3GPP TSG-RAN WG2 Meeting #127 draft R2-24xxxxx

Maastricht, Netherlands, Aug 19th – 23rd, 2024

Source: RAN2 Vice Chairman (CATT)

Title: Report from session on R18 MIMOevo, R18 MUSIM, R19 LP-WUS and R19 SBFD

## Orgnizational email discussion

* [AT127][200] Organizational – MIMOevo, MUSIM, LPWUS, and SBFD (RAN2 VC)

Scope:

a) Share plans and list of ongoing email discussions for the related sessions, and

b) Share meetings notes and agreements for review and endorsement

## 7.17 Dual Transmission/Reception (Tx/Rx) Multi-SIM for NR

(NR\_DualTxRx\_MUSIM-Core; leading WG: RAN2; REL-18; WID: [RP-233071](http://ftp.3gpp.org/tsg_ran/TSG_RAN/TSGR_100/Docs/RP-231461.zip))

Time budget: 0 TU

Tdoc Limitation: 1 tdocs

### 7.17.1 Organizational

Incoming LS, Rapporteur input, etc.

Corrections to TS 38.300.

R2-2407186 Corrections to TS 38.300 for R18 MUSIM China Telecom, Samsung CR Rel-18 38.300 18.2.0 0887 - F NR\_DualTxRx\_MUSIM-Core

* Agreed

### 7.17.3 Corrections

R2-2406715 Discussion on configuration for temporary capability restriction Huawei, HiSilicon discussion Rel-18 NR\_DualTxRx\_MUSIM-Core

Discussions

* Xiaomi do not think this is critical and think it is a signalling optimization. Nokia agree with this view.
* Samsung think Option 1 is ok. QC share this view.
* LG E understand the intention of this CR, and think Option 2 is better as Option 1 is NBC. ZTE agree with Option 2.
* Vivo think NW has the way to configure properly and think it is not so critical as this stage.
* Intel and Ericsson think changing need code as in Option 1 does not create NBC issue.

[CB]

R2-2407077 Further discussion on MUSIM capability restriction signalling Ericsson discussion Rel-18 NR\_DualTxRx\_MUSIM-Core

Discussions

P1

* QC, ZTE agree.
* Xiaomi think the functionality in P1 is already there in the spec.
* Huawei think it is a valid issue and think it is useful to clarify in the spec.
* Samsung think there is no such restriction that UE cannot include multiple entry for the same band. Samsung support P1.
* Huawei wonders whether we also need some clarification for the avoided bands. Xiaomi think we may need some changes. Samsung think we do not need any change for that part.
* Band entry (MUSIM-CapabilityRestrictedBandParameters-r18 with same musim-bandEntryIndex ) that appear more than once in musim-AffectedBandsList indicate that the UE supports intra-band non-contiguous CA on the band.

Chair: companies can check if any changes for avoided band is needed.

P2

* Nokia think more clarification is needed.
* QC think this proposal is fine.
* Samsung think this clarification better fit in the description of the candidate band list.
* HW think it is needed that UE can indicate PCell in this case but the intention is to release SCell.
* Intention of P2 is agreeable, can discuss further how to capture (e.g., whether the clarification is reflected in other places in the spec.)

[CB]

R2-2407104 Clarification on DAPS Handover for Dual TX/RX MUSIM operation Nokia discussion Rel-18

* Noted

Discussion

* HW do not think this we need to capture this restriction and think it is up to NW/UE implementation.
* Xiaomi think this does not impact DAPS feature and think it can be left to implementation.
* Nokia think with such combination there may be need for more coordinates btw the NW nodes and think those are not discussed sufficiently. Samsung wonders what is the R3 impact if we allow such combination.
* CATT also think it is up to NW implementation and we do not need further spec impact.

R2-2407321 Further Clarification on the Reconfiguration Failure Processing ZTE Corporation, Sanechips discussion Rel-18 NR\_DualTxRx\_MUSIM-Core

Discussions

* Samsung think if we agree the changes there may be some duplication and we should simplify.

?? the proposed changes are agreed, and the texts ‘in case the UE is unable to apply (part of) the configuration resulting from RRCReconfiguration message due to UE temporary capability restriction for MUSIM operation’ in the next sentence is removed.

[CB]

R2-2407515 Remaining issues on MUSIM Samsung Electronics Czech discussion Rel-18 NR\_DualTxRx\_MUSIM-Core

Discussion

P1

* Ericsson think if there is issue in the spec then we should better reflect in the spec. Samsung think this is to help the implementation.
* Vivo think the spec is ok, so no change is needed. HW also think the spec is clear and is OK to capture the texts in the minutes. Xiaomi agree no spec change is needed. LG E agrees.
* QC think it is the intended behaviour and think it is OK to add a note.
* RAN2 understands that upon T348 expiry, the UE still considers the latest configuration as the current configuration but does not perform any required behaviors about dedicated configuration associated with *musim-CapRestriction*. No spec impact is needed

P2

* LG E think current spec is fine so no need to change.

*Proposal 2: RAN2 to discuss whether the UE can include the musim-GapKeepPreference without the musim-GapPriorityPreferenceList in the UEAssistanceInformation message*

*Proposal 3: If the measurement gap requirements received in the musim-needForGapsInfoNR is included in the AS-Context, source gNB does not include the needForInterruptionInfoNR and needForGapNCSG-InfoNR (as in TP).*

[CB] P2 and P3

Post meeting email disc

* ?? [Post127][204][MUSIM] CR for TS 38.331 (vivo)

Scope: Update and review the CR for TS 38.331

Intended outcome: Agreed CR

Deadline: Short

## 7.20 NR MIMO evolution

(NR\_MIMO\_evo\_DL\_UL-Core; leading WG: RAN1; REL-18; WID: [RP-233028](http://ftp.3gpp.org/tsg_ran/TSG_RAN/TSGR_98e/Docs/RP-223276.zip))

Time budget: 0TU

Tdoc Limitation: 1 tdoc

### 7.20.1 Organizational

Incoming LS, Rapporteur input, etc.

Stage 2 corrections.

