kHz SCS.*
* *Option 2: TBA*

*Recommendations WF:*

* *Option 1 (previous WF agreement) and further discussion in CR format (with note or not)*

Sony: In the spec, there are tables to capture the requirements rather formula.

Ericsson: we use formula to derive the numbers.

Agreement: HD-FDD REFSENS for channel BW wider than 5 MHz can be calculated by REFSENS(5MHz) + 10log10(n x NRB/25), where NRB is the maximum transmission bandwidth configuration with n=1 for 15kHz SCS, n=2 for 30kHz SCS, and n=4 for 60kHz SCS.

**Issue 3-1-2: UL configuration**

* Proposals
* *Option1 : Keep previous WF but adding a note that # of RB allocation in UL configuration has no impact on REFSENS*
* *Option 2: use the full RB allocation in UL configuration table*
* Recommended WF
  + option 2

Xiaomi: we should keep the previous agreements for general.

Ericsson: this is only for HD-FDD.

Skyworks: we support option 2. In that case, we even not need UL configuration table.

Xiaomi: use the same configuration for both FDD and HD-FDD.

Huawei: if we use the same configuration, we can reduce the test effort.

Ericsson: The previous way forward is confusing that the requirement is only for a limited number of RB.

Apple: support Option 2.

Agreement: use the full RB allocation in UL configuration table for HD-FDD.

**Issue 3-1-3: Dual mode RedCap UE support (HD-FDD and FD-FDD )**

* Proposals
* *Option1 : LS to RAN1 to notify RAN4 decision on dual mode device*
* *Option 2: no LS .*
* Recommended WF
  + Option 2

Discussion:

Qualcomm: we should send LS to RAN1 to consider the dual mode. It cannot happen in this release.

Ericsson: Dual mode is proposed in RAN4. We de-prioritize it in RAN4. I do not know how to help RAN1.

Qualcomm: I also agree with de-prioritize for Rel-17.

Apple: we proposed the HD-FDD dual mode. We are OK to Option 2. We can come back to dual mode in Rel-18.

Huawei: we are busy for complete the Rel-17.

Agreement: agree on Option 2.

**Issue 3-1-4: specification Format of the HD-FDD REFSENS**

* Proposals
  + Option 1: RedCap UE 2Rx HD-FDD REFSENS power levels are explicitly tabulated in the specifications. [Apple] .e.g [**R4-2203692**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203692.zip)
  + Option 2: Based on the agreement in previous meeting, it’s proposed to specify the following test for HD-FDD REFSENS considering two key factors ΔRIB,HD and ΔRIB,1R . [Huawei]. E.g [**R4-2205278**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip)
  + Option 3: Formula in stead of the numbers for HD-FDD REFSESN considering different band dependent scaling factor , [Ericsson] e.g [**R4-2205540**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205540.zip)
* Recommended WF
* Use the power level and not formular in CR

Discussion:

Agreement: Use the power level and not formula in CR

CR feedback discussion:

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| [Revised](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B138%5D%20NR_RedCap/Round%202/Revised%20CR/draft%20CR%20from%20Revised%20from%20R4-2205540%20(R17%20RedCap)%20CR%20on%20RedCap%20UE%20FR1-RX%20v02_CMCC_Huawei.docx) **[R4-2205540](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_102-e/Inbox/Drafts/%5B102-e%5D%5B138%5D%20NR_RedCap/Round%202/Revised%20CR/draft%20CR%20from%20Revised%20from%20R4-2205540%20(R17%20RedCap)%20CR%20on%20RedCap%20UE%20FR1-RX%20v02_CMCC_Huawei.docx)** | CMCC: The section number of channel bandwidth is 5.3I instead of 5.3.5I. |
| Huawei:  1) The structure is incorrect. Delta 1R factor should be specified in general part.  2) We should decouple the band list issue and other requirements.  3) We have no agreement on HD-FDD mode.  4) For UL configuration, the duplex mode should be removed since the corresponding bands have indicated it. |
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Ericsson: why is 1R move to common part?

Huawei:

Company feedback on WF for Topic #2:

Issue 3-1-1-1comments:

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| **Company** | **Comments on 3-1-1-1** |
| Mediatek | Updated comment: Based on some further consideration of some of the potential design uncertainties and considering how Rx sens is defined in general, we would also agree Option 1. Option 2 was preferred initially as we stated in round1, but we could also go with Option1 if this is preferred by others. |
| Sony | OK both options |
| Xiaomi | Support recommendations WF |
| Qualcomm | Option 1 was already agreed in the previous meeting. |
| Apple | Option 1 |
| Huawei | Option 1 |
| ZTE | Option 1 is fine. |

Issue 3-1-1-2 comments:

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| **Company** | **Comments on** 3-1-1-2 |
| Mediatek | Updated comment: Based on some further consideration of some of the potential design uncertainties and considering how Rx sens is defined in general, we would also agree Option 1. Option 2 was preferred initially as we stated in round1, but we could also go with Option1 if this is preferred by others. |
| Sony | OK both options |
| Xiaomi | Support recommendations WF |
| Apple | Option 1 |
| Huawei | Option 1 |
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Issue 3-1-1-3 comments:

