**3GPP TSG-RAN WG4 Meeting # 102-e R4-2206338**

**Electronic Meeting, 21st Feb– 3rd March, 2022**

**Agenda item:** 10.20.2;

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [102-e][138] NR\_RedCap

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

The following topic will be discussed in 1st round:

1. RedCap UE Power class related issue and viable duplex distance operation for BWP on FDD band
   1. Document previous meeting agreement on the UE power class and architecture
   2. Viable duplex distance for BWP on FDD band
2. Operating band in FR1
   1. n79
   2. n47, n46, n96 and SUL band
3. REFSENS, UL configuration , Dual-mode HD-FDD for RedCap UE in FR1
   1. HD-FDD REFSESN
   2. UL configuration
   3. Dual mode RedCap UE support (HD-FDD and FD-FDD )
   4. specification Format of the HD-FDD REFSENS
4. FR2 aspects
   1. FR2 RedCap UE power class
   2. PC5 for RedCap UE
   3. new power class for FR2 RedCap
   4. what is “wearables” RedCap UE
   5. RF requirements for new power class Redcap UE
      1. RF architecture for new power class FR2 RedCap
      2. Min EIRP
      3. Spherical coverage
      4. REFSENS
      5. EIS
      6. Beam correspondence
      7. MBR
      8. Other RF requirement
5. LS on FR2 RedCap UE FR1

2nd round will focus the CR updates, WF on different topic.

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

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2204765](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204765.zip)** | ZTE Corporation | Proposal 1. Approve the follow tentative agreements:  1. 1 TX architecture of 23 dBm PA  2. 1 TX of 26 dBm PA in Rel-17 and 2 TX architecture is excluded in Rel-17  3. PC2 support based on operator request |
| **[R4-2205544](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205544.zip)** | Ericsson | Proposal-1:Treat the RedCap in FDD band for configuration of UL/DL BWP the same as legacy NR UE.  Proposal-3:Document below in new WF. |
| [**R4-2206072**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2206072.zip) | Skyworks Solutions Inc. | Proposal: 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. |
| [**R4-2206135**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2206135.zip) | MediaTek (Chengdu) Inc. | Proposal 1: 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.  Proposal 2: 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. |
| [**R4-2205275**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205275.zip) | Huawei, HiSilicon | **Observation: no matter whether RAN4 specify the REFSENS degradation due to the smaller Tx-Rx frequency separation between UL and DL BWPs, the BS deployment can’t be restricted.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1

*Sub-topic description:*

Some agreement on FR1 RedCap UE power class and architecture is not documented and companies suggest to confirm these agreement and document in WF. *Open issues and candidate options before e-meeting:*

**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

### Sub-topic 1-2

*Sub-topic description:*

One company also gives views on PC2 support on RedCap UE in HD-FDD. Views from companies can be collected.

*Open issues and candidate options before e-meeting*

**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
  + TBA

### Sub-topic 1-3

*Sub-topic description:*

The UL/DL BWP configuration in FDD band and potential issues are discussed by 3 companies. One company propose to add a note in TS and also possible LS to RAN2. Two companies think the issue is the same with legacy NR device. Furthermore, one company also propose options to solve this. Moderator view is firstly to confirm whether this is the same issue for legacy eMBB NR UE and then different options for solutions could be discussed. However, as this is related to legacy BS/UE behavior if this is the same issue for legacy UE, care should be taken when discussing the solution so backward compatibility should be maintained.

*Open issues and candidate options before e-meeting*

**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

**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
  + TBA

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

**Example 1**

Issue 1-1 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 1-1** |
| Ericsson | Option 1, Agree with WF |
| Skyworks | Support option 1: but PC2 based on operators request should apply for both issue 1.1.2 and 1.1.3. We are fine with only specifying based on operators requests but HD-FDD PC2 is a solution worth considering by operators for FDD bands since for now PC2 is only applicable to TDD bands. |
| Sony | Option 1 as already agreed in previous meeting |
| ZTE | Option 1, Agree with WF |
| Xiaomi | Option 1 |
| Qualcomm | Option 1 for 1TX and PC3 as baseline. PC2 based on operator request for existing TDD bands that support PC2 for regular UE.  Not sure enough time is there to consider HD-FDD PC2 operation for RedCap in release 17. As discussed in thread [119] PC2 FDD, RAN1/RAN2 needs to be notified and signaling changes could be required. Perhaps the WID needs to be updated to reflect the need for PC2 for FDD bands. |
| OPPO | Option 1 is ok. |
| Huawei | Option 1 is OK. |
| Apple | Option 1 |
| vivo | Option 1 |

Issue 1-2 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 1-2** |
| Skyworks | As clarified above, for now PC2 is only valid for TDD bands, but in the context of an HD-FDD UE PC2 is a potential solution for operators. |
| Sony | It is a good idea but there is very short of time in Rel-17 and further analysis is needed. Could it be postponed to Rel-18? |
| ZTE | The discussion on HD-FDD PC2 FDDare underway, there are no agreements so far. So it is better to postponed to future release. |
| Xiaomi | It is too late to research this method in this release. |
| Qualcomm | Not sure enough time is there to consider HD-FDD PC2 operation for RedCap in release 17. As discussed in thread [119] PC2 FDD, RAN1/RAN2 needs to be notified and signaling changes could be required. Perhaps the WID needs to be updated to reflect the need for PC2 for FDD bands. |
| OPPO | As commented by ZTE, HD-FDD is still under discussion in FDD HPUE topic, should wait for the completion there. |
| Huawei | We can wait for the outcome of the eMBB UE regarding to PC2 HD-FDD. |
| Apple | Option 1 |
| vivo | PC2 HD-FDD can be further discussed in Rel-18. |

Issue 1-3-1 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 1-3-1** |
| Ericsson | Option 1. We think it is the same issue with legacy eMBB UE in FDD band. |
| Sony | Option 1 |
| ZTE | Option 1 |
| Xiaomi | Option2, to help understanding, just consider the situation where UL BWP switch, DL BWP don’t change. The legacy UE can open BW larger for both UL and DL at the same time to include the target BWP when the configured the target BWP located out of the current UL BW, so it can keep the Tx-Rx distance. but Recap UE only support Max 20 MHz BW in FR1, when the configured the target BWP located out of the current UL, the UE switching BWP in UL equal to switch BW in UL, the DL BW don’t change, it seems the Tx-Rx distance has been changed in the process. |
| Qualcomm | Option 1 |
| OPPO | Need more clarification on the issue itself, what kind of problem could cause with this TX-RX distance for UL/DL BWP configuration in FDD band. Does it mean the frequency distance between configured BWP in UL and DL if larger than the Tx-Rx separation requirement defined for FDD bands in section 5.4.4 of 38.101-1 then there will be problem for UE? May need more information of what kind of issue could happen. |
| Huawei | Option 1 |
| MediaTek | Option 2. The proposal for Option 1 is ambiguous. The legacy eMBB UE supports a channel bandwidth that is larger than 20MHz. So it is unclear to us what “same as legacy eMBB UE” is supposed to mean for a RedCap UE only able to operate a 20MHz channel bandwidth. We would expect that the UL/DL ARFCNs for that 20MHz UL and DL channel bandwidth to fulfil the default Tx-Rx spacing. |
| Apple | Clarification on TX-RX distance is needed. Is it the duplex distance between the UL/DL channel BW or the duplex distance between UL/DL BWP? Also is the channel BW always defined as the gNB channel BW? |
|  |  |

Issue 1-3-2 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 1-3-2** |
| Ericsson | Option 3. We think this issue should be treated together with legacy eMBB device. |
| Skyworks | for channels ≤20MHz, default Tx/Rx separation should be met for the ARCFNs is the baseline for All REFSENS and BWPs are not considered and if configured our understanding is that they stay within the previous channel positions. We do not understand option 2B: REFSENS is defined with a specific UL allocation and assumes the full channel is configured (otherwise what happens if the UL BWP does not cover the UL configuration or if the DL BWP do not fall on a particular UL interference?). In our view REFSENS is only applicable to full channel support and default Tx-Rx separation. |
| Sony | Option 3 |
| ZTE | Option 3 |
| Qualcomm | Option 3.  Even if there is a BWP configuration in RedCap that exceeds the max range of TX-RX separation defined in 5.4.4 (if I’m understanding the concern here correctly from MediaTek), the requirements are only met at the nominal duplex offset spacing. It does not hurt to get clarification that the issue is no different than legacy UE |
| OPPO | Ok with Option 3 and also the 1st part of Option 1 as below:  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. |
| Huawei | Both option 2 and option 3 are OK. |
| MediaTek | First part of Option 1 is preferred.  This “legacy UE” text in Option 3 is ambiguous. I understand that Ericsson and Huawei believe that it means the Tx-Rx separation of the ARFCN according to the carrier BW provided by the Base Station. In the RedCap UE case the bandwidth of the UE will be restricted to 20MHz, so it should be the Tx-Rx separation of a UE operating a 20MHz channel bandwidth, not the full carrier BW of the spectrum block. |
| Apple | If gNB channel BW is wider than 20 MHz, there is no guarantee the RedCap UE UL/DL duplex spacing would be the same as nominal FDD band duplex distance. Some clarification may be needed. |
| vivo | Option 3 is OK |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **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* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