R2-2406214 Reply to RAN2 LS on type 3 PH value for the serving cell configured with mTRP (R1-2405619; contact: MediaTek) RAN1 LS in Rel-18 NR\_FeMIMO-Core, NR\_MIMO\_evo\_DL\_UL-Core To:RAN2

* Noted

R2-2406489 Remaining issues on PHR for mTRP STx2P Samsung discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

=> Moved to 7.20.2

### 7.20.2 Corrections

PHR aspects

R2-2406915 Remaining issue on STx2P PHR LG Electronics Inc. discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

* Noted

Discussion

P1

* CATT understand that R1 already discuss this in this week and agree that type 1 PHR is associated with the 1st TCI state. So CATT do not see a need to LS R1.
* HW think the proposed principle is fine and think we need to make it clear in the spec.
* QC think R1 already agreed so perhaps no need to ask R1.
* LG E think R1 agreement is for a different case when the MAC entity is not configured with twoPHR. Samsung think the same principle applies.

R2-2407202 Correction on PHR for STx2P in NR-DC Huawei, HiSilicon CR Rel-18 38.321 18.2.0 1905 - F NR\_MIMO\_evo\_DL\_UL-Core

* Noted, exact change on this issue will be discussed in Rapp’s MAC CR.

R2-2407434 Further Considerations on Harmonizing the PHR for Different Features ZTE Corporation discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1: Two values of PCMAX,f,c,k are obtained from physical layer for the serving cell configured with STx2P from the other MAC entity if the Enhanced Multiple Entry PHR for multiple TRP STx2P MAC CE is generated by this MAC entity and the other MAC entity is configured with twoPHRmode.*

Discussion

P1

* LG E agree with the intention. HW not sure about the intention.

*Proposal 2: RAN2 confirm that the Enhanced Multiple Entry PHR for multiple TRP STx2P MAC CE is generated If this MAC entity is configured with twoPHRmode and at least one Serving Cell of both MAC entities is configured with STx2P.*

*Proposal 3: RAN2 confirm that the Enhanced Multiple Entry PHR for multiple TRP MAC CE is generated if this MAC entity is configured with twoPHRmode and at least one Serving cell of both MAC entities is configured with mTRP PUSCH repetition and none of serving cells of both MAC entities is configured with STx2P.*

Chair: the proposals seem not well understood, it seems more offline discussions will be helpful.

Discussions in CB on P1-3 and necessary changes.

- ZTE explains that there have been offline and P2-3 can be skipped. And ZTE suggest to postpone P1.

- LG E suggest to address P1 in the CR discussion after the meeting. ZTE think there may be many changes. Samsung suggest to postpone.

* P2 and P3 are not pursued.
* P1 is postponed.

R2-2406489 Remaining issues on PHR for mTRP STx2P Samsung discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

Discussion

P1

* Xiaomi, ZTE, LG E, Ericsson agree.
* Oppo also fine with this proposal but think there is other case, and think we can perhaps check. ZTE think there is no need to send a LS.
* In PHR procedure, type 3 PH is not reported for serving cell configured with multiple TRP PUSCH repetition or multipanelSchemeSDM or multipanelSchemeSFN. Remove type 3 PH at two places in the above MAC procedural text.

P2-1

* OPPO think this is R1 discussion.
* Vivo think we could agree in R2 and think P2-1 is agreeable. Ericsson agree and think we can change the MAC accordingly.
* HW agree with the proposal. ZTE also agree, and think if R1 has different agreement then we can revisit.
* LG E can accept but want to send LS to R1 to confirm.
* The following is agreed and the exact change to MAC spec can be further checked. Can revisit if R1 agreed otherwise.

**For mTRP STx2P, if twoPHRmode is not configured,**

* **if there is at least a real PUSCH transmission,** 
  + **if the first TCI state is applied for a real PUSCH transmission, UE obtains the type 1 PH and the Pcmax associated with the first TCI state;**
  + **else UE obtains the type 1 PH and the Pcmax associated with the second TCI state.**
* **else if there is no real PUSCH transmission, UE obtains the type 1 PH and the Pcmax associated with the first TCI state.**

Other changes

R2-2406488 Correction to MIMO Evolution Samsung draftCR Rel-18 38.331 18.2.0 NR\_MIMO\_evo\_DL\_UL-Core

1. For mappingPattern-r17 in IE ConfiguredGrantConfig and IE PUSCH-Config, change the presence condition SRSsets to optional presence when two SRS sets are configured.

2. In the field description of n-TimingAdvanceOffset2 clarify that N\_TA-Offset2 is applied only for inter-cell multi-DCI multi-TRP operation with two TA, i.e, for PDCCH order CFRA towards the additional PCI and for all UL transmission associated to tag2.

Discussion

P1

* CATT think change 1 has Rel-17 impact so perhaps we should focus on R18 change. HW, QC agree with this view.
* It is clarified in the spec that for Rel-18 mappingPattern-r17 in IE ConfiguredGrantConfig and IE PUSCH-Config is absent, no changes to Rel-17 is needed. Detailed changes to the RRC spec can be checked further.

R2-2406519 Discussion on remaining issue for 8Tx in MAC specification ASUSTeK discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

Discussion

* ZTE think we do not need to add the note, and think UE will generate two TBs according to the UL grant.
* CATT think the issue is valid, and note is useful.
* LG E not sure whether the wording ‘for the HARQ process’ is correct.

Discussions in CB

- Asustek reports that in offline there are common understanding that some note may be needed, exact changes FFS.

- In addition, in the offline discussion, some companies pointed out that HARQ modelling (i.e., in LTE there are two HARQ process ID for two UL grants for the case of UL spatial multiplexing, but in NR there is only one) discussions are needed. Asustek think more time is needed, also may need to check with R1. ZTE think the potential issue was found in this meeting can think in R2 we can analyse the impact. Samsung think we need more time to check if any issue in R2 spec, can discuss based on company contribution.

- Samsung not ready to send LS to R1.

* Postponed

R2-2406574 Correction on simultaneousU-TCI-UpdateListx CATT draftCR Rel-18 38.331 18.2.0 NR\_MIMO\_evo\_DL\_UL-Core

Discussion

* Ericsson think the intention is OK but exact changes need further checking.
* Postponed

R2-2406778 Correction on unified TCI state for SRS vivo draftCR Rel-18 38.331 18.2.0 F NR\_MIMO\_evo\_DL\_UL-Core

Discussion

* Ericsson think the changes are needed.
* Endorsed, will merge into the RRC Rapp’s CR

R2-2406807 Random Access problem for SpCell with two TAGs Langbo discussion Rel-18 38.321 NR\_MIMO\_evo\_DL\_UL-Core

Discussion

* LG E has different understanding and think no change is needed. Samsung, QC share this view and think this is a minor optimization.
* Not pursued

R2-2406808 Clarification on the codebook type request in the UE capability enquiry Nokia Corporation discussion NR\_MIMO\_evo\_DL\_UL-Core

Discussion in CB

- CATT think the problem in the paper is valid, so agree with the proposals. Samsung agree.