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| **Company** | **Comments on** 3-1-1-3 |
| Sony | Agree to the framework but there is a table in the CR, no note. |
| Xiaomi | Support recommendations WF, n=4 for 60kHz SCS should be added in Option 1*.* |
| Apple | Option 1  Option 1 has been proposed by us. In our latest contribution R4-2203693, we have modified Option 1 to include n=4 for 60kHz SCS. We suggest to modify Option 1 to as below (as commented by Xiaomi),  *HD-FDD REFSENS for channel BW wider than 5 MHz can be calculated by REFSENS(5MHz) + 10log10(n x NRB/25), where NRB is the maximum transmission bandwidth configuration with n=1 for 15kHz SCS, n=2 for 30kHz SCS, and n=4 for 60kHz SCS.* |
| ZTE | Fine with the option 1, and ok with the revision proposed by Apple. |

Issue 3-1-2 comments:

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| **Company** | **Comments on** 3-1-2 |
| Sony | Open for both options |
| Xiaomi | Option 1, keep previous agreement |
| Apple | Option 2 |
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Issue 3-1-3 comments:

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| **Company** | **Comments on** 3-1-3 |
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Issue 3-1-4 comments:

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| **Company** | **Comments on** 3-1-4 |
| Sony | Option 1. We think the same shall yield for 1RX HD-FDD. |
| Xiaomi | Support recommendations WF |
| Qualcomm | Option 1. |
| Apple | Option 1  The 1Rx HD-FDD REFSENS requirements can be referenced to 2Rx HD-FDD REFSENS requirements (explicit power levels) by the 1Rx versus 2Rx delta. |
| Huawei | OK with recommended WF. |
| ZTE | Agree with Recommended WF |

# Topic #4: FR2 RedCap UE

**Moderator: majority view is to keep the previous WF from 1st and 2nd round discussion. some companies want to revisit the previous WF agreement from scalability view. Moderator view is that as current there are two different FWA types UE in FR2 so seems Redcap follow this does not seems a issue. For the sake of the progress, moderator recommend to follow the previous WF.**

Issue 4-0: FR2 RedCap UE power class

Proposal:

Option 1: no need to specify new power class for FR2 RedCap UE, reuse PC3 and PC5 with delta values for Minimum EIRP/Minimum EIS/Spherical coverage requirements and no need to ask RAN2 to design new capability [Huawei]

Option 2: Keep previous WF

Option 3: TBA

* Recommended WF
  + Option 2

Discussion:

Huawei: the option 1 does not conflict with the previous agreement.

Ericsson: in the previous agreement, we agreed to define the new power class. The Option 1 conflicts with the previous agreement. We have agreed LS to ask RAN2 about the signaling.

Agreement: keep previous WF.

**Moderator: Companies seems want to keep the MBR for the RedCap UE when RedCap support multi-bands. Moderator think that multi-band support may based on operator request and also current operator request is single band on n257, n258 and n261. Moderator view is that MBR concept could be discussed in future release in release independent way. RAN4 could discuss the below statement for PC5. (also the same for new issue 4-3-7)**

**New Issue 4-1: PC5 for RedCap UE**

*Tentative agreements:*

* *MBR does not apply to RedCap UE in Rel-17 for single band support* 
  + *specify MBR for multiple band support in future release based on operator request, FFS on MBR numbers for RedCap UE*
  + *MBR for RedCap is release independent as the same with FR2 NR UE*
* *add a note “other device type is not precluded for RedCap” or similar in Table 6.2.1.0-1*

Recommended WF

* + Discuss the tentative agreements

Discussion:

Mediatek: we checked the RedCap WID. There is no limitation on single band or multiple band case. We prefer to add MBR.

Apple: UE can be hardware capable to supporting 3 bands. Then MBR is required.

OPPO: agree with Mediatek and Apple. MBR depends on whether UE supports multiple band or not.

Ericsson: MBR is release independent. MBR value should be different.

Mediatek: we cannot agree to specify MBR in future release.

OPPO: it is not relaetd to CA.

Sony: we also discuss reusing the existing power class for redCap. If UE can reuse PC5, we should use the complete requirements for PC5.

Apple: UE can support all the three bands. Once UE supports three bands, the MBR needs be taken into account.

Xiaomi: Agree with mediatek. Whether to support multiple-band does not depend on operator request and it depends on UE implementation

*Agreements: For PC5 for RedCap UE, the existing MBR will be reused.*

**Moderator: majority companies are fine to option 1. Seems option 1 is agreeable.**

**Issue 4-2-1: new power class for FR2 RedCap**

Proposals:

* + Option 1: Define one new power class for “general” RedCap in Rel-17, suited for industrial sensors and wearables.
  + Option 2: TBA

Recommended WF

* + Option 1

*Sub-topic description:*

Two companies also want to clarify the meaning of “wearables” use cases.

*Open issues and candidate options before e-meeting:*

Discussion:

Huawei: I do not think indurstrial sensor and wearables can be viewed as one.

VIVO: We should confirm whether industry sensor and wearables have the same requirement or not.

ZTE: we share the similar view as VIVO. Any change on EIRP… needs a new power class.

Ericsson: we have discussed some use case last meeting. Both industrial sensor and wearables can be driven by reduction of power consumption and cost reduction. Majority companies are OK to use one power class for both. Companies think 50% for industrial and 70% for wearable. They can share the same charastics.

