**3GPP TSG-WG2 Meeting #109e draft -R2-2001916**

**24 Feb – 5 March 2020**

**Source: ZTE Corporation (offline discussion rapporteur)**

**Title: Summary of UP open issues**

**Agenda item:** **6.13.2**

**Document for:** **Discussion and Decision**

# Introduction

This document summarizes the open issues mentioned in tdocs submitted to agenda item 6.13.2. Also, any UP aspects mentioned in 6.13.4 are included. Note that the issues that were alreadydiscussed under the MAC CR email discussions [32], [33] and those that are explicitly handled in [1] are not included in this summary document. The only exception is the discussion of preamble grouping which is included in section 2.3. Note that some UP related aspects submitted to 6.13.4 agenda have also been included in the summary.

* [AT109e][507][2-step RA] UP open issues (ZTE)

Scope:

* + - Identify/Summarize all remaining open issues related to UP open issues from AI 6.13.2 and seek companies feedback on the need to solve the critical issue and preferred solutions.

 Intended outcome:

* + - Set of proposals with full consensus (aim to agree to those over email)
		- Set of proposals with almost full consensus and easy to agree
		- Set of open issues and proposals to postpone to next meeting.
		- Open issues that should no longer be pursued

 Deadline for providing comments:

* + - Companies input: Thursday, Feb. 27th 18:00 CET
		- Rapporteur proposals: Friday, Feb. 28th 18:00 CET (one day for rapporteur to make conclusions)
		- Comments on proposals’ wording, Tuesday, March 3rd by 08:00 CET

# Discussion

# Optimizations (i.e. 2-step RACH can work without this feature)

The following proposals fall under the category ofoptimisations (i.e. these are not essential for 2-step RACH to work in Rel-16).

If companies think that any of the proposal is not an optimization and is essential for 2-step RACH to work, they can add comments (in the comments section to explain their view).

**Table 1: Proposals for optimisation**

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Proposals** | **Ref** | **Company comments** **(if any, especially if you think this is not an optimisation)** |
| 1 | * The UE is allowed to apply the corresponding value of msgB-ResponseWindow provided in the RACH-ConfigDedicated
 | [4] | Rapporteur: Note for CFRA this is allowed already.[HW] this is carried in the RACH-configCommon of the target cell. Agree with rapporteur[Samsung]: Disagree with Rapporteur. In case of CFRA, *rach-ConfigGenericTwoStepRA*can be signaled in*RACH-ConfigDedicated.* However, UE is not allowed to use msgB-ResponseWindow configured bythis*rach-ConfigGenericTwoStepRA***.**[Nokia] Agree with Samsung.[vivo]: Samsung’s interpretation is valid according to the current RRC running CR.[LG] We have same understanding as Samsung. UE uses the corresponding values provided in *RACH-ConfigCommonTwoStepRA.* This UE behaviour is the same as in 4-step CFRA (The UE shall ignore *preambleReceivedTargetPower*, *preambleTransMax*, *powerRampingStep*, *ra-ResponseWindow* signaled within this field and use the corresponding values provided in *RACH-ConfigCommon*.)[ZTE]: Yes, it seems the rapporteur understanding is not correct. There is a restriction in RRC that the UE shall not use this value (even though it is included in the configuration for CFRA). So, we think then neither for CFRA nor for CBRA, this optimisation is applicable. [Intel] Agree with Samsung that this is currently not possible in the running CR.[QC] Agree with Samsung. According to RRC running CR, in rach-ConfigGenericTwoStepRA, the UE shall ignore *msgA-preambleReceivedTargetPower*, *preambleTransMax*, *msgA-powerRampingStep*, *msgB-ResponseWindow, msgA-TransMax* signaled within this field and use the corresponding values provided in *RACH-ConfigCommonTwoStepRA*.[OPPO]Same view with Samsung. But for 2-step CFRA and 2-step CBRA shared RO case, fallbackRAR can be multiplexed with the responses for other UEs (i.e. CFRA and CBRA share RO), should the response window be aligned with that for 2-step CBR? Or the NW will take care of this case?[Ericsson]: We do not think that this is too beneficial, so we agree with the other comments.[MTK] Agree with Samsung. However this is an optimization and not crucial for Rel-16. |
| 2 | * When the maximum number of msgA transmissions is reached, a 2-step Random Access problem is reported to upper layers.
* The UE should inform the gNB using RRC signalling (e.g. using MDT/SON framework) in case it experiences 2-step RA failure.
 | [10] | Rapporteur: Seems this should be discussed as part of MDT/SON.[Samsung]: Agree with rapporteur[vivo]: Same view as rapporteur.[LG] Agree with rapporteur[ZTE]: Same view as rapporteur[QC]: Agree with rapporteur[OPPO] Agree with rapporteur[MTK] Agree with rapporteur. |
| 3 | * The R-bit in the msgB BI subheader should be used to differentiate if after back off, the UE should continue with msgA transmission or switch to preamble transmission in the 4-step procedure.
* A UE receiving a back off indication for the 2-step RA procedure may switch to the 4-step procedure and do preamble transmission without back off if the 2-step and 4-step procedures have separate ROs.
 | [11] | Sony: Generally, we are ok with this. More specifically we prefer the 2nd proposal regardless whether 2-step and 4-step RACHs share same ROs or have separate ROs because the number of preambles for each may be different:* A UE receiving a back off indication for the 2-step RA procedure may switch to the 4-step procedure and do preamble transmission without back off ~~if the 2-step and 4-step procedures have separate ROs~~.