- HW think no changes are needed, since the new codebooks are introduced in later release.

- QC think the codebook type request is introduced in Rel-16. HW understand the codebook type request impact Rel-16 codebook. Samsung understand that it only applies to Rel-15.

- DCM wonders whether this belongs to other agenda item for earlier releases.

* Postponed
* [AT127][201][MIMOevo] Proposals for RRC changes (Ericsson)

Intended outcome: Review the proposed RRC changes from the company contributions, taking into account the agreements so far. Summary/proposals in R2-2407701 for discussion in the CB session.

Deadline: before Thursday CB session

R2-2407701 Summary for [AT127][201][MIMOevo] Proposals for RRC changes Ericsson

* P1 is agreed.
* P2 is agreed.

Post meeting email disc

* [Post127][202][MIMOevo] CR for TS 38.321 (Samsung)

Scope: Update and review the CR for TS 38.321.

Intended outcome: Agreed CR

Deadline: Short

* [Post127][203][MIMOevo] CR for TS 38.331 (Ericsson)

Scope: Update and review the CR for TS 38.331.

Intended outcome: Agreed CR

Deadline: Short

## 8.4 Low-power wake-up signal and receiver for NR (LP-WUS/WUR)

(NR\_LPWUS-Core; leading WG: RAN1; REL-19; WID: [RP-240801](http://ftp.3gpp.org/tsg_ran/TSG_RAN/TSGR_103/Docs/RP-240801.zip))

Time budget: 1 TU

Tdoc Limitation: 3 tdocs

### 8.4.1 Organizational

LS, Rapporteur input, including workplan, etc.

### 8.4.2 Procedure and configuration of LP-WUS in RRC\_IDLE/INACTIVE

Procedure and configuration of LP-WUS indicating paging monitoring triggered by LP-WUS, including at least configuration, sub-grouping and entry/exit condition for LP-WUS monitoring

LP-WUS configuration

*(Whether dedicated configration is needed or not)*

R2-2406787 Discussion on procedure and configuration of LP-WUS in RRC\_IDLE/INACTIVE Huawei, HiSilicon discussion

*Proposal 1: RAN2 confirms that the network does not need to be aware of whether the UE is monitoring LP-WUS or not in RRC\_IDLE/INACTIVE.*

*Proposal 3: The network indicates whether LP-WUS capable UE(s) is/are allowed to use the LP-WUS functionality, the detailed signalling is FFS.*

Discussion

P1

* OPPO agree with the intention. OPPO understand that P1 means no signalling for this but NW implementation can achieve sth.
* Xiaomi, LG E, CATT think no need to discuss P1 as it was already agreed in SI phase.
* Sony see some benefit for NW to know this info.
* Nokia think NW has some way to know in some cases.
* Baseline: The network does not need to be aware of whether the UE is monitoring LP-WUS or not in RRC\_IDLE/INACTIVE

P3

* Xiaomi do not think this is needed as UE can know from SI.
* ZTE support the idea of having per UE signalling. LG E think per UE activation/deactivation is useful, for example for some UE with high traffic the power saving gain from monitoring lpwus is limited.

R2-2407240 Discussion on LP-WUS operation in RRC\_IDLE/INACTIVE modes InterDigital, Inc. discussion Rel-19 NR\_LPWUS-Core

*Proposal 1: Support LP-WUS configuration via system information (e.g., cell-specific). Do not support dedicated LP-WUS configuration*

* Noted

Discussion

P1

* Vodafone think we need to have the possibility of using dedicated signalling to override the cell level configuration.
* QC want to first understand what dedicates signalling needs to be introduced.
* NEC think at least entry/exist condition can be dedicated configuration.
* Samsung support P1, since this is for idle/inactive and think there is no need to introduce new configuration in RRCRelease.
* Nokia think dedicated signalling is useful.
* Vivo think we can postpone the discussion and we can conclude after more discussion on what needs to be provided.

*(Whether configuration of entry/exit condtion is mandatory or not)*

R2-2407156 LP-WUS operation in RRC\_IDLE and RRC\_INACTIVE LG Electronics Inc. discussion Rel-19 NR\_LPWUS-Core

*Proposal 1 The configuration of the entry/exit condition of LP-WUS monitoring is mandatory present in the LP-WUS related configuration.*

R2-2407096 LP-WUS operation in IDLE/Inactive state Qualcomm Incorporated discussion NR\_LPWUS-Core

*Proposal 2 If the gNB does not configure the conditions, it is left to UE implementation to determine whether to enter or exit LP-WUS mode.*

R2-2407396 LP-WUS in Idle and Inactive Ericsson discussion Rel-19 NR\_LPWUS-Core

*Proposal 1 For OFDM-based WUR the entry/exit condition is optional.*

*Proposal 2 For OOK-based WUR the entry/exit condition is mandatory.*

*Proposal 3 Separate entry/exit conditions can be configured for OFDM-based and OOK-based WUR.*

Discussions on the above proposals

* HW do not think the configuration should be mandatory, and think if not configured it can rely on default values. CATT agree, for PEI the condition is not configured, and think Ericssion proposal is good compromise way to go.
* Xiaomi support LG E P1, and think LP-SS/LP-WUS may not be full coverage of the cell. Nokia support LG E proposal and also ok with Ericsson proposal. Lenovo, NEC also agree with LG E P1.
* LG E think even for OFDM-based LR we need to consider inter freq case. NEC agree.
* Lenovo agree with P3 in Ericsson paper and think it is already a working assumption in R1.
* ZTE want to the condition is optional and think HW proposal is a good compromise.
* Samsung prefer to have the condition optional, and think we need to discuss whether different types of LR can be differentiated. OPPO do not think the condition is mandatory and do not need default value.
* Vodafone think in some case NW do not really know the coverage and think different UE may have different measurement. Vodafone prefer to have separate conditions for different LR types.
* NEC support P3 from Ericsson paper.
* Ericsson think LPWUS should not impact system performance.