# Topic #2: RedCap UE operating bands in FR1

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2205601**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205601.zip) | Qualcomm Incorporated | List bands explicity in the Table 5.2I-1 as per the last RAN#93 Pleanry agreement |
| **[R4-2204765](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204765.zip)** | ZTE Corporation | **Obversation: From RAN4 aspect, all the issues have been resloved for band n79 introducing new channel bandwidths**  **Proposal 2. From RAN4 aspect, band n79 can be supported for RedCap UE in Rel-17.** |
| **[R4-2205544](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205544.zip)** | Ericsson | Proposal-2:Discuss the below wording to accommodate the RAN WF RP-212634.zip..  For a terminal that is a RedCap UE, the requirements (general + suffix I) apply to operation in a single band at a time. |
| [**R4-2205539**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205539.zip) | Ericsson | introduce new operating band chapter for RedCap; |
| **[R4-2205278](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip)** | Huawei, HiSilicon, Deutsche Telekom, CMCC, CBN, Vivo | To introduce requirements for RedCap UE |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1

*Sub-topic description:*

The LS to solve the n79 is sent from RAN4 to RAN1 last meeting and RAN1 will discuss it in this meeting, if RAN1 could reach consensus during this meeting, RAN4 can specify n79 for RedCap UE in FR1.

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

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

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

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

*Sub-topic description:*

Though all companies propose to add the operating band list for RedCap in FR1, there are discrepancies how to handle the SUL band, V2X band and shared spectrum bands. This results from different understandings for RAN WF and this has been discussed for several meetings. This issue if not solved will block the finalization of the Rel-17 RedCap WI. The tricky thing for these bands is that currently specification allows the simultaneous multiple bands operation for SUL and V2X, while in RedCap WI, it is single band operation at a time is in the WI objective. Such confliction cannot be solved in RAN4 in last meeting and will not solved by RAN4 because RAN WF say no time spend on it. For band support on one feature, RAN4 always uses release-independent way if the is no RAN1 specification change or NBC issue. Moderator think that companies could give opinion whether to discuss these band (SUL, V2X , unlicensed ) in Rel-18 eRedcap WI and make these band as release independent if it is feasible (e.g there is no RAN1 specification impact or other NBC issue).

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

* Proposals
* Option 1: In objective of the Rel-18 RedCap WI, specify SUL band, n46, n96 and n47 support in release independent manner if it is feasible.
* Option 2: TBA
* Recommended WF
  + TBA

*Sub-topic description:*

**Companies’ views are to be collected and also please comment the CR at 2.3.2.**

**Issue 2-1-3: SUL band, n46, n96 and n47**

* Proposals
  + Option 1: In RedCap operating band list [Huawei, Deutsche Telekom, CMCC, Vivo, CBN]
  + Option 2: Not in RedCap operating band list [Ericsson, Qualcomm Incorporated ]
  + Option 3: TBA
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 2-1:  Sub topic 2-2:  ….  Others: |

Issue 2-1-1 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 2-1-1** |
| Ericsson | Option 1. RAN1 will discuss the LS in this meeting. Better to wait Ls response before adding n79. |
| Skyworks | Although we support having n79 included, we do not see harm in waiting RAN1 answer until round2 |
| ZTE | From RAN4 perspective, the issues for n79 supporting smaller channel bandwidth have already solved. Also we are fine to wait for RAN1’s answer until round 2. |
| Qualcomm | Option 1 or 2: It is not a question of if n79 can be supported. One of the alternatives given to RAN1 will be selected from RAN4 outgoing LS last meeting. Perhaps the band can be placed in [square brackets] in section 5.2I. |
| OPPO | Tend to agree with Option 2. This is not special for Redcap UE and should not be an issue prevent from Redcap UE supporting this since there will be a long time before UE can support Rel-17 features. |
| CMCC | Option 2. It was already for sure n79 will support smaller bandwidth. |
| Huawei | Option 2. |
| MediaTek | We hope the issue will be solved so Option 1 or 2 is fine. |
| CBN | Option 2. |
| vivo | Option 1 or 2 both OK. Option 2 is slightly preferred. |
|  |  |

Issue 2-1-2 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 2-1-2** |
| Ericsson | To proponent of the SUL band and combination, n47, n46 and n96: RAN4 can always add bands in a release independent way if there is no NBC and RAN1 spec impact, so please share your opinion if you are fine to add these bands in Rel-18 work in a release independent way from Rel-17.  The issue is discussed several meetings and if there is no compromise, the rel-17 work item will not be finalized. Even to extend the work item to another quarter, the situation will not change. As rapporteur of the RedCap WI, I do not see any point to further extend the WI if this is the only issue. |
| Skyworks | Given our understanding of the RAN discussion, we believe it is better to postpone introduction of unlicensed and SUL bands to R18 |
| Qualcomm | Option 1 is preferable. Requirements for SUL and unlicensed bands cannot be completed in release 17 based on RAN plenary agreement. |
| OPPO | Tend to agree with specify in Rel-17 rather than Rel-18. But it should be clear of the requirements for these bands if supported in Rel-17. |
| CMCC | To us, the foundamental question is that why we need a new table for RedCap bands. We prefer to reuse existing band table so that we don’t need to discuss whether to exclude any bands. Following RAN plenary guidance, no specification work for SUL, unlicensed and V2X, but we should also not prevent any implementaion. |
| Huawei | Based on the RAN plenary’s WF RP-212634, SUL feature is allowed to be implemented in Rel-17 for RedCap UE. I don’t understand how we can violate the RAN plenary’s agreement and postpone it to Rel-18.  RedCap UE supporting SUL feature has no impact on RAN4’s spec. I don’t understand why companies want to specify something to restrict the SUL implementation. |
| MediaTek | Some fundamental points are that there was no consensus to add these bands at RAN plenary, there was agreement to not do any specification work on them in rel-17, and agreement to spend no time on them in Rel-17 timeframe. Agreeing to add requirements (implicitly or explicitly) under such conditions does not seem appropriate to us. These requirements could be considered in a later Release, but difficult to commit at this stage on Release-independence without the evaluation of impact being performed. |
| CBN | We don’t support option 1. |
| vivo | We also prefer to finalize this work in Rel-17. |

Issue 2-1-3 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 2-1-3** |
| Ericsson | Companies are encouraged to provide options which may be compromised from both sides. Already in 1st round, such updated CR with any proposal could be initiated so companies can have early feedback on it. |
| Skyworks | Given our position on 2-1-2 we believe these bands should not be added in R17. |
| Sony | Option 2 |
| Qualcomm | Option 2 |
| OPPO | Option 1. For clarification, what prevents UE from supporting these features in Rel-17? |
| CMCC | Have we agreed to have a dedicated RedCap band table? Same comments as last issue, we prefer to reuse existing band table for RedCap. |
| Huawei | Option 1.  One compromise is that we don’t specify the operating band clause since it is too controversial to reach an agreement. And we can’t specify a band list without SUL bands to restrict the implementation of SUL feature for RedCap UE. |
| MediaTek | Option 2, Implicitly including requirements in a spec on the basis that it has been agreed not to discuss them would seem to set a very dangerous precedent. |
| CBN | Option 1. |
| vivo | Option 1 |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

*Moderator comments on CR splitting:*

We have CRs in FR1 and three companies have submitted CRs. Moderator suggest to three companies focus on three different part of CR work:

|  |  |  |
| --- | --- | --- |
| Huawei | Clause 3.3, clause 4.3, clause 5.3I, clause 6.2.1I | General and TX part without clause 5.2I |
| Ericsson | Clause 3.2, 7.1I, 7.2, clause 7.3I | RX part for FR1 |
| Qualcomm | Clause 5.2I | Operating band list for RedCap |