[HW] For the first proposal, we think it is optimization and not clear about the motivation. If the network wants the UE to fallback, at least for once, it can send fallbackRAR to the UE and the UE can also rely on the msgA-TransMax mechanism. For Second proposal, we think it is not optimization and reasonable. One step further, we think even for shared RO, the UE should not perform backoff since the code domain, 2-step/4-step are still separated.[Samsung]: Using backoff indication to switch to 4 step RA was discussed previously and not agreed. In our view current mechanism to switch to 4 step RA is sufficient.[Nokia]: We would be OK to specify the first alternative (ie., NW can indicate UEs to switch using 4-step RACH) or then something similar Sony proposes above (we don’t see a need to restrict this to separate ROs given the preambles are different in any case).[vivo]: In the previous RAN2#108 meeting, the BI-based solution for load balancing between 2-step and 4-step had been warmly discussed. And we had reached the agreement that this will be not supported for Rel-16. Thus, we prefer not to revert the achieved agreement.[Fujitsu] The proposals are OK to us. Depending on the burden of 2step ROs we believe the reserved bits of BI can be appropriately used by NW as the indication to send UE back to 4step RACH.[LG] RAN2 was discussed this overload control twice, and made the decision that this will not be supported for Rel-16.[ZTE]: We agree with Vivo. Similar solutions have been discussed in the past and we explicitly agreed that we will not use such mechanisms (for load balancing). So, we think this should not be discussed any further. [Intel] We have discussed this several time and had reconfirmed twice that such overload control is not supported in Rel-16. Also we do not see the need of such mechanism w.r.t access control and existing backoff mechanism.[QC]: We have already discussed in the previous meeting, and conclusion was that not to pursue this aspect in Rel-16. In addition, 2-step RACH already has method to switch to 4-step RACH. This optimization seems not needed in Rel-16.[OPPO] Agree not to introduce other indication than msgA-TransMax for RA type switching.[Ericsson]: We think that both would have minimal specification effort and greatly improves the network behavior. Furthermore we agree with some of the comments that the back off indication does not need to be only for separate ROs.[MTK] Agree with vivo. |
| 4 | * Allow connected UEs to also use preamble group B configured for idle/inactive UEs if the active BWP overlaps the 2-step resources on the initial BWP.
 | [12] | Sony: to reduce the resource wastage, it is reasonable to support this proposal.[vivo]: The preamble grouping and msgA PUSCH configurations are left to gNB implementation. In our understanding, if the gNB wants the CONNECTED UEs to utilize the PUSCH configuration B used for IDLE/INACTIVE UEs, it can configure the corresponding configurations in the active BWP as long as the maximum number of PUSCH configuration for this overlapped UL BWP is not larger than 2.[Fujitsu]: Not clear about the use case and necessity of this proposal. [LG] UE has to use only 2-step resources configured for the active BWP. If using 2-step resources on non-active BWP, network cannot know whether the UE has switched to initial BWP or not, considering autonomous BWP switching of NR-U.[ZTE]: We think this optimisation can be considered in future (i.e. not essential for Rel-16.[Intel] I think this has been discussed and agree to not consider this case for Rel-16[QC] Since we have agreed that only up to 2 PUSCH configuration from UE perspective, it seems not allow to have proposed configuration.[OPPO] Not sure how can this proposal work in the case where the msgA payload is failed decoded. gNB can not recognize this connected UE and determine the corresponding downlink BWP. The UE can not receive the NW response in this case. |
| 5 | * How to differentiate between msgB carrying RRC messages for a single UE and other messages (i.e. fallbackRAR, Backoff indicator (BI) and SuccessRAR without RRC messages) should be specified.
* Consider including RAPID, DMRS Port index and/or sequence index in the DCI payload to identify msgB with RRC messages for a single UE.