Discussion on P3 from R2-2407396

* Nokia suggest to put FFS on detailed signalling. Vivo think it is already R1 assumption, and suggest to add ‘if NW support both types of LR’.
* Separate entry/exit thresholds can be configured for OFDM-based and OOK-based WUR if a cell supports both types of LRs. Signalling details are FFS.

LP-WUS entry/exit condition

R2-2407013 LP-WUS in IDLE and INACTIVE Nokia discussion Rel-19 NR\_LPWUS-Core

*Proposal 4: LP-WUS monitoring entry condition includes both MR (cell coverage) and LR (LP-WUS coverage) measurements.*

*Proposal 5: LP-WUS monitoring exit condition is evaluated based on LR measurement.*

*Proposal 6: RAN2 assumes that RAN1 defines LR measurements quantities for LP-WUS.*

R2-2406730 Procedure and configuration of LP-WUS in RRC\_IDLE/INACTIVE Apple discussion Rel-19 NR\_LPWUS-Core

*Proposal 2: The entry condition for LP-WUS monitoring is not based on measurement from LR.*

R2-2406427 Discussion on LP-WUS WUR in RRC\_IDLE INACTIVE vivo discussion Rel-19 NR\_LPWUS-Core

*Proposal 3: Regarding whether any measurement via LR is needed for entry condition and whether any measurement via MR is needed for exit condition, RAN2 to wait for RAN1/RAN4 progress.*

Discussion on P4 in R2-2407013 and P2 in R2-2406730

* NEC do not think LR results are needed for entry condition. HW, Lenovo agree.
* Sony think LR results are needed for entry condition, since there might be different rx sensitivities at the UEs. QC agree.
* Spredtrum think it depends on NW configuration. IDT share this view. IDT, OPPO think R1 has similar understanding and think we need to check the R1 progress. HW agree. Ericsson think we can conclude in R2.
* Ericsson think LR measurement is useful in some cases, and think if we only allow MR based results then NW may be forced to configure higher thresholds. ZTE also think LR results are needed. LG E, CATT, Xiaomi agree.
* Vodafone think the entry condition is mainly for the case when UE is in very good coverage, so LR results may not be so useful, and think Pingpong can be handled by offset btw entry/exit thresholds. Samsung share this view. HW agree.
* Samsung, Apple think we can postpone.
* Working assumption (can revisit if R1/R4 reached different conclusions): If the entry/exit conditions are configured, besides MR-based thresholds, LP-WUS monitoring entry condition can also include LR-based thresholds.

*Proposal 4: The metric for serving cell quality measured by MR for entry condition includes RSRP and optional RSRQ.*

*Proposal 5: RAN2 assumes the metric for serving cell quality measured by LR for exit condition includes RSRP and optional RSRQ. An LS is sent to RAN1/RAN4 for confirmation.*

Discussion

P4 and P5 in R2-2406427

* IDT, Nokia fine with P4 and P5.
* Xiaomi think these metrics should be decided in R1/4. Vivo think these metrics have already agreed there will be LP-RSRP/Q kind of measurements, and think R2 can decide to use them.
* Nokia, Ericsson, ZTE, NEC do not see a need to send LS.
* The metrics for serving cell quality measured by MR/LR for entry condition includes (LP-)RSRP and optional (LP-)RSRQ.
* The metrics for serving cell quality measured by LR for exit condition includes (LP-)RSRP and optional (LP-)RSRQ.

LP-WUS Subgrouping

R2-2407543 Discussion on Procedure and configuration in RRC\_IDLE-INACTIVE NTT DOCOMO INC.. discussion Rel-19 NR\_LPWUS-Core

*Proposal 1: In UE\_ID based subgrouping, a mechanism should be applied that allocates PEI and LP-WUS subgroups differently in order to reduce the false paging rate.*

R2-2406772 Discussion on procedure and configuration of LP-WUS in RRC\_IDLE/INACTIVE OPPO discussion Rel-19 NR\_LPWUS-Core

*Proposal 8 For LP-WUS, UE can be assigned by CN a different subgrouping ID than the subgrouping ID for PEI.*

*Proposal 9 For LP-WUS, RAN can configure a different subgrouping number used in UE ID-based subgrouping than the subgrouping ID for PEI.*

Discussions

* HW, NEC, Xiaomi agree with DCM P1. NEC think this same principle may also apply to CN based.
* HW think ‘different subgrouping number’ in OPPO P8 is not so clear. OPPO clarifies this means the formula may be the same but exact parameters can be different.
* Xiaomi think we can further discuss details of the formula.
* LG E think it is possible to achieve the same effect configure different # of subgroups.
* Ericsson think we need to first discuss in R2 whether PEI and LPWUS are used together for a UE, and think it is controlled by the NW. CATT and HW think there is already agreement in R1.

?? In UE\_ID based subgrouping, a mechanism should be applied that allocates PEI and LP-WUS subgroups independently and separately (if UE is configured to use both PEI and LP-WUS and if UE support both) in order to reduce the false paging rate. FFS on detailed configurations.

R2-2406447 Procedure and configuration of LP-WUS for IDLE and INACTIVE mode ZTE Corporation, Sanechips discussion Rel-19 NR\_LPWUS-Core

R2-2406495 LP-WUS procedure in RRC\_IDLE INACTIVE NEC discussion Rel-19 NR\_LPWUS-Core

R2-2406575 LP-WUS in RRC\_IDLE/INACTIVE CATT discussion Rel-19 NR\_LPWUS-Core

R2-2406585 General considerations on the procedure for RRC\_IDLE\_INACTIVE Xiaomi Communications discussion

R2-2406617 RAN2 aspects on LP-WUS/WUR in RRC Idle/Inactive mode Sony discussion Rel-19 NR\_LPWUS-Core

R2-2406753 Discussion on LP-WUS operation in IDLE/INACTIVE mode Spreadtrum Communications discussion Rel-19

R2-2406802 Discussion on entry exit conditions for LP-WUS monitoring Sharp discussion

R2-2406900 LP-WUS Operation in RRC\_IDLE/INACTIVE China Telecom discussion Rel-19 NR\_LPWUS-Core