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2205278**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip) | ***Moderator****: this CR, please comment only TX and general part, the RX part can be commented in topic #3 where REFSENS is discussed.* |
| T-Mobile USA: We think it should be clear in R4-2205278 in 5.3I that only the specified channel bandwidths up to the maximum shall be supported. Proposal in yellow:  5.3I Channel bandwidth for RedCap  The requirements in this specification apply to the combination of channel bandwidths, SCS and operating bands shown in Table 5.3.5-1 with maximum channel bandwidth of 20MHz. The transmission bandwidth configuration in Table 5.3.2-1 shall be supported for each of the specified channel bandwidths up to 20 MHz. The channel bandwidths are specified for both the TX and RX path.  We will place a revision of R4-2205278 in the round 1 folder.  Huawei: We have highlighted the maximum channel bandwidth is 20MHz. But I’m OK with T-mobile’s suggestion. |
| Apple: For 2Rx HD-FDD REFSENS requirements, our preference is to explicitly tabulate the REFSENS power level instead of using formula. With that the ΔRIB,HD does not need to be explicitly specified. Also for HD-FDD REFSENS, the UL configuration should be with full allocation, otherwise, the following statement would not completely apply for HD-FDD REFSENS requirements.  “The reference receive sensitivity (REFSENS) requirement specified for RedCap UE shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2-3.” |
|  | Qualcomm: For REFSENS, it is preferred to explicitly list the values. For operating bands, RP-210918 states that the WI focuses on SA mode and single connectivity with operation in a single band at a time. We prefer to list the operating bands per R4-2205601. There seems to be a disagreement in the interpretation of RP-212634. |
| [**R4-2205601**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205601.zip) | Company A |
| Company B |
| Huawei: I can’t agree with this CR. 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. |
|  | Qualcomm: |
| [**R4-2205539**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205539.zip) | Huawei: I can’t agree with this CR. In clause 5.2I and 6.2.1I, we can’t agree to specify a band list without SUL bands to restrict the implementation of SUL feature for RedCap UE. In clause 4.2, if we want to make progress on this WI, it’s better to remove this clause since this issue is too controversial. |
| Apple: n79 is listed in operation band table, but is missing in UE power class table. |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **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 1-2-3** | *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.* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

*Moderator comments on CR splitting:*

We have CRs in FR1 and three companies have submitted CRs. Moderator suggest to three companies focus on three different part of CR work:

|  |  |  |
| --- | --- | --- |
| Huawei | Clause 3.3, clause 4.3, clause 5.3I, clause 6.2.1I | General and TX part without clause 5.2I |
| Ericsson | Clause 3.2, 7.1I, 7.2, clause 7.3I | RX part for FR1 |
| Qualcomm | Clause 5.2I | Operating band list for RedCap |

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| **[R4-2205278](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip)** | *To be Revised, according to 1st round comment and Moderator CR work splitting* |
| **[R4-2205601](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205601.zip)** | *To be Revised, according to moderator CR work splitting* |
| **[R4-2205539](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205539.zip)** | *No pursued, according to moderator CR work splitting* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

|  |  |
| --- | --- |
| **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. |

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

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2203692**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203692.zip) | Apple | ***Proposal 1****: The HD-FDD 5MHz REFSENS tightening from FD-FDD is proposed as in the table below.*   |  |  |  | | --- | --- | --- | | FD-FDD 5MHz REFSENS | HD-FDD REFSENS Tightening | Bands | | ≤ -100 dBm | 0 dB | n1, n18, n24, n70 | | > -100 dBm and ≤ -99 dBm | 0.5 dB | n30, n65, n66, n74 | | > -99 dBm | 0.8 dB | n2, n3, n5, n7, n8, n12, n13, n14, n20, n25, n26, n28, n71, n85 |   ***Proposal 2****: 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.*  ***Proposal 3****: For bands n91, n92, n93, and n94, no REFSENS tightening is needed from FD-HDD to HD-FDD.*  ***Proposal 4****: UL configuration for HD-FDD REFSENS requirements is specified with full allocation.*  ***Proposal 5****: RedCap UE 2Rx HD-FDD REFSENS power levels are explicitly tabulated in the specifications.* |
| [**R4-2203865**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203865.zip) | Mediatek India Technology Pvt. | ***Observation 1****: The 5MHz REFSENS <=-100dBm (n1, n18, n24, n70) could be further improved by 0.2dB.*  ***Proposal 1****: The HD-FDD 5MHz REFSENS tightening from FD-FDD is proposed as in the table below.*   |  |  |  | | --- | --- | --- | | FD-FDD 5MHz REFSENS | HD-FDD REFSENS Tightening | Bands | | ≤ -100 dBm | 0.2 dB | n1, n18, n24, n70 | | > -100 dBm and ≤ -99 dBm | 0.5 dB | n30, n65, n66, n74 | | > -99 dBm | 0.8 dB | n2, n3, n5, n7, n8, n12, n13, n14, n20, n25, n26, n28, n71, n85 |   ***Proposal 2****: The tightening value of the HD-FDD 5MHz REFSENS of n91, n92, n93, and n94 is 0.2dB.* |
| [**R4-2204766**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204766.zip) | ZTE Corporation | ***Observation 1: The bands are listed in the framework for HD-FDD RedCap REFSEN***  ***Proposal 1: In future, new bands support RedCap UE should be added and checked one by one.***  **UL configuration:**  ***Observation 2: For HD-FDD mode, whether partial or full RB allocation will not impact on the REFSEN requirements.***  ***Proposal 2. For simplification of the specification, approve the above tentative agreements, i.e. option 2.***  **Dual mode RedCap UE support (HD-FDD and FD-FDD):**  ***Proposal 3. Approve the above tentative agreements, i.e. option 2.*** |
| [**R4-2205276**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205276.zip) | Huawei, HiSilicon | **Proposal 1: The ΔRIB,HD exceptions for band n91, n92, n94 and n94 can be zero based on the same principle for band n1, n18, n24 and n70.**  **Proposal 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****.** |
| **[R4-2205544](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205544.zip)** | Ericsson | 1. Discuss further what capability RedCap UE report operating in n91, n92, n93 and n94 before deciding on the HD-FDD REFSENS. |
|  |  |  |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

Based on previous WF of scaling factor for REFSENS, companies providing further views on the exception of scaling factor for some bands for HD-FDD mode.

### Sub-topic 3-1

*Sub-topic description:*

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

**Issue 3-1-1: HD-FDD REFSESN**

* Proposals
* Option 1a: per band exception and selected band for different scaling factor as below: [Apple]
* *The HD-FDD 5MHz REFSENS tightening from FD-FDD is proposed as in the table below.*

|  |  |  |
| --- | --- | --- |
| FD-FDD 5MHz REFSENS | HD-FDD REFSENS Tightening | Bands |
| ≤ -100 dBm | 0 dB | n1, n18, n24, n70 |
| > -100 dBm and ≤ -99 dBm | 0.5 dB | n30, n65, n66, n74 |
| > -99 dBm | 0.8 dB | n2, n3, n5, n7, n8, n12, n13, n14, n20, n25, n26, n28, n71, n85 |

* *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 1b: per band exception and selected band for different scaling factor as below: [Huawei]
  + Proposal 1: The ΔRIB,HD exceptions for band n91, n92, n94 and n94 can be zero based on the same principle for band n1, n18, n24 and n70.
  + Proposal 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.
* Option 2: [MediaTek]
  + *The HD-FDD 5MHz REFSENS tightening from FD-FDD is proposed as in the table below.*

|  |  |  |
| --- | --- | --- |
| FD-FDD 5MHz REFSENS | HD-FDD REFSENS Tightening | Bands |
| ≤ -100 dBm | 0.2 dB | n1, n18, n24, n70 |
| > -100 dBm and ≤ -99 dBm | 0.5 dB | n30, n65, n66, n74 |
| > -99 dBm | 0.8 dB | n2, n3, n5, n7, n8, n12, n13, n14, n20, n25, n26, n28, n71, n85 |

* + *The tightening value of the HD-FDD 5MHz REFSENS of n91, n92, n93, and n94 is 0.2dB.*
* Option 3: [Ericsson]
  + Discuss further what capability RedCap UE report operating in n91, n92, n93 and n94 before deciding on the HD-FDD REFSENS.
    - No need to specify HD-FDD REFSENS for these bands if RedCap UE does not report HD-FDD capability
* Recommended WF
  + TBA

*Moderator: This has been discussed several meeting, maybe we can follow the previous WF? It does not matter how UL config would be specified as it does not have impact on HD-FDD REFSESNS.*