Huawei: we can compromise as Option 1.

Sony: we think the wearable could be different from industrial. Given the limited time, we can have one. We can use PC3 for wearable.

Agreement: Define one new power class for “general” RedCap in Rel-17, suited for industrial sensors and wearables.

**Moderator: several companies shows concern on the below statement too limit on the interpretation of the usage of the RedCap UE, we have also another point to discuss the note in general table to reflect MTK proposal, suggestion to focus new issue 4-1 second proposal instead.**

**Issue 4-2-2:** **what is “wearables” RedCap UE**

*options:*

* + - ***RAN4 assumes watch as starting point for wearable RedCap requirement discussion.***
    - ***Proposal2: Throughput, battery life, UE implementation feasibility, and use case shall be considered together before specifying FR2 requirements for wearable.***
* Recommended WF
  + no need to discuss, focus on new issue 4-1 to reflect this.

**Issue 4-3-1: RF architecture assumption for new power class FR2 RedCap**

* Proposals:
  + Option 1: single panel, dual polarization, 2x1 array [ Sony, Qualcomm]
  + Option 2: TBA
* Recommended WF
  + Option 1

Moderator: One company shows concern but seems RAN4 gathered enough analysis on this so option 1 seems agreeable..

Discussion:

Agreement: RF architecture assumption for new power class FR2 RedCap

* single panel, dual polarization, 2x1 array

**Issue 4-3-2: min EIRP**

* Proposals:
  + Option 1: 16.4 dBm for n257 n258 and n261 [xiaomi, Huawei, Sony, Qualcomm]
  + Option 2: TBA
* Recommended WF
  + Optoin 1

**Moderator: most companies agree with option 1 from 1st and 2nd round. One company has concern on the 50%-tile or 75%-tile, moderator suggest to refer to issue 4-2-1. Considering 4-2-1, it seems 50%-title could be agreeable.**

Discussion:

VIVO: the design for RedCap is different from the handheld. We need to evaluate link budget. We cannot define the requirement just based on PC3.

Apple: the number looks the directly scaling from PC3. For the wearable device, the form factor would be different from normal handheld UE.

Ericsson: We did not derive the number from PC3. Some companies provided the link budget for the analysis. We can discuss the number.

Apple: We do not contribution and need more time. We need analyze the antenna design. It make difficult to do analysis. We are thinking that in the RAN4 processing normally RAN4 has dedicated WI to handle such new device.

VIVO: for EIRP value, 2 dB relaxation would be acceptable.

Ericsson: we would like to put [16.4] dBm. It may impact RAN1. I still think we could discuss the number. We should not relax too much. We have rel-18 industry sensor objective. We could also discuss the even lower power class there.

Qualcomm: one possibility is to define two new power class: one for wearable and one for industrial sensor. The wearable can be a separate one.

Ericsson: It is better to stick the agreement of one power class. Where does 2dB relaxation come from?

VIVO: VIVO is not the only company who has the concern.

Apple: Comparing the proposed value, there is 6dB difference which met the reduction of antenna element number by half. The antenna design would be different.

Tentative Agreement: for min EIRP

* [16.4] dBm for n257 n258 and n261
  + FFS whether the relaxation is needed

**Issue 4-3-3: Spherical coverage**

* Proposals:
  + Option 1: EIRP spherical coverage for RedCap power class shall be 5.5 dBm for n257, n258, n261 and 2.0 dBm for n260 at 50 %-tile CDF. [Sony, Ericsson]
  + Option 2: For the low-power RedCap UE, spherical gain drop from peak direction is specified along the 75th %ile direction as: [Qualcomm]

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| --- | --- | --- | --- | --- | --- | --- |
| **Band** | **n257** | **n258** | **n259** | **n260** | **n261** | **n262** |
| **Gain drop (dB)** | **8** | **8** | **9** | **9** | **8** | **10** |

* + Option 3: Adopt 11dB as the gain drop of spherical coverage @50%-tile for 28GHz bands [vivo]
  + Option 4: the same delta value 6 dB relaxer than FR2 PC3 can be used for EIS and Spherical coverage requirements of wearable use case.[Huawei]
  + Option 5:the min EIRP spherical coverage, REFSENs and EIS spherical coverage for wearable use case Redcap UE should also reduce 6dB based on PC3 handheld UE. [Xiaomi]
* Recommended WF
  + Optoin 1 (Reusing the gain drop from PC3)

Discussion:

Apple: the spherical coverage depends on the antenna design due to form factor design. We can consider Qualcomm proposal. We suggest to put the agreed value in [ ].

Sony: Option 1 is from our contribution. The gain is the same as PC3.

Huawei: whether n260 should be included.

Agreement: for spherical coverage, EIRP spherical coverage for RedCap power class shall be [5.5] dBm for n257, n258, n261 at 50%-tile CDF.