R2-2406985 LP-WUS operation in IDLE/INACTIVE modes CMCC discussion Rel-19 NR\_LPWUS-Core

R2-2407127 Procedure and Configuration of LP-WUS in RRC Idle/ Inactive Lenovo discussion NR\_LPWUS-Core

R2-2407310 Procedure and Configuration of LP-WUS in RRC Idle Inactive Mode Samsung discussion Rel-19

R2-2407357 Procedure of LP-WUS in RRC\_IDLE and INACTIVE HONOR discussion Rel-19 NR\_LPWUS-Core

### 8.4.3 RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE

RRM relaxation of UE MR for both serving and neighbor cell measurements, and UE serving cell RRM measurement offloaded from MR to LP-WUR, including the necessary conditions

General aspects

R2-2406496 LP-WUS RRM measurement NEC discussion Rel-19 NR\_LPWUS-Core

*Proposal-1: Only LP-WUS capable UE is applicable to LP-WUS specific measurement offloading/relaxation, i.e., it is not applicable to normal UE.*

*Proposal-2: RAN2 to confirm that non-LPWUS-capable UE is not the target of this WI, e.g. the RRM measurement relaxation is applicable only for LPWUS-capable UE.*

*Proposal-3: RAN2 to confirm that as long as the UE is in LP-WUS monitoring mode, the UE always need to use LR to perform measurement on serving cell.*

*Proposal-4: RAN2 is suggested to further consider fully offloading case (no any measurement by MR) and relaxed case b (both relaxed serving cell and neighbour cell measurement by MR) identified in RAN4.*

Discussion

P1, P2

* QC think R4 is discussing the scenarios, so R2 do not need to discuss this. CATT think in R4 the high level assumption is the same as the proposals.
* HW, Apple, Nokia, Samsung support P1, P2.
* Xiaomi not sure about the relaxation case and want to wait for R4.
* Vivo explain there are two cases agreed in R4, full offloading and serving cell relx with LR measurements, so we only need to focus on these cases (no need to agree on P1, P2.).
* Ericsson think it is already clear based on WI scope.
* RAN2 only discuss RRM measurement offloading/relaxation for LP-WUS UEs.

Serving cell measurment offloading (i.e., there is no serving cell measurement by MR)

R2-2406754 Discussion on RRM measurement relaxation and offloading in IDLE/INACTIVE mode Spreadtrum Communications discussion Rel-19

*Proposal 1: UE serving cell RRM measurement can be offloaded from MR to LR with the follows conditions:*

* Option 1: when signal quality of serving cell is greater than a threshold.*

* Option 2: when entry condition of using LP-WUS is satisfied.*

R2-2406803 Discussion on RRM measurement offloading and relaxation Sharp discussion

*Proposal 1: The entry/exit condition(s) for LP-WUS monitoring is also applied for serving cell RRM measurement offloading from MR to LR.*

Discussion

* Xiaomi support Sharp proposal to use the same conditions for LPWUS monitoring and RRM measurement offloading. LG E, CATT, QC, Nokia think we do not need to link these two together. QC think there are different UE capabilities.
* Apple support P1, and think it is only one of the condition, other aspects e.g., neighboring cell measurement can also be consider. Ericsson can accept separate conditions but think the power saving gain is very limited if the conditions are different for LPWUS monitoring and measurement offloading. ZTE share the understanding from Ericsson.

R2-2406970 Discussion on RRM measurement relaxation and offloading in RRC\_IDLE INACTIVE CMCC discussion Rel-19 NR\_LPWUS-Core

*Proposal 2: Serving cell measurement relaxation/offloading of MR cannot affect the performance of cell (re)selection by UE.*

*Proposal 3: The entry conditions for serving cell measurement offloading can be defined as at least MR greater than a certain RSRP threshold, and LR could also be considered if it is on at this time.*

*Proposal 4: The RSRP threshold can be considered in conjunction with the threshold for LP-WUS monitoring. That is, the two thresholds can be the same or offset by a predetermined value.*

*Proposal 5: The exit condition is based on the LR measurement results.*

*Proposal 6: According to the 'Fully offloading case' agreed by RAN4, the threshold for offloading measurements to the LR is not less than the threshold for starting neighboring cell measurements.*

*Proposal 7: UEs with high-mobility do not perform serving cell measurement offloading.*

*Proposal 8: RAN2 discuss how to deal with the measurement loss during the hundreds of milliseconds required to restart MR.*

*The entry/exit condition(s) for LP-WUS monitoring is also applied for serving cell RRM measurement offloading from MR to LR.*

Discussion in CB on P3-5 in R2-2406970

* NEC think the conditions for serving cell meas offloading should be tighter than relx.
* Lenovo, OPPO, Samsung, CATT generally with P3 and P5.
* OPPO wonders what are the metrics for the thresholds.
* Samsung want to keep it open for other possible conditions. Nokia not sure what are those.
* Apple wonders what is the impact with P3 on neighbouring cell measurement, and think it is possible that it is not new condition but it reuse the exiting condition. Nokia not sure whether exiting conditions can be used.
* Ericsson do not agree adding FFS to other conditions.
* For serving cell measurement offloading (i.e., there is no serving cell measurement by MR):
  + - The entry conditions for serving cell measurement offloading can be defined as at least MR greater than a certain RSRP threshold, and LR could also be considered.
    - The exit condition is based on the LR measurement results.

Other proposals

Chair: other contributions/proposals may also be discussed if time allows, detailed plan to be updated during the meeting (e.g., before CB session)

R2-2406285 RRM measurement relaxation and offloading in RRC\_IDLE or RRC\_INACTIVE Huawei, HiSilicon discussion Rel-19 NR\_LPWUS-Core

R2-2406428 Discussion on RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE vivo discussion Rel-19 NR\_LPWUS-Core

R2-2406448 RRM measurement relaxation and offloading in RRC\_IDLE and RRC\_INACTIVE mode ZTE Corporation, Sanechips discussion Rel-19 NR\_LPWUS-Core

R2-2406576 RRM Relaxation and Offloading in RRC\_IDLE/INACTIVE CATT discussion Rel-19 NR\_LPWUS-Core

R2-2406586 Discussion on RRM measurement relaxation for RRC\_IDLE\_INACTIVE Xiaomi Communications discussion

R2-2406618 Discussion on RRM aspects for LP-WUS/WUR Sony discussion Rel-19 NR\_LPWUS-Core