 | [17] | Sony: It is important that SRB RRC messages are transmitted in the second step of 2-step RACH (i.e. msgB) in order to achieve the benefit of latency reduction for 2-step RACH.So, we propose these proposals to be agreed.[HW] For proposal1, already handled by the current MAC spec.[vivo]: Agree with Huawei.SONY2: Replying to the above comments. The main point is the second proposal which will allow a network to be able to schedule multiple RRC messages separately in a slot or PDCCH monitoring occasion. This means that each UE should decode multiple msgBs (DCIs and PDSCHs) in a PDCCH monitoring occasion which will increase the complexity and power consumption. So, in order to reduce the complexity and power consumption, a UE should only decode multiple DCIs (but not PDSCHs), and DCI should contain information that identifies for the targeted UE whether to decode the PDSCH (PDU) or not. This information in the DCI payload is to identify msgB with RRC messages for a single UE. If this information is not present in the DCI payload, msgB will carry other messages (i.e. fallbackRAR, Backoff indicator (BI) and SuccessRAR without RRC messages).[LG] Same understanding as Huawei.[ZTE]: RAN2 discussed this in the past and concluded that the current mechanism of not using multiplexing for RRC message case and using multiplexing without RRC is the wayforward. We don’t think we should re-discuss this at the last meeting! [QC] The proposal is about the DCI payload which may have RAN1 impact. Should be discussed in RAN1 first.[OPPO] It can be an optimization. The random access procedure is completed upon receiving the corresponding successRAR even without RRC message. From the perspective of random access procudure, no much gain by introducing multiple MsgBs |
| 6 | * When CA is configured, msgB with PDCCH addressed to C-RNTI can be cross-scheduled by the PCell.
 | [22] | Rapporteur: I believe this is not precluded (so perhaps no need to discuss this in any case?)Sony: The DCI that carries msgBis DCI format 1\_0 and it does not support“Carrier indicator” field. So, this proposal cannot be simplysupported in RAN2.[HW] WE share the same view with the rapporteur in a certain level. This will affect the stage2 spec only. For DCI 1\_0, this corresponds to the normal case of scheduling with PDCCH addressed to C-RNTI, not sure why carrier indicator is not supported. [Nokia]: Agree with rapporteur.[vivo]: Same view with the rapporteur.[Fujitsu]: Same view with rapporteur.[LG]: Agree with rapporteur. This has already been discussed.[ZTE]: Agree with rapporteur, if there are any restrictions in DCI format, then these can be discussed in RAN1. [OPPO] Agree with rapporteur. |
| 7 | * Allow a triggered BSR to be transmitted over 2-step Random access and not trigger/cancel pending SR.
* UE should continue to monitor as it does for the scheduling request after transmitting the BSR in 2-step RA.
* MsgB monitoring when transmitting BSR in 2-step should not required.
 | [31] | Sony: We think this can be discussed in Rel-17 small data transmission WI. Hence, not in Rel-16.[HW] BSR transmission can already be supported if LCP allows it. [vivo]: Agree with Huawei. Additionally, there is no need to cancel the pending SR since the UE anyway will get a RAR grant for BSR transmission during the RA procedure.[LG] If network wants UE to send BSR using 2-step RA, the network doesn’t have to configure SR resources. In the current MAC specs, UE triggers RA procedures if there is no valid SR resource.[ZTE]: we agree with comments above that this is not needed. [Intel] This is already possible via SR transmission random access, if no dedicated SR is configured.[QC] Detailed can be discussed in Rel-17. |
| 8 | * Support configuration of CP extension also for msgA PUSCH.
* Configuration of CP extension for msgA PUSCH can be carried in SIB and dedicated RRC signalling
* RAN2 sends an LS to RAN1 asking them to specify CP extension for msgA
* Allow usage of the msgA-ssb-sharedROmaskindex also for the non-shared RO case.
* If Proposal 4 is not agreed, support that the UE can be configured to only use the last RO in the PRACH slot.
* RAN2 sends an LS to RAN1 asking them to allow usage of the msgA-ssb-sharedROmaskindex also for the non-shared RO case.
 | [33] | Rapporteur: The proposals basically optimize for the case when there is a large gap between PUSCH and RACH of MSGA (which necessitates extra LBT) – formats without this gap are also possible.[HW] This can be done in RAN1 first if they think it is necessary.[vivo]: Agree with Huawei. By the way, regarding P4 and P5, they had already been discussed in past RAN1meetings. We prefer not to ask RAN1 to discuss these proposals again in the stage.[LG]: Agree with Huawei.[ZTE]: Agree that these can be discussed in RAN1 if needed. Not necessary for Rel-16. [Intel] This is more in the RAN1 scope and NR-u.[QC] Should discuss in RAN1 first.[OPPO] Agree with Huawei.[Ericsson]: Without this we cannot support short preamble formats without using 2 LBTs. These formats are essential to small cells which to our understanding is the primary use case for 2-step RA. |
|  |  |  |  |