**Issue 4-3-4: REFSENS**

* Proposals:
  + Option 1: [Sony]
    - The RedCap REFSENS requirement should be based on a 2-element array reference design.
    - REFSENS for RedCap PC shall be -82.3 dBm for n257, n258, n261 and -79.7 dBm for n260 for 100MHz BW.
  + Option 2: the min EIRP spherical coverage, REFSENs and EIS spherical coverage for wearable use case Redcap UE should also reduce 6dB based on PC3 handheld UE. [Xiaomi]
  + Option 3: Scaling of the 3 dB in PC3 REFSENS for RedCap UE for band n261, n257, n258. [Ericsson, Qualcomm]
  + Option 4: TBA
* Recommended WF
  + Option 3 (same with option 1)

Agreement: Scaling of the [3] dB in PC3 REFSENS for RedCap UE for band n261, n257, n258.

**Issue 4-3-5: EIS**

* Proposals:
  + Option 1: EIS spherical coverage for RedCap power class shall be -71.4 dBm for n257, n258, n261 and -67.1 dBm at 100MHz BW and for n260 at 50 %-tile CDF. [Sony, Ericsson]
  + Option 2: For FR2 wearable Rx requirement, the same gain drop of Tx proposed in [1] should be adopted [Vivo, Ericsson]
  + Option 3: the min EIRP spherical coverage, REFSENs and EIS spherical coverage for wearable use case Redcap UE should also reduce 6dB based on PC3 handheld UE. [Xiaomi]
  + Option 4: the same delta value 6 dB relaxer than FR2 PC3 can be used for EIS and Spherical coverage requirements of wearable use case. [Huawei]
  + Option 5: TBA
* Recommended WF
  + Option 2

Agreement: For general FR2 Rx requirement for the new power class, the same gain drop [10.9]dB should be adopted.

**Issue 4-3-6: Beam correspondence**

* Proposals:
  + Option 1: General requirements for Beam Correspondence (6.6.1) apply to all RedCap UEs. [Qualcomm]
  + Option 2: Side condition of beam correspondence should be updated with gain drop from spherical coverage requirement [Ericsson]
  + Option 3: TBA
* Recommended WF
  + Option 1 and 2.

Discussion:

Huawei: based on the previous agreement, we only focus on EIRP, spherical coverage.. It is not aligned with the previous agreement, i.e., using PC3 as baseline. We do not prefer to change the BC requirement.

Qualcomm: There are new power class defined without bit-0. Bit-0 is for the old UE. It may require a lot of network effort.

Huawei: I think we are specifying the requirement for reduced capability UE. Is Bit-0 not allowed for RedCap UE?

Qualcomm: Bit-0 UE needs to support additional capability.

Sony: we have another reference architecture with wider beam. If bit-0 introduced, we need more work for design.

Huawei: we can compromise that some clarification is needed.

Agreement: In Rel-17 only bit-1 beam correspondence requirement will be specified for power class 7 for FR2 RedCap UE.

**Moderator: Same issue with new issue 4-1**

**New Issue 4-3-7:** MBR

* Proposals:
* Option 1 *MBR does not apply to RedCap in Rel-17 for single band operation* 
  + *FFS to specify MBR for multiple band support in future release*
* Option 2: TBA
* Recommended WF
  + Opiton 1

Agreement: Reuse the PC3 MBR for the new power class for FR2 RedCap UE.

**Issue 4-3-8:** Other RF requirment

* Proposals:
* Option 1: [Qualcomm]
  + Clause 6.3, 6.4 and 6.5 requirements for PC3 are applicable to RedCap low power UE.
  + Requirement clauses 7.4, 7.5 and 7.6 are applicable to all RedCap UEs.
* Option 2: Reuse MPR, A-MPR, Beam correspondence from PC3 to RedCap UE. [Ericsson]
* Option 3: [ZTE]
  + No changes for the requirements of EVM, SEM, ACLR, Maximum Input level, ACS, blocking, Tx/Rx spurious emission for FR2 RedCap UE.
  + To reuse the existing PC3 MPR values(BWchannel ≤ 200 MHz) for the power classes of RedCap UE
* Recommended WF
  + Check CR direct, no discussion in 2nd round.

CR feedback:

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| Revised **[R4-2205541](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205541.zip)** | Company A |
| Company B |
| Huawei: Beam correspondence requirements didn’t follow the previous agreement since 0-bit UE requirements are dropped. |
| Revised **[R4-2205542](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205542.zip)** | Company A |
| Company B |
| Huawei: we can’t leave X into the final CR. |

Company feedback on WF for Topic #4:

Issue 4-0 comments:

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| --- | --- |
| **Company** | **Comments on 4-0** |
| MediaTek | OK for Recommended WF (Option 2) |
| Qualcomm | Agree with moderator WF.  Option 1 is not scalable if this feature spawns more device types in the future |
| Sony | Agree to WF proposal |
| Xiaomi | Option 1 is more scalable, in 1st round discussion about Issue 4-2-2, some companies thought there is already no limitation, I’m not sure that means PC3 and PC3-6dB can be used in parallel for wearable Redcap UE. Whether it also means PC1, PC2, PC4 can be used by Redcap UE. If the answer is Yes, maybe in future PC1-Delta, PC2-Delta, PC4-Delta and PC5-Delta are request for Redcap UE. If like this, at least 4 new power classes need introduce for Redcap in future. If RAN 4 just define the delta value based on PC3, and introducing new UE capability represents the reduction Rx capability, each PC can represent two power classes. |
| Apple | Option 1 is our preference |
| Huawei | Option 1. Share the similar view with Xiaomi. Tons of power class are not constructive. |
| ZTE | Ok with Recommended WF |
| OPPO | Ok with WF |
| vivo | Ok with WF proposal |