R2-2406731 RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE Apple discussion Rel-19 NR\_LPWUS-Core Late

R2-2406739 Discussion on RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE mode China Telecom discussion

R2-2406767 Discussion on RRM measurement in RRC IDLE and INACTIVE OPPO discussion Rel-19 NR\_LPWUS-Core

R2-2406882 RRM measurement relaxation and offloading in RRC\_IDLE/INACTIVE Lenovo discussion Rel-19

R2-2407014 RRM measurement relaxation in RRC\_IDLE/INACTIVE Nokia discussion Rel-19 NR\_LPWUS-Core

R2-2407098 LP-WUS RRM measurement relaxation and offloading Qualcomm Incorporated discussion NR\_LPWUS-Core

R2-2407157 RRM relaxation and RRM offloading LG Electronics Inc. discussion Rel-19 NR\_LPWUS-Core

R2-2407241 Discussion on RRM measurement relaxation and offloading InterDigital, Inc. discussion Rel-19 NR\_LPWUS-Core

R2-2407311 RRM measurement relaxation and offloading in RRC Idle Inactive Mode Samsung discussion Rel-19

R2-2407397 LP-WUS and RRM measurements Ericsson discussion Rel-19 NR\_LPWUS-Core

### 8.4.4 Procedures for LP-WUS in RRC\_CONNECTED

Procedures to allow UE MR PDCCH monitoring triggered by LP-WUS including activation and deactivation procedure of LP-WUS monitoring.

Understanding of Option 1-2-1 and 1-2-2

Discussion

- Rapporteur suggest that R1 already made agreements during the week and think we should take into account those progress.

R2-2406587 Discussing on LP-WUS monitoring for RRC\_Connected Xiaomi Communications discussion

*Proposal 1 For Option 1-2-2, PDCCH monitoring not triggered by legacy C-DRX cycle and drx-onDurationTimer when monitoring LP-WUS will not be supported.*

R2-2406449 Procedures for LP-WUS in RRC\_CONNECTED ZTE Corporation, Sanechips discussion Rel-19 NR\_LPWUS-Core

*Proposal 2: Option 1-2 is supported, e.g. UE can monitor LP-WUS with a LP-WUS cycle during the non-active time of C-DRX cycle if LP-WUS for RRC\_CONNECTED state is configured and activated.*

*Proposal 2a: UE starts drx-OnDurationTimer after a timeOffset when it detects LP-WUS.*

*Proposal 2b: UE determines the LP-WUS monitoring occasion with the similar formula as that to determine the start of drx-onDurationTimer, e.g. the UE monitors LP-WUS during the non-active time of C-DRX cycle if:*

*[(SFN × 10) + subframe number-(drx-StartOffset - timeOffset)] modulo (LP\_WUS-cycle)) = 0*

R2-2406577 Analysis on LP-WUS for RRC\_CONNECTED Mode CATT discussion Rel-19 NR\_LPWUS-Core

*Option 1-2-1:*

*Proposal 6: RAN2 confirms the following understanding for Option 1-2-1:*

*- The UE is triggered to perform PDCCH monitor based on LP-WUS indication during the time outside legacy DRX active time;*

*- UE behaviors related to drx-HARQ-RTT-TimerDL/UL and drx-RetransmissionTimerDL/UL are not impacted by LP-WUS.*

*Option 1-2-2:*

*Proposal 8a: The UE is triggered to perform PDCCH monitor based on LP-WUS indication during the time outside legacy DRX active time and the time during legacy drx-onDuration in option 1-2-2.*

*Proposal 8b: For option 1-2-2, UE behaviors related to drx-HARQ-RTT-TimerDL/UL and drx-RetransmissionTimerDL/UL are not impacted by LP-WUS.*

*Proposal 9a: For option 1-2-2, after LP-WUS triggers the UE to perform PDCCH monitoring, the UE starts one timer. When the timer is running, the UE monitors PDCCH. The timer can be new defined timer or legacy drx-inactivityTimer.*

*Proposal 9b: For option 1-2-2, the timer is started at a configured time offset after LP-WUS. The range of time offset is left for RAN1.*

*Proposal 9c: For option 1-2-2, (long) DRX command MAC CE can be used to stop the timer. The other indications, e.g. DCI or LP-WUS, are dependent on RAN1.*

*Proposal 10: For option 1-2-2, whether to enhance CSI reporting during legacy drx-onDurationTimer depends on RAN1.*

*Proposal 11: For option 1-2-2, whether the legacy drx-onDurationTimer is started or not can wait for further inputs from RAN1, especially progress on CSI reporting during drx-onDurationTimer.*

Discussion

* Nokia pointed out that in R1 Option 1-2-1 and 1-2-2 are merged. Nokia suggest to discuss whether UE monitor LPWUS when onDurationTimer is running.
* Nokia suggest to disucss CSI measurement as well. Ericsson also think we need to consider CSI measurement. LG E has concern on 1-2-2 in terms of CSI measurement, as it consumes UE power, and it depends on how DRX configuration is configured. QC think CSI measurement in connected state needs no enhancement, and there is no discussion on it in R4.
* Lenovo think R2 can discuss the timer for PDCCH monitoring trigger by LP-WUS. Apple agree.
* ZTE suggest to discuss P9a.

P9a

- ZTE think there may be three options. Nokia think we do not consider onDurationTimer, slightly prefer a new timer. Ericsson think with Option 1-2 we introduce a new timer, and think if UE receives PDCCH when this new timer is running, UE starts the legacy drx-inactivityTimer.

- LG E suggest think we can just say new timer or existing timer. Xiaomi agrees.

- QC think new timer is clear solution as that avoids impact to legacy procedure.

- vivo suggest we confirm in R2 that a new timer is introduced. Lenovo, Apple agrees. ZTE not ready for that and want to keep the wording legacy timer in the bullet. Xiaomi suggest to first clarify the UE behaviour when the new timer expires. Nokia think if the timer expires, UE go back to monitoring LPWUS. Apple agree with this understanding.

- HW think we can use legacy timer.

P9b

- HW suggest to remove ‘configured’.

- Nokia wonders whether the offset is the wake up time needed for UE. CATT think this proposal is only about the procedure.