|  |
| --- |
| **Q 2.1.1: Do companies agree that the proposals in Table 1 are optimisations (i.e. not essential for 2-step RACH)?** |
| Company | Yes/No (if you think any of the proposal is essential for the feature, please indicate more details in **Table 1** comments section for the corresponding set of proposals) |
| SONY | No. We think proposals 3, 4 and 5 are essential features and must be discussed, please see our comments on each item. |
| Huawei | No, see the comments above |
| Samsung  | See comments above |
| Nokia, Nokia Shanghai Bell | Yes, proposal #3 we’re OK to consider as this seems to be simple to implement. |
| Potevio | Yes |
| vivo | Yes but P1and P2 can be considered further. |
| Fujitsu | Yes, but we are fine to have proposal 3 re-discussed within Rel-16. |
| LG | Yes. |
| ZTE | Yes, we think none of the proposals above are essential for the feature to work.  |
| Intel | See our comments above |
| Qualcomm | Yes. |
| OPPO | Yes. |
| Ericsson | 8) is essential for the most basic use case of 2-step RA and the proposals in 3) are beneficial and does not seem to have a lot of specification impact. |
| MediaTek | Yes |
| CATT | Yes. In short we found none of them critical. We can move forward without those in R16. |

# Proposals to fix a new issue or change existing agreements

For these issues, companies can add any existing means (i.e. using the current framework of agreements in 2-step RACH) to fix the identified issue – Add this in the 4th column (under Alternatives).

Then companies can also comment on the issue itself and the need to resolve this in Rel-16 etc (in the last column).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Proposals** | **Ref** | **Alternatives** **(which require no changes to the current status)** | **Company comments** **(please answer the following question for each proposal)****Q: Do we need the proposed fix in Rel-16?**  |
| 1 | * For PDCCH order initiated CFRA (i.e. random access procedure is initiated by PDCCH order and the ra-PreambleIndex explicitly provided by PDCCH is not 0b000000), if 4 step PRACH occasions are not configured in active UL BWP: switch the active UL BWP to BWP indicated by initialUplinkBWP; if the Serving Cell is an SpCell: switch the active DL BWP to BWP indicated by initialDownlinkBWP
 | [5] | Rapporteur: Seems one option is toleave this to network implementation (i.e. why should network initiate 4-step CFRA on a BWP where there are no 4-step ROs?) | [HW] NO need, agree with the rapporteur that this can be handled by network implementation. If 4-step RACH resource is not configured, then network should not send PDCCH order triggered 4-step CFRA.[Samsung]: For PDCCH order initiated CFRA, if 4 step ROs are not configured in active UL BWP, UE will switch to initial BWP and perform CFRA. This is a release 15 behaviour. This behaviour should not be changed.Regarding Rapporteurproposal: We cannot mandate a specific network implementation. Network may support 4 step ROs only in initial BWP. Just to support PDCCH order initiated CFRA, network will not always keep UE in initial BWP or configure each BWP with 4 step ROs.[Nokia]: Agree with rapporteur, this seems like a network error which we don’t usually specify.[Potevio]: No, agree with the rapporteur.[vivo]: Agree with the rapporteur. We think the smart network can avoid this situation[Fujitsu]: We don’t think it’s necessary to capture the proposal into spec because NW is not likely to send PDCCH order on a BWP without 4-step RA resource.[LG]: Agree with rapporteur.[ZTE]: Can be left to network implementation. [Intel] Agree with the rapporteur this can be solved by network.[QC]: Same view with Samsung. It is good to specify much clearer.[OPPO]The proposed fix is needed. It has been agreed that for random access initiated by PDCCH order, if PDCCH order includes non-zero RA preamble index, UE selects 4 step RA i.e. UE will perform legacy CFRA. BWP operation is performed before RA type selection, UE should select the BWP with 4-step RA resource to implement the agreement.[Ericsson]: It can be handled by network implementation, in other words to not configure a faulty network implementation.[MTK] Agree that the network should avoid this scenario.[CATT] Agree that this can be handled via implementation.  |
| 2 | * The following operation is not supported:
	+ if the uplink grant for HARQ process zero is received for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the HARQ process zero was for the transmission of the MSGA payload, UE consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.