New Issue 4-1 comments:

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| --- | --- |
| **Company** | **Comments on 4-1** |
| MediaTek | We’d like to make our position be clearer, and avoid wording misunderstanding issue:  Case1) While a UE supports multiple bands (ex: n257 **and** n258), and even if only supports single band **ACTIVE** at one time (n257 **or** n258), MBR still shall be applied as normal FR2 PC rule.  Case2) While a UE only supports one band (ex: n257 **or** n258), then MBR is not applied as normal FR2 PC rule.  In RedCap WID, we didn’t find limitation on how many bands a RedCap can support; hence, we think MBR is still needed for the RedCap UEs which support multiple bands, even if no inter-band CA operation. What we only see in WID so far is *“This WI focuses on SA mode and single* ***connectivity*** *with operation in a single band* ***at a time****.”*  Echo Sony’s insight, if a UE really only supports one band, even if we define MBR for RedCap, MBR won’t be applied to this single-band UE actually.  Hence, the tentative agreement is **NOT** agreeable for us so far. |
| Qualcomm | No strong view:  We understand that if the front-end of Redcap PC5 is shared with regular PC5, so the same MPR framework would be carried over. It is not desirable, but we are ok to live with MBR |
| Sony | Regarding MPR we share the same view as Qualcomm. Regarding the note “other device types …”: as proponent we thing this informative note is a good idea. |
| Xiaomi | Thanks for Media Tek’s explanation, we have similar view with Media Tek. |
| Apple | We share the similar view with MediaTek. Whether the same MBR values can be reused need further evaluations. |
| ZTE | We are ok not to consider MBR for RedCap UE in Rel-17 although we think MBR is not exactly indentical to CA. |
| OPPO | Agree MTK comment. |

Issue 4-2-1 comments:

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| --- | --- |
| **Company** | **Comments on 4-2-1** |
| MediaTek | One power class can be the target, to make power class types concise. |
| Qualcomm | Agree with moderator WF. |
| Sony | Agree to WF proposal |
| Apple | We are fine to start with a new PC. Whether the same PC would be applicable to wearables and industrial sensors needs further discussions. A new WI for a new FR2 power class requirements seems to be more appropriate if we would follow the RAN4 normal procedure which may receive more attentions from companies who are interested in this topic. |
| Huawei | I prefer to specify two kinds of power class for Rel-17. |
| ZTE | We are also fine with WF proposal in case of the industry sensor and wearables can share the same requirements and be seens as similar UE type. |
| OPPO | As long as requirements are same, then one power class is ok. |
| vivo | Not so sure whether single panel, dual polarization, 2x1 array assumption can apply to industry sensor, if not, two power class is preferred. |

Issue 4-2-2 comments:

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| **Company** | **Comments on 4-2-2** |
| MediaTek | Support the tentative agreement, and we feel companies are generally okay for this to converge technical discussion. |
| Qualcomm | Do not agree as framed.  Agree on this condition: If ‘Wearable’ is found to have constraints that require a different set of UE RF requirements than the ‘general’ low-power Redcap UE, a separate PC should be defined. |
| Sony | We sympathize with both MedaTek and Qualcomm. It is early for FR2 RedCap which means that what we do in Rel-17 may not be optimal (compare e.g., PC4). Our opinion is that we (RAN4) should try our best to do something. |
| Apple | We are fine with the tentative agreement. |
| Huawei | I share the similar with QC. I don’t agree it. |
| OPPO | Ok to use watch as wearable to define requirements, however, it might not be suitable to only limited to watch in the specification, should be more general for similar constraint UE types. |

Issue 4-3-1 comments:

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| --- | --- |
| **Company** | **Comments on 4-3-1** |
| MediaTek | Recommended WF is made sense from watch view. |
| Qualcomm | Agree with moderator WF |
| Sony | Agree to WF proposal |
| Apple | We are fine with the moderator WF. |
| OPPO | Ok with WF |
| vivo | Agree the proposal |

Issue 4-3-2 comments:

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| **Company** | **Comments on 4-3-2** |
| MediaTek | Recommended WF is okay for us, if 4-3-1 is agreed. |
| Qualcomm | Agree with moderator WF |
| Sony | Agree to WF proposal |
| Apple | FFS: we still think the factors other than antenna number scaling need to be considered. For example, is the antenna efficiency and implementation loss the same as PC3 handheld UE? |
| ZTE | Agree with moderator WF |
| vivo | We share similar view with Apple |

Issue 4-3-3 comments:

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| --- | --- |
| **Company** | **Comments on 4-3-3** |
| MediaTek | Recommended WF is okay for us for n257/n258/n261. |
| Sony | Agree to WF proposal |
| Apple | We need to first agree on either 50%tile or 75%tile for spherical coverage. |
| OPPO | Ok with “Reusing the gain drop from PC3” but this is not option 1? |
| vivo | Based on our simulation results, we are OK to reuse the gain drop for PC3. |

Issue 4-3-4 comments:

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| **Company** | **Comments on 4-3-4** |
| MediaTek | Recommended WF is okay for us, if 4-3-1 is agreed. |
| Sony | Agree to WF proposal |
| Apple | Same comment as in 4-3-2 |