* For option 1-2,
  + - After LP-WUS triggers the UE to perform PDCCH monitoring, the UE starts one timer. When the timer is running, the UE monitors PDCCH. FFS on the timer (e.g., newly defined timer or legacy timer.)
    - The timer is started at a time offset after receiving the LP-WUS indication for PDCCH monitoring. The range of time offset is left for RAN1.

Other proposals

Chair: other contributions/proposals may also be discussed if time allows, detailed plan to be updated during the meeting (e.g., before CB session)

R2-2406429 Discussion on LP-WUS WUR in RRC\_Connected vivo discussion Rel-19 NR\_LPWUS-Core

R2-2406497 LP-WUS procedure in RRC\_CONNECTED NEC discussion Rel-19 NR\_LPWUS-Core

R2-2406619 Considerations on LP-WUS/WUR in RRC Connected mode Sony discussion Rel-19 NR\_LPWUS-Core

R2-2406717 Discussion on LP-WUS for RRC\_CONNECTED mode Huawei, HiSilicon discussion Rel-19 NR\_LPWUS-Core

R2-2406732 Procedures for LP-WUS in RRC\_CONNECTED Apple discussion Rel-19 NR\_LPWUS-Core

R2-2406768 Discussion on LP-WUS in RRC\_CONNECTED OPPO discussion Rel-19 NR\_LPWUS-Core

R2-2406901 Discussion on LP-WUS in RRC\_CONNECTED China Telecom discussion Rel-19 NR\_LPWUS-Core

R2-2406978 Discussion on LP-WUS operation in CONNECTED mode CMCC discussion Rel-19 NR\_LPWUS-Core

R2-2407097 LP-WUS operation in CONNECTED state Qualcomm Incorporated discussion NR\_LPWUS-Core

R2-2407134 LP-WUS in RRC Connected Mode Lenovo discussion NR\_LPWUS-Core

R2-2407242 Discussion on LP-WUS operation in RRC\_CONNECTED mode InterDigital, Inc. discussion Rel-19 NR\_LPWUS-Core

R2-2407286 Discussion on Procedures for UE MR PDCCH monitoring triggered by LP-WUS in RRC\_CONNECTED Mode LG Electronics Inc. discussion Rel-19 NR\_LPWUS-Core

R2-2407312 Procedures for LP-WUS in RRC Connected Mode Samsung discussion Rel-19

R2-2407358 Discussion on LP-WUS in RRC\_CONNECTED HONOR discussion Rel-19 NR\_LPWUS-Core

R2-2407398 LP-WUS in Connected Ericsson discussion Rel-19 NR\_LPWUS-Core

R2-2407406 LP-WUS in RRC\_CONNECTED Nokia discussion NR\_LPWUS-Core

R2-2407512 Discussion on LP-WUS in RRC\_CONNECTED NTT DOCOMO INC.. discussion Rel-19 NR\_LPWUS-Core

## 8.11 Evolution of NR duplex operation: Sub-band full duplex (SBFD)

(NR\_duplex\_evo-Core; leading WG: RAN1; REL-19; WID: [RP‑241614](https://www.3gpp.org/ftp/meetings_3gpp_sync/ran/docs/RP-241614.zip))

Time budget: 0.5 TU

Tdoc Limitation: 2 tdocs

### 8.11.1 Organizational

Incoming LS, Rapporteur input, including workplan, etc..

R2-2406314 RAN2 workplan for Rel-19 Evolution of NR duplex operation Huawei, HiSilicon Work Plan Rel-19 NR\_duplex\_evo-Core

* Noted

### 8.11.2 Random access in SBFD

RAN2 impacts to support SBFD operation to support random access in SBFD symbols by UEs in RRC \_CONNECTED mode and RRC\_IDLE/INACTIVE mode.

R2-2406452 Impacts on the random access by the evolution of duplex operation Huawei, HiSilicon discussion Rel-19 NR\_duplex\_evo-Core

*Proposal 1: RAN2 to discuss for which triggering events, random access procedure in SBFD symbols is supported.*

*Proposal 2: RAN2 to confirm that the network provides the RACH configuration for SBFD via SIB. Whether to provide the RACH configuration for SBFD via dedicated RRC signalling is pending on RAN1’s progress.*

*Proposal 3: RAN2 to confirm that RACH configuration for SBFD can be either based on the legacy RACH parameters or a new set of RACH parameters, and to discuss the signalling design for both options.*

*Proposal 4: RAN2 to consider the criterion for the SBFD-aware UE to select between the PRACH resource in SBFD symbols and the PRACH resource in non-SBFD symbols.*

*Proposal 5: RAN2 to discuss new fall-back behaviour if UE fails on the PRACH resource in SBFD symbols.*

Discussion

P1

* ZTE agree with P1, and suggest to make it a working assumption.
* LG E suggest to exclude SI request case.
* CATT, Xiaomi, NEC, QC think all those events can be supported, do not see strong reason to drop any of them.
* Apple think for P1 we also need to consider RACH resource.
* Ericsson think the main benefit of SBFD is to reduce the latency, so we may look at those latency sensitive cases. Nokia share this view.
* Nokia think we first agree on the cases for UEs in connected state.
* Nokia and LG E suggest to focus on connected state use case.
* Working assumption: Random access procedure in SBFD symbols is supported for all the existing RACH trigger events.

P2

* Xiaomi wonders this is for connected UE or also for idle/inactive. HW clarifies that it is for both.
* ZTE think dedicated signalling can be confirmed as well. Ericsson think main benefit is for connected mode, so also suggest to confirm dedicated singaling is supported.
* RAN2 assume RACH configuration for SBFD via SIB and/or dedicated RRC signalling is supported. Detailed signalling FFS.

P3

* LG E think it is ok since it confirms R1 agreement.
* Apple not sure if this implies NW can configure two configurations for a UE at the same time, and think only one is configured in a cell.
* HW clarifies that P3 is to confirm what R1 agreed from R2 perspective, nothing new.
* Ericsson, Goolge think we do not need to confirm this in R2.

P4

* ZTE not sure whether such selection is before or after selection of ‘configuration’. CATT ok to discuss. Xiaomi think such selection is up to UE’s implementation.
* Samsung think we do not discuss selection criteria in R2, we can wait for R1.
* Ericsson think at some point we need to discuss this, this cannot be completely left to UE implementation.
* Nokia wonders whether P4 is only for the configuration option 2 in R1.