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

* Proposals
  + Option 1: UL configuration for HD-FDD REFSENS requirements is specified with full allocation [Apple]
  + Option 2: uplink configuration for reference sensitivity of 1Rx in FD-FDD mode, 1Rx and 2Rx in HD-FDD mode could reuse the uplink configuration for reference sensitivity of 2Rx in FD-FDD mode with the channel bandwidth of 5MHz, 10MHz, 15MHz, and 20MHz.[Previous WF]
* Recommended WF
  + Option 2

*Moderator: This has been discussed several meeting, maybe we can follow the previous WF?*

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

* Proposals
  + Option 1: No considered in Rel-17.
  + Option 2: Deprioritize dual mode RedCap device in Rel-17.[Previous WF]
* Recommended WF
  + Option 2

*Moderator: Maybe it is different flavor of specification style for the HD-FDD REFSENS, as long as the REFSENS is captured correctly. Previous WF agree to use the apple’s formular for the HD-FDD REFSENS, but it does not say if it is a value format or formular format. Companies can share opinion on this.*

**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
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

Issue 3-1-1 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 3-1-1** |
| Ericsson | We are fine with Option 2.  To Huawei: for the band n91, n92, n93, n94, what capability signaling will UE report to network? HD-FDD or it is the dual mode device if there is no RF transceiver change to support HD-FDD? |
| Sony | Option 1a as agreed in last meeting. It should also be emphasized that RAN4 follows the agreement to include the additional note (“*HD-FDD REFSENS for channel BW wider than 5 MHz can be …”).* In our understanding this note is applicable to both 2RX HD-FDD and 1RX HD-FDD. Option 2 also acceptable (if the above mentioned note is included). |
| ZTE | Option 1a/2 are the agreed framework in last meeting.  For option 1a: we think *REFSENS(5MHz) + 10log10(n x NRB/25)* may not correct for larger than 5MHz CBW. NRB should be the maximum transmission bandwidth configuration for the specfic SCS.  For option 2, where is 0.2dB from? |
| Xiaomi | Support Option 2 |
| Qualcomm | Framework and band tightening was already agreed last meeting.  Option 1a and n91, n91, n93, n94 can be added to 0dB tightening row as stated in Option 1b. |
| OPPO | Option 1a and Option 2. |
| Huawei | We are fine with both option 1a and option 2, but the ΔRIB,HD exceptions for band n91, n92, n94 and n94 can follow the same value for band n1, n18, n24 and n70.  To Ericsson, It’s not dual mode device. For capability, it can follow other FDD bands. |
| Apple | Option 1a and Proposal 1 in Option 1b |
| vivo | Option 1a is OK. |
| MediaTek | Option 2 preferred. |

Issue 3-1-2 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 3-1-2** |
| Ericsson | Option 2. |
| Skyworks | We do not see why we should limit the UL configuration for HD-FDD and thus we support option 1 which can be easily implemented in the specification by saying that fully allocated UL configuration applies in HD-FDD without having to add any UL configuration table. |
| Sony | Option 2 (but are OK with Option1 as well) |
| ZTE | Either option 1 and option 2 are ok. For simplification of the specfication, option 2 is slightly prefered. |
| Xiaomi | Support Option 2 |
| Qualcomm | Option 2. Full UL configuration makes no difference for REFSENS. But, the same UL configuration as legacy FDD bands may be better to help better meet any potential UE-UE coexistence issues for other RedCap and non-RedCap UEs in proximity. |
| OPPO | Option 2. |
| Huawei | Option 2 is preferred. |
| Apple | Option 1  The requirement should be based on technical merit, not the ease or simplification of the specifications. If the intention is to simplify the specifications and use a text to reference the HD-FDD REFSENS UL configurations to non-RedCap UE REFSENS UL configurations in Clause 7.3.2, then the following context in Clause 7.3.2 would not be technically correct for HD-FDD REFSENS as UL transmission bandwidth wider than those specified in Table 7.3.2-3 is also applicable for HD-FDD REFSENS.  The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.2-1 and Table 7.3.2-2 shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2-3.  That is also the reason why we propose to explicitly specify the 2Rx HD-FDD REFSENS requirements, including the power levels and the UL configurations. |
| vivo | Option 2 is OK |

Issue 3-1-3 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 3-1-3** |
| Ericsson | Option 2. |
| Sony | Option 2 as previous WF (but don’t really see the difference). |
| ZTE | Option 2 as previous WF (but don’t really see the difference). |
| Xiaomi | Option 2 |
| Qualcomm | LS should be sent to RAN1 for this consideration. |
| OPPO | Option 2. |
| Huawei | Option 2 |
| vivo | Option 2 |

Issue 3-1-4 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 3-1-4** |
| Ericsson | Option 3. We think option 1 &3 are the same, the difference is format in REFSESN in CR. Value or formular; formular is easier to understand or flexible when scaling factor change for added new band in future. |
| Skyworks | It seems better to have an explicit REFSENS table since the delta is meant for 5MHz but for HD FDD, the cases where UL noise degrades REFSENS for larger BW should not apply thus 5MHz REFSENS value with NRB scaling is sufficient |
| Sony | Option 1. We think this is a much clearer way. Note that a similar table for 1Rx HD-FDD need to be derived. According to our understanding the agreement “*HD-FDD REFSENS for channel BW wider than 5 MHz can be …”* also applies to 1RX HD-FDD, consequently, scaling factor 2RX HD-FDD to 1RX HD-FDD is 2.5dB for all BW. (The ΔR1R = 3dB scaling factor for BW>5MHz applies to **FD-FDD only**, due to simultaneously RX and TX). |
| ZTE | Although we think it is simpler to use fomular, the framework agreed in the last meeting should be respected. So option 3 is prefered. |
| Xiaomi | *Using the formula of REFSENS(5MHz) + 10log10(n x NRB/25) is not very correct, the NRB for different SCSs is not n times, i.e., for 15kHz SCS, NRB for 5MHz is 25, for 30kHz SCS, NRB for 5MHz is 11, but 25/2=12.5.*  *Still prefer to define the tighten value for RedCap UE 2Rx HD-FDD REFSENS based on 2Rx FD-FDD REFSENs* |
| Qualcomm | Option 1. Be explicit as this is the format of the specification where the formula is applied to TDD bands with many BWs. |
| Huawei | Option 2. HD-FDD is just like TDD bands. Formulas can be used, |
| Apple | Option 1  We were the originator to propose using equation-based formula for TDD bands simply for the reason that the existing specifications cannot accommodate the table width with the increasing number of UE channel BWs. However, our preference is still to keep the explicit power level for better visualization on the requirements. For RedCap UE, there are only 4 channel BWs. The table side should not be an issue to explicitly specify the power levels.  To Xiaomi, we are not sure why the formula is not correct. For 5MHz with 30kHz, the REFSENS would be scaled by *10log10(2 x 11/25)* from 15kHz SCS as 30kHz has less spectrum utilization. Is there anything wrong here? By the way, 30kHz SCS for 5MHz has never been specified for any band. |
| MediaTek | Explicit table entries preferred, or it gets very confusing. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2205540**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205540.zip) | Skyworks: rather than complicated tables and equations, Why not integrate DR1R and DRHD-FDD directly in the 5MHz number? Or point to the 5MHz value in FD-FDD table + delta and scaling generic to all bands? |
| Sony: We think HD-FDD REFSENS power levels shall be explicitly tabulated in the specifications (1Rx and 2Rx). We also think ΔR1R = 2.5dB applies for all BW for HD-FDD 1Rx and 2Rx. |
| ZTE: the fomular in 2Rx HD-FDD table may not ture |
| Xiaomi: the formula *of REFSENS(5MHz) + 10log10(n x NRB/25) is not very correct*,  still prefer to define the REFSENs for HD-FDD as below:  For RedCap UE supporting HD-FDD in FDD operating bands with two Rx antenna connectors, reference sensitivity for 2 Rx antenna ports in Table 7.3.2-1a and Table 7.3.2-1b shall be modefined by the amount given in ΔRIB,HD.  For RedCap UE supporting HD-FDD in FDD operating bands with one Rx antenna connectors, reference sensitivity for 2 Rx antenna ports in Table 7.3.2-1a and Table 7.3.2-1b shall bemodefined by the amount given in ΔRIB,1R and ΔRIB,HD.  Huawei: This sentence can be removed. “Operating in single band in the bands specified in clause 5.2I”. Clause 7.1I can be removed since we have no agreement on clause 5.2I. The sentence related to clause 5.2I should be removed.  n91/n92/n93/n94 are missing in Table 7.3I.2-2, Table 7.3I.2-3 and Table 7.3I.2-4. It should follow the same value for n1, n18, n24, n66. |
| Apple: we propose to explicitly specify the 2Rx HD-FDD REFSENS requirements.  Ericsson:  To Sony: either use formular or power value could be up to majority view, we are open to that. Agree also only use ΔR1R = 2.5dB for 1 RX, but seems for 2 RX, the **ΔRHD-FDD** could apply, we are open to discuss this further in 2nd round.  To ZTE: this is according to option 1a which is framework by APPLE, maybe an explanation from APPLE on derivation of the formular could be good, I myself interpret it this:  REFSENS for 10MHz channel of SCS 30kHz: REFSENS( 5MHz of SCS 15kHz) + *10log10(NRB-10MHz\_15kHz/NRB-5MHz-15kHz) +10log10(NRB-10MHz\_30kHz/NRB-10MHz-15kHz) =* REFSENS( 5MHz of SCS 15kHz) +*10log10(NRB-10MHz\_30kHz/NRB-5MHz-15kHz)*  To Xiaomi: For formular, maybe APPLE could provide offline explanation.  To Huawei: operating band could be discussed separately. n91/n92/n93/n94 will be added in 2nd round.  To apple: open to discuss use power level for table. |
| [**R4-2205278**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip) | ***Moderator****: this CR, please comment only RX part* |
| Skyworks: if equation only are used then the best is to have tables for the Deltas and point to the FD-FDD REFSENS value at 5MHz? |
| Sony: We think HD-FDD REFSENS power levels shall be explicitly tabulated in the specifications (1Rx and 2Rx). We also think ΔR1R = 2.5dB applies for all BW for HD-FDD 1Rx and 2Rx.  ZTE: It seems Rx part was not based on the agreed framework.  Huawei: To Skyworks, I’m OK to have a table for HD-FDD mode.  To Sony, it seems not RAN4’s agreement.  To ZTE: It’s based on what we have agreed. |
| Xiaomi: still prefer to define the REFSENs for HD-FDD as below:  For RedCap UE supporting HD-FDD in FDD operating bands with two Rx antenna connectors, reference sensitivity for 2 Rx antenna ports in Table 7.3.2-1a and Table 7.3.2-1b shall be modefined by the amount given in ΔRIB,HD.  For RedCap UE supporting HD-FDD in FDD operating bands with one Rx antenna connectors, reference sensitivity for 2 Rx antenna ports in Table 7.3.2-1a and Table 7.3.2-1b shall bemodefined by the amount given in ΔRIB,1R and ΔRIB,HD. |
| Qualcomm: Explicit Table entries are preferred. |
| Apple: Same comment as in section 2.3.2 for R4-2205278 |
| MediaTek: Explicit table entries preferred. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **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.* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| **[R4-2205540](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205540.zip)** | *To be revised, according to moderator CR work split* |
| **[R4-2205278](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip)** | *Same decision in 2.4.2* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| Revised **[R4-2205540](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205540.zip)** | 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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# Topic #4: FR2 aspects