Issue 4-3-5 comments:

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| **Company** | **Comments on 4-3-5** |
| MediaTek | Recommended WF is made sense. |
| Qualcomm | Agree with moderator WF |
| Sony | Agree to WF proposal |
| Apple | We agree with moderator WF. |
| vivo | As proponent, we support Option 2 (moderator WF) |

Issue 4-3-6 comments:

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| **Company** | **Comments on 4-3-6** |
| MediaTek | Recommended WF is okay for us. |
| Qualcomm | Agree with moderator WF |
| Sony | Agree to WF proposal |
| Apple | We are fine with moderator WF. |
| ZTE | Agree with moderator WF |
| OPPO | Ok with WF. |

New Issue 4-3-7 comments:

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| **Company** | **Comments on 4-3-7** |
| MediaTek | The issues seems duplicated to 4-3-1. Just similar comment in 4-3-1:  We’d like to make our position be clearer, and avoid wording misunderstanding issue:  Case1) While a UE supports multiple bands (ex: n257 **and** n258), and even if only supports single band **ACTIVE** at one time (n257 **or** n258), MBR still shall be applied as normal FR2 PC rule.  Case2) While a UE only supports one band (ex: n257 **or** n258), then MBR is not applied as normal FR2 PC rule.  In RedCap WID, we didn’t find limitation on how many bands a RedCap can support; hence, we think MBR is still needed for the RedCap UEs which support multiple bands, even if no inter-band CA operation. What we only see in WID so far is *“This WI focuses on SA mode and single* ***connectivity*** *with operation in a single band* ***at a time****.”*  Echo Sony’s insight, if a UE really only supports one band, even if we define MBR for RedCap, MBR won’t be applied to this single-band UE actually.  Hence, the recommended WF is **NOT** agreeable for us so far. |
| Sony | We agree with MedaTek. We will also echo Qualcomm’s comment under 4-1. Thus if a PC is reused all specification including MBR is reused. |
| Xiaomi | prefer MBR is reused |
| Apple | We share the similar view with MediaTek. Whether the same MBR values can be reused need further evaluations. |
| OPPO | Agree with MTK. |

Issue 4-3-8 comments:

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| **Company** | **Comments on 4-3-8** |
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# References

1. R4-2206338 Email discussion summary for [102-e][138] NR\_RedCap, Ericsson

# Annex

***1st round summary and recommendation for WF from Modearator:***

|  |  |
| --- | --- |
| **Issue 1-1** | *All company agree option 1. One company think PC2 HD-FDD device worth considering for RedCap UE, one company think it may be too late to consider it Rel-17 and seems proponent also fine to study it in futher release.*  *Tentative agreements:*  *Option 1*  *Recommendations for 2nd round:*  *No discussion in 2nd round* |
| **Issue 1-2** | *Similar observation for issue 1-1 and moderator view is that the same conclusion with issue 1-1 is fine. Some companies also mention the PC2 HD-FDD device is under specifying so maybe it also be good to have a PC2 HD-FDD before further discussion for RedCap. Seems there is no confliction with issue 1-1 conclusion.*  *Tentative agreements:*  *Same conclusion with issue 1-1*  *Recommendations for 2nd round:*  *No discussion in 2nd round* |
| **Issue 1-3-1** | *5 companies think this issue is the same for legacy eMBB UE. 2 companies think it is specific for Redcap UE and 2 companies think it need further clarification on the issue is needed. Moderator view is that this issue could be further discussed in 2nd round to further align the views between companies. Moderator view is that further discussion in 2nd is needed and focus should be to clarify “the same issue with eMBB device” with some clarification from option 1. Maybe offline mail discussion would be appropriate.*  *Tentative agreements:*  *Candidate options:*  *Option1:* Yes, the issue is the same.  *Option 2:* No, only for RedCap UE  *Recommendations for 2nd round:*  *Continue the discussion in 2nd round* |
| **Issue 1-3-2** | *More companies think that option 3 is fine. This is to treat the RedCap UE the same with legacy eMBB device. One company think option 1 is preferred. This could be discussed together with issue 1-3-1. One company explains the RAN4 minimum requirement apply to the REFSESN with full channel support and default/nomimal Tx-Rx distance and seems it will not be changed for RedCap UE. Moderator view is to discuss further with issue 1-3-1 in 2nd round. Discuss only issue 1-3-2 once RAN4 identified the RedCap specific issue.*  *Candidate options:*  *Recommendations for 2nd round:*  *no discussion in 2nd round* |