P5

* Xiaomi think it introduces complexity and would like to leave it to UE implementation.

R2-2407078 Discussion on subband full duplex (SBFD) RA operation Ericsson discussion Rel-19 NR\_duplex\_evo-Core

Discussion

P1

* CATT, Google, Nokia support P1.
* Xiaomi want to make it a working assumption.
* Vivo want to understand what the common design means.
* LG E think for CFRA we need dedicated signalling, and think we could confirm this for CBRA.
* RAN2 to strive for a common SBFD CBRA framework independent of RRC state.

P6

* LG E, Sony think it too early to discuss P6. Xiaomi think P6 is related to many other aspects that we need to discuss further, so prefer to skip for it right now.

P7

* Nokia think this is not needed for configuration Option 1.
* ZTE, Sony think this is only related to UE sending RACH using legacy RA resource but not SBFD resource. CATT has different view and think UE may indicate in Msg3.
* Xiaomi think this can wait for R1.
* QC think early indication is needed.
* Ericsson think considering the existing features, there is no much room/tool for extra early indication. Samsung share this understaning and wonders how idle UEs do this.
* Apple agree with ZTE for msg1, but for legacy RO case, there is technical issue to handle.
* LG E has slight preference of introducing early indication for msg1.
* HW also think it is ok to wait for R1.
* ZTE suggest to add msg1-based as an example. CATT think the key point is whether SBFD is treated as a feature in RA.
* FFS whether/how early indication is used during a SBFD RA procedure.

P8

* Google think 2step is also covered.
* HW, Nokia think in R1 2step is FFS, so in R2 we just discuss 4step.
* RAN2 focus on 4-step RACH for SBFD RA, FFS on 2-step if needed.

R2-2406342 Random Access for SBFD Operation NEC discussion

R2-2406363 Discussion on RACH in SBFD Xiaomi discussion Rel-19

R2-2406486 Discussion on SBFD random access operation CATT discussion Rel-19 NR\_duplex\_evo-Core

R2-2406630 SBFD configuration and supporting Random access Sony discussion Rel-19 NR\_duplex\_evo-Core

R2-2406690 Framework to support RACH in SBFD Apple discussion Rel-19 NR\_duplex\_evo-Core

R2-2406724 Discussion on random access in SBFD vivo discussion Rel-19

R2-2406794 Discussion on random access procedure in SBFD ZTE Corporation discussion Rel-19 NR\_duplex\_evo-Core

R2-2406822 Random Access Aspect of SBFD Nokia Corporation discussion Rel-19 NR\_duplex\_evo-Core

R2-2406962 Discussion on random access in SBFD CMCC discussion Rel-19 NR\_duplex\_evo-Core

R2-2407143 Random Access in Sub-Band Full Duplex Google Ireland Limited discussion

R2-2407192 Views on random access for SBFD Qualcomm Incorporated discussion NR\_duplex\_evo-Core

R2-2407313 Random access in SBFD Samsung discussion Rel-19

R2-2407461 Discussion on Random Access procedure for SBFD LG Electronics Inc. discussion Rel-19 NR\_duplex\_evo-Core

### 8.11.3 Other aspects

Other RAN2 impacts with SBFD if not covered by the previous agenda items.

R2-2407427 SBFD Overall and Support of Cross Link Interference Samsung discussion Rel-19 NR\_duplex\_evo-Core

*Proposal 1: Source gNB request SBFD support and configuration (semi-static cell-specific SBFD time/frequency configuration) to other gNBs in Xn Setup Request or NG-RAN node Configuration Update message*

*Proposal 2: Semi-static cell-specific SBFD time/frequency configuration is provided by SIB1.*

*Proposal 3: RAN2 wait the RAN1 decision on support of the SBFD configuration by the dedicated RRC configuration.*

*Proposal 4: For the support gNB-to-gNB CLI handling, RAN2 wait the RAN1 parameter list on UL resource muting for PUSCH i.e. only RRC signalling support is expected.*

*Proposal 5: For L1 based UE-to-UE CLI measurement and reporting, the legacy CSI resource and report structure is reused and need to check how to exchange the information on the activation/deactivation of SRS at aggressor gNB.*

Discussion on P2 and P3

* LG E suggest to add ‘at least in P2’, HW do not see a need.
* Ericsson think P3 is not clear, think dedicated signalling is not needed. CATT agree.
* Charter support P2.
* CATT think no need for dedicated signalling.
* Cell-specific SBFD time/frequency configuration is provided by SIB1 (or via dedicated signalling to covey cell specific configuration). FFS on UE specific dedicated RRC configuration if needed, pending on RAN1 progress.

R2-2406410 SBFD resource indication and CLI handling Xiaomi discussion Rel-19 NR\_duplex\_evo-Core

R2-2406466 Other impacts by the evolution of duplex operation Huawei, HiSilicon discussion Rel-19 NR\_duplex\_evo-Core

R2-2406487 Discussion on other aspects of SBFD CATT discussion Rel-19 NR\_duplex\_evo-Core

R2-2406725 Discussion on other issues in SBFD vivo discussion Rel-19

R2-2406795 Discussion on CLI measurement in SBFD ZTE Corporation discussion Rel-19 NR\_duplex\_evo-Core

R2-2406957 Other aspects of SBFD Nokia discussion Rel-19 NR\_duplex\_evo-Core

R2-2406983 Discussion on SBFD related issues CMCC discussion Rel-19 NR\_duplex\_evo-Core

R2-2407079 Non-RA aspects for subband full duplex (SBFD) operation Ericsson discussion Rel-19 NR\_duplex\_evo-Core

R2-2407194 Other aspects of SBFD Qualcomm Incorporated discussion NR\_duplex\_evo-Core

## List of post meeting email discussions

Details to be added after the post meeting email disc have been confirmed in the sessions.

* [Post127][202][MIMOevo] CR for TS 38.321 (Samsung)

Scope: Update and review the CR for TS 38.321.

Intended outcome: Agreed CR

Deadline: Short

* [Post127][203][MIMOevo] CR for TS 38.331 (Ericsson)

Scope: Update and review the CR for TS 38.331.

Intended outcome: Agreed CR

Deadline: Short

* ?? [Post127][204][MUSIM] CR for TS 38.331 (vivo)

Scope: Update and review the CR for TS 38.331

Intended outcome: Agreed CR

Deadline: Short