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2204040**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204040.zip) | Sony | **Observation 1 It needs to be checked whether table 6.2.1.0-1 should be updated with more device types.**  **Observation 2 About 1 dB less antenna (element) efficiency could be expected in a smart watch formfactor compared to a smart phone form factor but could be compensated for in the implementation.**  **Observation 3 Other power classed (e.g., PC3) is not precluded for a wearable device, to be used in parallel with the new RedCap PC.**  **Observation 4 Spherical coverage @50%-tile gain drop for a RedCap wearable device could be expected to be in the order of 8 – 10dB for the single array case.**  **Observation 5 For an industrial sensor only, it may be sufficient to specify spherical coverage at 60%tile or 75**%tile point.  **Proposal 1 Define one new power class for “general” RedCap in Rel-17, suited for industrial sensors and wearables.**  **Proposal 2 Peak EIRP for RedCap PC shall be 16.4 dBm for n257, n258, n261 and 14.6 dBm for n260.**  **Proposal 3 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.** |
| [**R4-2204041**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204041.zip) | Sony | **Observation 1 One new power class for “general” RedCap in Rel-17 is sufficient.**  **Observation 2 About 1 dB less antenna (element) efficiency could be expected in a smart watch or small industrial sensor formfactor compared to legacy PC3, however, handled without impact.**  **Observation 3 EIS spherical coverage gain drop can be re-used from PC3.**  **Proposal 1 The RedCap REFSENS requirement should be based on a 2-element array reference design.**  **Proposal 2 REFSENS for RedCap PC shall be -82.3 dBm for n257, n258, n261 and -79.7 dBm for n260 for 100MHz BW.**  **Proposal 3 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.** |
| [**R4-2204226**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204226.zip) | MediaTek Beijing Inc. | ***Observation1: Companies’ view on device type assumption of “wearable” are summarized, more comments on raised questions are shared.***  ***Observation2: Companies’ views are not so diverse.***  ***Proposal1: 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.***  ***Proposal3: Spherical coverage shall be FFS, both “which %-tile” and “what value”.*** |
| [**R4-2204767**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204767.zip) | ZTE Corporation | **Video surveillance**  ***Proposal 1:For video surveillance RedCap, except for the requirements of MBR and CA related, the other existing PC5 RF requirements of <=100MHz channel bandwidth can be reused.***  **Wearable UE and industry sensor**  ***Proposal 2: Two new power classes would be needed for the use cases of FR2 RedCap UE, i.e. Industry sensor and wearables.***  ***Proposal 3: +23dBm for max. TRP and +43dBm for max. EIRP are applied to all FR2 RedCap UE power classes.***  ***Proposal 4: No changes for the requirements of EVM, SEM, ACLR, Maximum Input level, ACS, blocking, Tx/Rx spurious emission for FR2 RedCap UE.***  ***Proposal 5: To reuse the existing PC3 MPR values(BWchannel*** ≤ ***200 MHz) for the power classes of RedCap UE.*** |
| [**R4-2204961**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204961.zip) | vivo | **Proposal 1: Adopt 11dB as the gain drop of spherical coverage @50%-tile for 28GHz bands.**  **Proposal 2: Adopt 13.3dB as the gain drop of spherical coverage @50%-tile for 39GHz bands.** |
| [**R4-2204962**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204962.zip) | vivo | **Proposal 1: For FR2 wearable Rx requirement, the same gain drop of Tx proposed in [1] should be adopted.** |
| [**R4-2205119**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205119.zip) | Xiaomi | **Observation1: the min EIRP spherical coverage for wearable use case Redcap UE reduced 6dB based on PC3 handheld UE will cause negative values for band n259 and n262.**  **Proposal 1: 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.**  **Proposal 2: the max TRP for wearable use case Redcap UE should keep 23dBm.** |
| [**R4-2205277**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205277.zip) | Huawei, HiSilicon | **Observation 1: FR2 RedCap UE based on PC3 and PC5 should be studied and discussed for 26~28GHz FR2 exemplary bands (n257/n258/n261) in this meeting.**  **Proposal 1: To specify delta values for Minimum EIRP/Minimum EIS/Spherical coverage requirements based on the PC3 and PC5 requirements when RAN4 specify the FR2 RedCap UE requirements.**  **Proposal 2:** **the same delta value 6 dB relaxer than FR2 PC3 can be used for EIS and Spherical coverage requirements of wearable use case.**  **Proposal 3: 5~6 dB relaxer than FR2 PC5 can be used for minimum EIRP, EIS and Spherical coverage requirements of industry sensor use case.** |
| [**R4-2205545**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205545.zip) | Ericsson | Proposal-1:The RedCap UE could have a mEIRP at least 16.4 dBm  Proposal-2:MBR in PC3 does not apply to RedCap UE.  Proposal-3:Reusing the gain drop from PC3 for Redcap UE.  Proposal-4:Side condition of beam correspondence should be updated with gain drop from spherical coverage requirement.  Proposal-5:Scaling of the 3 dB in PC3 REFSENS for RedCap UE for band n261, n257, n258.  Proposal-6:Reuse MPR, A-MPR, Beam correspondence from PC3 to RedCap UE. |
| [**R4-2206058**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2206058.zip) | Qualcomm Incorporated | **Observation 1: A single module low power UE is better suited to the RedCap mission.**  **Proposal 1: REFSENS is degraded 3 dB from PC3 for the low-power RedCap UE which has 6 dB lower min. peak EIRP compared to PC3.**  **Proposal 2: For the low-power RedCap UE, spherical gain drop from peak direction is specified along the 75th %ile direction as:**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Band** | **n257** | **n258** | **n259** | **n260** | **n261** | **n262** | | **Gain drop (dB)** | **8** | **8** | **9** | **9** | **8** | **10** |   **Proposal 3: Clause 6.3, 6.4 and 6.5 requirements for PC3 are applicable to RedCap low power UE.**  **Proposal 4: General requirements for Beam Correspondence (6.6.1) apply to all RedCap UEs.**  **Proposal 5: Requirement clauses 7.4, 7.5 and 7.6 are applicable to all RedCap UEs.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