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| **Issue 2-1-1** | *Seems there is no controversial view here. N79 will be added and just when. Some companies think it should already in this meeting with bracket or checking LS in this meeting. Moderator think adding bracket on n79 in CR would be fine in this meeting. Bracket could be removed once LS from RAN1 confirms.*  *Recommendations for 2nd round:*  *No discussion needed. Add n79 with bracket in the CR directly in FR1.* |
| **Issue 2-1-2** | *Some companies are fine to add the v2x, unlicensed band in release indepent way in rel-18. Two companies have strong view and see these bands already should be supported in rel-17. The view is from different understanding with RAN WF and moderator view is that further to discuss together with issue 2-1-3. Moderator thinks it need further discussion on this during 2nd round based on proponent possible new proposal to have compromise. And to separate the band SUL and v2x, unlicned band. Meanwhile, the CR to reflect proponent view could be discussed together.*  *For v2x and unlicensed band*  *Candidate options:*   1. *Study the requirements impacts in Rel-18 timeframe and, if no protocol spec impact compared to Rel-17 spec is identified, then consider to specify those requirements in Rel-18 specs with Release-independence from Rel-17* 2. *TBA*   *Recommendations for 2nd round:*  *For SUL band*  *Candidate options:*  *Option 1:* *Study the requirements impacts in Rel-18 timeframe and, if no protocol spec* *compared to Rel-17 spec is identified, then consider to specify those requirements in Rel-18 specs with Release-independence from Rel-17*  *Option 2: Following RAN plenary’s agreement in RP-212634, the specification will not contain any restriction to prevent implementation of RedCap UEs with SUL feature.*  *Recommendations for 2nd round:* |
| **Issue 2-1-3** | *There is no need to discuss this issue, combine the issue 1-2-2 to find the compromise solution if possible.*  *Recommendations for 2nd round:*  *No discussion in 2nd round, discuss issue 1-2-2 only with possible compromise.* |

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| **Issue 3-1-1** | *Most company are fine with option 1a and option 2. Seems companies view are fine that if band n1, n18, n24, n70 could be tightened,. To progress, moderator view is that to discuss 0.2 dB tightening on band n1, n18, n24, n70 and further check if companie has strong view over 0 dB tightening or not (then possible go with 0.2 dB). The proposal of option 1a was agreed last meeting, so it seems we can keep previous WF as it is. some companies question the formular in option 1a, seems some explanation may be needed offline.*  *For band n1, n18, n24, n70, the tightening of REFSENS for HD-FDD is*  *Candidate options:*   * *Option1 : 0 dB* * *Option 2: 0.2 dB*   *Recommendations for 2nd round:*   * *Option 2*   *For n91, n92, n93, and n94, the tightening of REFSENS for HD-FDD is*  *Candidate options:*   * *Option1 : 0 dB* * *Option 2: 0.2 dB*   *Recommendations for 2nd round:*   * *Option 2*   *For framework of HD-FDD REFSESN, discuss further if additional note is need in CR.*  *Candidate options:*   * *Option1 : HD-FDD REFSENS for channel BW wider than 5 MHz can be calculated by REFSENS(5MHz) + 10log10(n x NRB/25), where NRB is the maximum transmission bandwidth configuration with n=1 for 15kHz SCS and n=2 for 30kHz SCS.* * *Option 2: TBA*   *Recommendations for 2nd round:*   * *Option 1a and further discussion in CR format (with note or not)* |
| **Issue 3-1-2** | *This is discussed for several meetings though majority view is to keep previous WF. Two company prefer to use full transmission bandwidth to avoid the confusion as the REFSESN is specified with the condition of the UL transmission bandwidth and it is not true for HD-FDD and it could also be interpreted as RAN4 has specified the REFSENSE with UL configuration limitation which is not case. Moderator view is that better to clarify it with a note in the UL configuration if the previous WF to be kept so to avoid the confusion on the interpretation of the REFSNES for RedCap UE*  *Candidate options:*   * *Option1 : Keep previous WF but adding a note that # of RB allocation in UL configuration has no impact on REFSENS* * *Option 2: use the full RB allocation in UL configuration table.*   *Recommendations for 2nd round:*  *Discuss above two options.* |
| **Issue 3-1-3** | *All company agree option 2, one company think a LS to RAN12 may be good, in 2nd round, maybe some view from companies for the necessity of the LS.*  *Candidate options:*   * *Option1 : LS to RAN1 to notify RAN4 decision on dual mode device* * *Option 2: no LS .*   *Recommendations for 2nd round:*  *Discuss above two options.* |
| **Issue 3-1-4** | *5 companies favour the value of power level instead of formular. 2 companies think formular is fine and one company also think formular but different with option 1a. Moderator view is that as this is related to CR work, the majority view is fine and suggest to use power level not formular in CR.*  *Tentative agreements:*  *Use the power level not formular in CR.*  *Recommendations for 2nd round:*  *No discussion in 2nd round.* |