*Moderator view: we had agreement last meeting on the power class as below, Moderator view is that the last meeting agreement should be kept as this is last meeting to finalize the Rel-17 work.*

* For power class for FWA device
  + Reuse the PC5 power class
* For power class for wearable UE and additional industry sensor use case
  + FFS whether to define the new power class for wearable UE and additional industry sensor separately, or define one power class for both

### Sub-topic 4-0 (power class for FR2 RedCap UE)

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

### Sub-topic 4-1 (PC5 for RedCap UE)

*Sub-topic description*

*Last meeting, PC5 is agreed to reuse for RedCap but how to reflect this is not decided and companies have some proposal relate to this.*

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

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

* Proposals
  + Option 1: It needs to be checked whether table 6.2.1.0-1 should be updated with more device types. [Sony]
  + Option 2: For video surveillance RedCap, except for the requirements of MBR and CA related, the other existing PC5 RF requirements of <=100MHz channel bandwidth can be reused. [ZTE]
  + Option 3: [Huawei]
    - To specify delta values for Minimum EIRP/Minimum EIS/Spherical coverage requirements based on the PC3 and PC5 requirements when RAN4 specify the FR2 RedCap UE requirements.
    - 5~6 dB relaxer than FR2 PC5 can be used for minimum EIRP, EIS and Spherical coverage requirements of industry sensor use case.
  + Option 4: TBA
* Recommended WF
  + TBA

### Sub-topic 4-2 (new power class for FR2 Redcap UE)

*Sub-topic description:*

It is agreed last meeting that new power class for both industry sensor and wearables or separately.

* For power class for wearable UE and additional industry sensor use case
  + FFS whether to define the new power class for wearable UE and additional industry sensor separately, or define one power class for both

Consider this is the last meeting and also what we have agreed on the new power class, moderator view is that to combine the industry sensor and wearables into one. From the companies submitted paper, this seems possible which not too much deviation on the key RF parameters.

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

**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. [Sony]
  + Option 2: Two new power classes would be needed for the use cases of FR2 RedCap UE, i.e. Industry sensor and wearables. [ZTE]
  + Option 3: 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:*

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

* Proposals:
  + Option 1: Other power classed (e.g., PC3) is not precluded for a wearable device, to be used in parallel with the new RedCap PC. [Sony]
  + Option 2: [MTK]
    - ***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.***
    - ***Proposal3: Spherical coverage shall be FFS, both “which %-tile” and “what value”.***
  + Option 3: TBA
* Recommended WF
  + TBA

### Sub-topic 4-3 (RF requirements for new power class Redcap UE)

*Sub-topic description:*

Here the companies view on the key RF parameters are collected and companies are encouraged to share opinion if they could compromise to reach consensus in 1st round. The final agreed values would be reflected in updated CR in 2nd round.

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

**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 view: companies view align well on min EIRP, we will focus on n257 n258 and n 261 as these are example bands proposed from operator.**

**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 view: the gain drop for PC3 is 10.9 dB and some companies are fine with reusing the PC3 gain drop. One company want to specify 75%-tile but also list the 50%-tile in paper with 1 or 2 dB more relaxation. If the new power class RedCap UE support both wearable and industry sensor, it would make sense to support 50%-tile. There are two companies not clearly mentioning the gain drop so it will be good if proponent of option 5 and option 6 further clarify their position on gain drop of the new power class RedCap UE. Moderator view is that to check if companies would be fine to comprise to reuse the gain drop for PC3 which is option 1.**

**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]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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)

**Moderator view: Option 1 and option 3 are the same. Moderator suggest to use 3 dB as scaling factor**

**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)

**Moderator view: This was discussed last meeting and most companies seems fine with reusing the same gain drop from spherical coverage. Companies are encouraged to share views to see if any compromise could be made for option 2.**

**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

**Moderator view: Option 2 is complementary for option 1 so company can provide view to see if option 1 and 2 is fine.**

**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.

**Moderator view: This is discussed in last meeting and seems option 1 should be agreable, companies could provide their views.**

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

* Proposals:
* Option 1: MBR in PC3 does not apply to RedCap UE. [Ericsson]
* Option 2: TBA
* Recommended WF
  + Opiton 1

**Moderator view: Seems companies quite align on the other RF requirement to reuse the same with PC3. Companies could provide view on this or directly comment the CR for the relevant part.**

**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
  + TBA

## Companies views’ collection for 1st round

### Open issues

Issue 4-0 comments:

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| --- | --- |
| **Company** | **Comments on 4-0** |
| Qualcomm | option 2 because it is more future proof in our view |
| MediaTek | 1. Option2, because it is the agreed WF. 2. To my understanding based on prior GTW clarification, “reuse” means the requirement values are the same w/o change, and RAN4 won’t define new power class for this reuse part. 3. About wearable UE and additional industry sensor handling, it depends on this meeting’s discussion. |
| Ericsson | Option 2. |
| Sony | Option 2: Keep previous WF Any change on min EIRP/TRP max EIRP/TRP and device type leads to a new power class, due to the release independent of power class definition. |
| ZTE | Option 2: Keep previous WF. We share similar view with Sony that any change on min EIRP/TRP max EIRP/TRP and device type leads to a new power class. |
| Xiaomi | One concern: whether keep previous WF means the power classes of Redcap UE just include PC5 and one new power class (PC3-delta), whether it still includes PC3 and (PC5-delta) need further clarify. |
| OPPO | Option 2. |
| Huawei | Option 1.  If we go option 2, we have to specify two new power class for wearable and industry sensor. |
| Apple | Option 2 |
| vivo | Option 2 |

Issue 4-1 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-1** |
| Qualcomm | Option 1 and option 2 |
| MediaTek | **About Option1:** We don't have strong view because it’s anyway just UE type assumption. There is no real limitation on exact UE type.  **About Option2:** While we double-check the WID "*This WI focuses on SA mode and single connectivity with operation in a single band* ***at a time****.*", it seems that a RedCap UE supports multi-band is still **possible**. If our understanding is correct, we think MBR shall also be reused.  **About Option3:** We prefer the framework in prior WF. Of course, the exact requirement value for potential new power class can be further discussed as below. |
| Ericsson | **Option 1 and 2. We donot think MBR is relevant for single band operation in rel-17.** |
| Sony | Option 1 and Option 2. Regarding Option 1: To our understanding Table 6.2.1.0-1 is “for information”, however, to clarify it should be updated with new device types or maybe better a note is added explaining that other device types are not precluded. Regarding Option 2: We agree with MediaTek MBR doesn’t harm if UE only has one band implemented. |
| ZTE | Option 1 and Option 2.  For the MBR, we are ok not to consider MBR for RedCap UE although we think MBR is not exactly indentical to CA. |
| Xiaomi | need first clarify the power classes for the Redcap UE  About Option2, I think a PC5 Redcap UE can still support multi-bands. |
| OPPO | Option 1 and 2 are ok. |
| Huawei | Option 3. This new power class is for industry sensor. |
|  |  |

Issue 4-2-1 comments:

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| --- | --- |
| **Company** | **Comments on 4-2-1** |
| Qualcomm | Option 1 is preferred. We are open to revising our view if proponents can elaborate use-case for another UE type that is different from PC5 RedCap and low-power (2x1 array) RedCap. |
| MediaTek | Share similar view with Qualcomm. If there is no need to have different requirement sets, concise power class options is preferred. |
| Ericsson | Option 1. Industry sensor and wearables both driven by battery. |
| Sony | Option 1. |
| ZTE | We are proponent of option 2 since we think any change on min EIRP/TRP max EIRP/TRP and device type leads to a new power class. We are also fine with option 1 if companies think Industry sensor and wearables can share the same requirements and be seens as similar UE type. |
| Xiaomi | The new power class is needed when the min peak EIRP and/or spherical coverage is changed if there is no other capability to distinguish the min peak EIRP of PC3-delta Redcap and normal PC3 UE. And if only introducing PC3-delta, one new power class is needed. If introducing PC3-delta and PC5-delta, two new power classes are needed. |
| OPPO | Option 1. No clear difference can be seen for industry sensor and wearable device from requirement point of view. |
| Huawei | Option 2. A UE capability for RedCap UE will be developed. |
| Apple | Option 2 is preferred  We are not sure if the same requirements will suit for both wearables and industrial sensors. |
| vivo | We also prefer Option 2. We can not confirm same requirements for these UE types currently. |

Issue 4-2-2 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-2-2** |
| MediaTek | Option1 & 2 are not preclusive.  About Option1: based on current framework, we think there is already no limitation. Just like we can have PC3 CPE for example.  About Option2: As the proponent, we just wanna clarify the “assumption” for requirement discussion, and no intention to limit the exact UE type as current framework. If we have no similar picture on exact type assumption, it would be difficult to discuss the %-tile, value etc solidly. |
| Sony | Option 1 (Fits some of the use cases). A note should be added as discussed in 4-1. Option 2 We think smart watch is a good approach for wearable use case. |
| Xiaomi | What are the other power classes in the Option1? Does it mean all PCs in FR2, i.e., PC/2/3/4/5 or just PC3? It need further clarify. |
| OPPO | Option 2. |
| Apple | Option 2 |
| vivo | Option 2 |

Issue 4-3-1 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-3-1** |
| Qualcomm | OK with moderator WF |
| MediaTek | We are generally okay for Option1, especially from watch view. To make it clearer, it should be RF architecture “**assumption**” for requirement discussion. |
| Ericsson | Option 1. |
| Sony | Option 1. Fits wearables and industrial sensors (some of the use cases). |
| ZTE | We believe this is for FR2 RedCap UE of wearables and industrial sensors. |
| Xiaomi | Option 1 |
| OPPO | Option 1. |
| Apple | Is this for wearables? |
| vivo | For wearable UE, Option 1 is OK. |

Issue 4-3-2 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-3-2** |
| Qualcomm | OK with moderator WF |
| MediaTek | I guess there is a typo “~~n260~~ -> n261”. |
| Ericsson | Ok with WF, thanks MTK, now corrected. |
| Sony | Option 1. |
| ZTE | Option 1. 6dB lower than PC3. |
| Xiaomi | Option 1 |
| Apple | FFS: The antenna gain may not be the same as handheld UE and needs to be re-evaluated. So the minimum peak EIRP may not directly scale with antenna element number. |
| vivo | Option 2, as mentioned in some contributions, some margin on top of 6dB should also be considered for wearable UE type. |

Issue 4-3-3 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-3-3** |
| MediaTek | Maybe we can also only focus on these example bands “n257, n258, and n261” (#28GHz group) currently. |
| Ericsson | Option 1. Yes, the band n257, n258 and n261 will be new power class FR2 Redcap bands. |
| Sony | Option 1. |
| Xiaomi | support Option 1, Option4 and Option 5, I think Option 1, Option4 and Option 5 have the same meanings. |
| Huawei | Option 4 |
| Apple | 75%tile instead of 50%tile for spherical coverage is preferred. The gain drop from peak direction needs to be evaluated. |
| vivo | Option 3 is preferred as proponent. But we are also OK to consider option 4 and option 5. |

Issue 4-3-4 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-3-4** |
| Qualcomm | OK with moderator WF |
| MediaTek | Maybe we can also only focus on these example bands “n257, n258, and n261” (#28GHz group) currently. |
| Ericsson | Ok with WF. |
| Sony | Option 1 or Option 3 (which is the same). |
| ZTE | A question: For Tx min.EIRP, it is 20log(2)=6dB lower than PC3, however, for REFSEN in option 1 and option 3, it seem 10log(2)=3dB lower than PC3. Why there is difference? |
| Xiaomi | Option 2 keep the same antenna gain drop due to reduce the antenna elements.  I’m not clear the gain drop due to reduce the antenna elements in UL is 6dB, when it is just 3dB scaling for REFSENs in Option 1 and Option 3. |
| Huawei | Option 2. EIS should be aligned with EIRP. |
| Apple | FFS: Similar to our comment in Issue 4-3-2 where the requirement may not directly scale with antenna element number. |
| vivo | We share same view with Apple. Further discuss requirement based on 6dB gain difference. |

Issue 4-3-5 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-3-5** |
| Qualcomm | OK with moderator WF |
| MediaTek | Same Tx/Rx gain drop is made sense. Maybe we can also only focus on these example bands “n257, n258, and n261” (#28GHz group) currently. |
| Ericsson | Ok with WF. |
| Sony | Option 1. (or Option 2 given that the right decision is taken ) |
| Xiaomi | support reuse the same gain drop with Tx. |
| Huawei | Share the similar view with Xiaomi. Option 4. EIS should be aligned with EIRP. |
| Apple | 75%tile instead of 50%tile for spherical coverage is preferred. The gain drop from peak direction needs to be evaluated. |
| vivo | Option 2 |

Issue 4-3-6 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-3-6** |
| Qualcomm | OK with moderator WF |
| Ericsson | Ok with WF. |
| Sony | Option 1 and Option 2. They are not in conflict. The side condition needs to be updated with the spherical coverage of redcap. |
| Xiaomi | agreed Sony, Option 1 and Option2 are not confliction, The side condition needs to be updated with the spherical coverage of redcap |
| Huawei | Option 3 no need to specify this requirement since we have agreed to relax EIRP, EIS and spherical coverage. |
| Apple | We are fine with moderator WF. |
| vivo | Support WF from moderator |

Issue 4-3-7 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-3-7** |
| Qualcomm | OK with moderator WF |
| MediaTek | While we double-check the WID "*This WI focuses on SA mode and single connectivity with operation in a single band* ***at a time****.*", it seems that a RedCap UE supports multi-band is still **possible**. If our understanding is correct, we think MBR shall also be reused. |
| Ericsson | OK with WF. |
| Sony | We think MediaTek has a point. Besides, if only one band is implemented MBR has no effect. |
| ZTE | OK with WF. |
| Xiaomi | Option 2, Redcap UE may can support multiple bands, MBR is still needed for Redcap UE. |
| Apple | FFS: The requirements need to be re-evaluated. |
| vivo | Option 2. Agree with MTK comments. Further discuss MBR for redcap UE |

Issue 4-3-8 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 4-3-8** |
| Qualcomm | The proposals seem to be consistent. Agree will all the options. |
| ZTE | Agree will all the options. |
| Xiaomi | support Option 1 and Option 3.  About Option2, what does the meaning of beam correspondence from PC3?  We are OK if it just include the general requirements for Beam Correspondence (6.6.1). Not support, if it also includes the side condition. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2205541**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205541.zip) | Company A |
| Company B |
| Qualcomm: Coordination may be required between rapporteurs of this WI and of FR2\_HST respectively. ([129], Samsung), both these WIs plan to define new FR2 power classes.  Sony: We understand that “PC6” is already reserved for HST (R4-2202273). To reduce risk of confusion, Table 6.2.1.0-1 should be updated with a note saying that other power classes are not precluded for RedCap in parallel.  ZTE: except the PC6 maybe occupied, it seems new PC for RedCap. But there were 3 use cases for FR2 RedCap, for the video surveillance, it was agreed to reuse PC5 (as FWA), so if use PC6 for RedCap UE type, then it seems it exclude video surveillance as one of the RedCap UE.  Xiaomi: prefer to add new suffix for Redcap, then define related PCs and requirements under the suffix. Since from the note 2 in table 5.3.5-1:  NOTE 2: For PC6 RedCap UE, the maximum channel bandwidth is 100MHz.  and table 6.2.1.0-1, we only get PC6 is for Redcap UE.  One question: whether all FR2 bands can be supported in Redcap UE.  Huawei: there is no need to specify the Beam correspondence requirements. I don’t think FR2 RedCap UE can have a good direction performance.  Apple: Is PC6 intended for wearable devices? The EIRP requirements are too early to be concluded.  Ericsson: To Qualcomm and Sony, if PC6 is reserved, then we need step up the number to PC7, fine with note on RedCap UE applicability.  To ZTE: would a note suitable for this purpose or we need mention it explicitly, could follow discussion 4-1.  To Xiaomi: The new power class itself make a clear distinction on RedCap UE type and seems the new suffix does not add value considering reuse PC5 RF also for RedCap UE. Only 257 .258 , 261 as example bands requested by operator.  To Huawei: maybe we can follow decision in 4-3-6. |
| [**R4-2205542**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205542.zip) | Company A |
| Company B |
| Sony: We understand that “PC6” is already reserved for HST (R4-2202273) otherwise good.  ZTE: same above.  Huawei: Reference sensitivity can be 6dB relax same as EIRP.  Apple: The EIS requirements are too early to be concluded.  Ericsson: To Huawei, when antenna size is reduced to half compared to PC3, the antenna gain reduced by 3dB. |
| [**R4-2205279**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205279.zip) | Qualcomm: Do not agree: There does not seem to be justification to apply relaxation to RedCap PC5 given that it uses the same front end as ‘regular’ PC5. |
| Sony: We prefer a dedicated power class for RedCap rather than defining ΔRCP and ΔRCS referring to existing power classes.  ZTE: Perfer new power class(es). |
| Xiaomi: prefer to add new suffix for Redcap, then define related PCs and requirements under the suffix. If just introduce Delta based on current PC3 or PC5, how can the network distinguish PC3 and PC3-Delta?  To Xiaomi: A specific capability for RedCap UE will be developed to distinguish RedCap UE and eMBB UE. |
| Apple: New power class is preferred to differentiate device types. The EIRP and EIS requirements are too early to be concluded. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **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.* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| **[R4-2205541](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205541.zip)** | *To be revised*  **Chairman: Would you please Please add Qualcomm Incorporated as co-sign in revised Tdoc** |
| **[R4-2205542](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205542.zip)** | *To be revised*  **Chairman: Would you please Please add Qualcomm Incorporated as co-sign in revised Tdoc** |
| **[R4-2205279](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205279.zip)** | **[not](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205279.zip) pursed** |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **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. |