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| **Issue 4-0** | *Most company think keep previous WF is fine. One company does not want to specify new power class. Moderator view is that previous WF can be kept and thus discuss if below tentative agreement would be ok.*  *Tentative agreements:*   * *Same as previous WF on power class of RedCap UE*   *Recommendations for 2nd round:*  *Check if the above tentative agreement would be fine in 2nd round.* |
| **Issue 4-1** | *Most companies are ok with option 1 and option 2. Though some company want to reserve the MBR for the redcap even it is not used in rel-17. One company think the MBR considered may not be same for MBR for CA/DC. Multiband operation is not within the WID objective and it should be fine not focus on that aspect and moderator think for rel-17. Thus, moderator view is that not considering the MBR in rel-17 would be agreeable, MBR however, could be discussed in future release though may not relate to the CA/DC.*  *One company want to add a note “ other device type is not precluded for RedCap” as Table 6.2.1.0-1 is informative. Note the MBR is repeated in issue 4-3-7.*  *Tentative agreements:*   * *MBR does not apply to RedCap in Rel-17 for single band operation*    + *FFS to specify MBR for multiple band support in future release* * *add a note “other device type is not precluded for RedCap” in Table 6.2.1.0-1*   *Recommendations for 2nd round:*  *Discus if the above tentative agreement would be fine for companies to reserve the MBR concept.* |
| **Issue 4-2-1** | *6 companies want one combined power class and 3 companies want 2 power class. 1 company seems fine with option 1 if the same RF requirement. Considering the issue 4-1, there is no preclusion of RedCap UE to use other power class so does the new power class. Both wearable and industry sensor may be driven by battery and limited by size so specifying the same requirement benefit the cost factor from UE perspective. Moderator view is that to further alignment for companies view is needed in 2nd round. Proponent of 2 new power class may need to exemplify the RF requirement difference for industry sensor and wearables.*  *Tentative agreements:*   * *Option 1:* Define one new power class for “general” RedCap in Rel-17, suited for industrial sensors and wearables.   *Candidate options:*   * *Option 2;* Two new power classes would be needed for the use cases of FR2 RedCap UE, i.e. Industry sensor and wearables.   *Recommendations for 2nd round:*  *Further check if tentative agreement would be agreeable.* |
| **Issue 4-2-2** | *Most companies think option 1 and option 2 could be discussed at starting point. However, in option 2, there is FFS on spherical coverage requirement and not sure what it means as this is the last meeting, RF requirement need to be specified. Moderator view is that to encourage proponent of option 2 to examine the CR on spherical coverage if possible. Apart of this, other points could be kept in WF for RAN4 considerations when design RedCap UE.*  *Tentative agreements:*   * + - ***RAN4 assumes watch as starting point for wearable RedCap requirement discussion.***     - ***Proposal2: Throughput, battery life, UE implementation feasibility, and use case shall be considered together before specifying FR2 requirements for wearable.***   *Candidate options:*  *Recommendations for 2nd round:*  *Further check if tentative agreement would be agreeable. Also further check CR on spherical coverage requriemets for proponent of option 2.* |
| **Issue 4-3-1** | *All company but one are ok with option 1. One company has question if it is for wearables. Moderator view is that majority is fine with RF architecture so no need to discuss in 2nd round.*  *Tentative agreements:*  *Option 1.*  *Recommendations for 2nd round:*  *No discussion in 2nd round.* |
| **Issue 4-3-2** | *Most company agree the 6 dB reduction compared to PC3. One company think some margin may be needed. One company also comment the gain drop may not scale with antenna element number. Moderator view is that it seems majority view could be used for minPeak power. It may need to confirm this in 2nd round.*  *Tentative agreements:*  *Option 1.*  *Recommendations for 2nd round:*  *Further check the tentative agreement in 2nd round and proponent of the modification of minPeak power could also suggest finetuning number during 2nd round if there is any.* |
| **Issue 4-3-3** | *Most company are fine with option 1 and 3. One company want to option 2. One company want option 4. The majority view is to use the same spherical coverage. Moderator view is to further check if the reusing of PC3 spherical coverage is fine. Considering the power class discussion in 4-2-1.*  *Tentative agreements:*  *Option 1.*  *Recommendations for 2nd round:*  *Further check the tentative agreement in 2nd round.* |
| **Issue 4-3-4** | *Most companies are fine with option 1 or option 3 (they are same). Two companies want to finetuning the number. Two companies think 6 dB reduction. Moderator think the gain reduction caused by half reduction of the array size is 3 dB not 6 dB as the incoming received signal impinging on the Rx receiver antenna is the same for any antenna array size. Thus only antenna gain play role here. This is different for Tx EIRP where the # of PA will be added on top of the antenna gain. Having said this, moderator think companies may be fine with scaling of 3 dB for REFSENS.*  *Tentative agreements:*  *Option 1 or option 3*  *Recommendations for 2nd round:*  *Further check the tentative agreement in 2nd round.* |
| **Issue 4-3-5** | *Most companies think option 2 (same as option 1) fine. One company want a different spherical coverage than 50%tile. One company want option 4. Moderator view is to discuss if the same gain drop with spherical coverage is agreeable.*  *Tentative agreements:*  *Option 2*  *Recommendations for 2nd round:*  *Further check the tentative agreement in 2nd round* |
| **Issue 4-3-6** | *Most companies are fine with WF. One company want option 3. Moderator view is to see if opton 1&2 is agreeable.*  *Tentative agreements:*  *Option 1&2*  *Recommendations for 2nd round:*  *Further check the tentative agreement in 2nd round,* |
| **Issue 4-3-7** | *5 companies want to keep MBR for RedCap if multiple band would be supported. Modearator view is that it could be discussed in future release. Similar discussion with previous issue 4-1.*  *Tentative agreements:*   * *MBR does not apply to RedCap in Rel-17 for single band operation*    + *FFS to specify MBR for multiple band support in future release*   *Recommendations for 2nd round:*  *Discus if the above tentative agreement would be fine for companies to reserve the MBR concept.* |
| **Issue 4-3-8** | *Seems companies are fine with options. One companies does not want to include the side condition for beam correspondene requirement, Seems for beam corresponding requirement overlapping 4-3-6. Moderator view is that to close this issue and follow issue 4-3-6 instead.*  *2nd round discussion:*  *No need discussion, review CR direct.* |