# Topic #5: LS on FR2 RedCap UE

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2205543**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205543.zip) | Ericsson | **Proposal: LS to RAN2/RAN1 to ask if there is any impact on signaling design due to the e new power class for FR2 RedCap UE introduced by RAN4.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

**Issue 5-1:** LS to RAN2

* Proposals:
* Option 1: LS to RAN2/RAN1 to ask if there is any impact on signalling design due to the e new power class for FR2 RedCap UE introduced by RAN4. [Ericsson]
* Option 2: TBA
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |

Issue 5-1 comments:

|  |  |
| --- | --- |
| **Company** | **Comments on 5-1** |
| Qualcomm | Support communicating with RAN2. |
| Ericsson | Support to LS to RAN2. |
| Sony | Option 1. |
| OPPO | Ok with LS to RAN2. |
| vivo | OK with a LS to RAN2. But the content should be updated to accommodate outcome of this meeting. Besides, PC6 is FR2 HST device. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
|  | Company A |
| Company B |
|  |
|  | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Issue 5-1** | *All companies agree to have LS to RAN2, so in 2nd round, LS should be discussed.*  *Tentative agreements*   * LS to RAN2/RAN1 to ask if there is any impact on signalling design due to the e new power class for FR2 RedCap UE introduced by RAN4   *Recommendations for 2nd round:*  *Discuss the LS contend in 2nd round.* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
| *WF on RedCap in Rel-17* | *Ericsson* | *Keep remaining issue or open issues to be agreed to continue in TEI* |
| LS on FR2 RedCap UE | *Ericsson* |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| [**R4-2203692**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203692.zip) | RedCap UE REFSENS requirements | Apple | Noted |  |
| [**R4-2203865**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203865.zip) | RedCap UE HD-FDD REFSENS requirements | Mediatek India Technology Pvt. | Noted |  |
| [**R4-2204040**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204040.zip) | Peak EIRP and EIRP spherical coverage for RedCap FR2 | Sony | Noted |  |
| [**R4-2204041**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204041.zip) | REFSENS and EIS spherical coverage for RedCap FR2 | Sony | Noted |  |
| R4-2204211 | RedCap operating bands CR Cat F rel 17 | Qualcomm Incorporated | Noted |  |
| [**R4-2204226**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204226.zip) | Further discussion on FR2 RedCap | MediaTek Beijing Inc. | Noted |  |
| [**R4-2204765**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204765.zip) | On RedCap FR1 Operating band | ZTE Corporation | Noted |  |
| [**R4-2204766**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204766.zip) | On RedCap FR1 REFSEN requirements | ZTE Corporation | Noted |  |
| [**R4-2204767**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204767.zip) | Discussion on FR2 RedCap UE | ZTE Corporation | Noted |  |
| [**R4-2204961**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204961.zip) | Further Discussion on FR2 RedCap Tx requirements | vivo | Noted |  |
| [**R4-2204962**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204962.zip) | Further Discussion on FR2 RedCap Rx requirements | vivo | Noted |  |
| [**R4-2205119**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205119.zip) | Discussion on RF requirements for FR2 wearable use case Redcap UE | Xiaomi | Noted |  |
| [**R4-2205275**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205275.zip) | Discussion on FR1 Tx-Rx distance for RedCap UE | Huawei, HiSilicon | Noted |  |
| [**R4-2205276**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205276.zip) | Discussion on FR1 REFSENS requirements for RedCap UE | Huawei, HiSilicon | Noted |  |
| [**R4-2205277**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205277.zip) | Discussion on FR2 RF requirements for RedCap UE | Huawei, HiSilicon | Noted |  |
| [**R4-2205278**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip) | CR for 38.101-1 to introduce RF requirements for RedCap UE | Huawei, HiSilicon, Deutsche Telekom, CMCC, CBN, Vivo | To be Revised |  |
| [**R4-2205279**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205279.zip) | CR for 38.101-2 to introduce RF requirements for FR2 RedCap UE | Huawei, HiSilicon | Noted |  |
| [**R4-2205539**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205539.zip) | CR on RedCap UE FR1-TX | Ericsson | No pursued |  |
| [**R4-2205540**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205540.zip) | CR on RedCap UE FR1-RX | Ericsson | To be revised  **Chairman: Would you please Please add Qualcomm Incorporated as co-sign in revised Tdoc** |  |
| [**R4-2205541**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205541.zip) | CR on RedCap UE FR2-TX | Ericsson | To be revised  **Chairman: Would you please Please add Qualcomm Incorporated as co-sign in revised Tdoc** |  |
| [**R4-2205542**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205542.zip) | CR on RedCap UE FR2-RX | Ericsson | To be revised |  |
| [**R4-2205543**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205543.zip) | LS on FR2 RedCap UE | Ericsson | Noted |  |
| [**R4-2205544**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205544.zip) | Remaining issue for RedCap RF requirements in FR1 | Ericsson | Noted |  |
| [**R4-2205545**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205545.zip) | On FR2 RedCap RF requirements | Ericsson | Noted |  |
| [**R4-2205601**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205601.zip) | RedCap operating bands CR Cat B rel 17 | Qualcomm Incorporated | To be Revised |  |
| [**R4-2206058**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2206058.zip) | On RF requirements for the low-power Redcap FR2 UE | Qualcomm Incorporated | Noted |  |
| [**R4-2206072**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2206072.zip) | PC2 HD-FDD for RedCap | Skyworks Solutions Inc. | Noted |  |
| [**R4-2206135**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2206135.zip) | RedCap Tx-Rx separation for FDD | MediaTek (Chengdu) Inc. | Noted |  |
| R4-2206137 | Channel raster and sync raster for the 6 GHz licensed band | MediaTek (Chengdu) Inc. | Noted |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |
| R4-2206544 | WF on RedCap in Rel-17 | Ericsson | Agreeable | *GTW version seems agreable* |
| R4-2206545 | LS on FR2 RedCap UE | Ericsson | Agreeable | *Latest draft version seems agreeable* |
| R4-2206546 | CR for 38.101-1 to introduce RF requirements for RedCap UE | Huawei, HiSilicon, Deutsche Telekom, CMCC, CBN, Vivo | Agreeable | *Revised from* [R4-2205278](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205278.zip), *Latest draft version seems agreeable* |
| R4-2206547 | CR on RedCap UE FR1-RX | Ericsson | Agreeable | *Revised from* [R4-2205540](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205540.zip)  *Latest draft version seems agreeable* |
| R4-2206548 | CR on RedCap UE FR2-TX | Ericsson; Qualcomm Incorporated | Agreeable | *Revised from* [R4-2205541](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205541.zip)  *Latest draft version seems agreeable* |
| R4-2206549 | CR on RedCap UE FR2-RX | Ericsson; Qualcomm Incorporated | Agreeable | *Revised from* [R4-2205542](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205542.zip)  *Latest draft version seems agreeable* |
| R4-2206550 | RedCap operating bands CR Cat B rel 17 | Qualcomm Incorporated | revised | *Revised from*  [R4-2205601](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205601.zip)  *On SUL, v2x, unlicensed band, not agreed, to see if progress could be made in last round of return to.* |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)