Note: This proposal is already included in the running CR. However, this issue is still included here because, it seems if we go this way, then upon the completion of CFRA RACH procedure, the HARQ buffer for HARQ process 0 is flushed (this happens even if MSGA payload is lost in case of CFRA) and if the MSGA payload is lost, then HARQ retransmission of the MSGA payload using C-RNTI based grant for CFRA case is not possible (since the HARQ buffer is flushed). A simple fix for this could be to agree the proposal from Samsung as above, **but to not flush the HARQ buffer in case of CFRA for 2-step RACH**. | [6] | Note: companies are invited to comment on the highlighted issue and the proposed fix (to not flush the HARQ buffer for the CFRA case, assuming the proposal from Samsung is acceptable, as already implemented in the running CR). | [HW] not sure why this is needed, if the msgA payload needs retransmission, the network can send fallback RAR to the UEWant to double check with the rapporteur whether the following spec is the spec that you referred to on covering the proposal, does the “configured grant” include the msgA resource configuration?*If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running timeAlignmentTimer and for each grant received for this PDCCH occasion:**1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or**1> if an uplink grant has been received in a Random Access Response:**2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:*3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.[Samsung]: No strong view.[Nokia]: First of all, we did not understand rapporteur’s comment about the flush of HARQ buffer creating any issue? When the grant is received in fallbackRAR, the MAC PDU is obtained in the MSGA/Msg3 buffer and so it does not matter even if the HARQ buffer was flushed upon completion. Note that the MSGA/Msg3 buffers are flushed only upon initiation of the next RA.Then, we think the proposal is fine that the C-RNTI grant we consider NDI to have been toggled. However, we realized that re-transmission possibility should be given for the NW and the UE, hence, it seems we after all should not ignore the TC-RNTI provided in fallbackRAR but that should be used for possible re-transmission grant (as with CBRA). It should be noted that the NW has to provide TC-RNTI value different from the C-RNTI to the UE to enable re-tx.[Potevio]: In our understanding, if MSGA payload is lost in case of CFRA, the CFRA procedure should not be deemed completed successfully, as thus the HARQ process #0 buffer could not be flushed.[vivo]: It seems the issue raised by the rapporteur will only happen in 2-step CFRA. In this case, if MsgA preamble is successfully detected while the MsgA PUSCH (e.g. C-RNTI + complete message) is not, for safe, a smart NW should respond to UE with the FallbackRAR instead of the absolute TA MAC CE. This is because the NW cannot know whether the complete message is included in the MsgA payload or not. Then the UE will complete the 2-step CFRA, obtain the MAC PDU from MsgA/3 buffer, and store it in HARQ buffer 0 for transmission. From this perspective, retransmission is possible based on the current MAC running CR. We don’t think we need to specify anything new.[FJ]: We think there could be two possible solutions for 2step CFRA:1. The retransmission of MSGA is based on the PDCCH addressed to C-RNTI.

NW delivers the absolute TA MAC CE with C-RNTI on successful reception of preamble, regardless of the PUSCH is received or not. UE will regard the RA is completed by receiving the absolute TA MAC CE scheduled by PDCCH addressed to C-RNTI. In that case, the HARQ buffer of process 0 should not be flushed on “completion of RA”, otherwise UE will consider the following DCI scheduling with C-RNTI as a grant of new transmission that MSGA HARQ retransmission is not possible.1. The retransmission of MSGA is based on Fallback RAR.

NW does not deliver the absolute TA MAC CE with C-RNTI unless the PUSCH is received successfully. Fallback RAR is used when only preamble is received, which means the buffer will not be flushed until the completion of the PUSCH transmission. In that case the issue rapporteur mentioned is not exist.We should decide which option to use. If option 2) is applied to 2step CFRA, no change of spec is needed.[LG]: If preamble is detected but payload is not successfully received, network sends Fallback RAR to UE.[ZTE]: We have similar view as FJ/Vivo. It seems there are two alternatives: 1. Do nothing: in this case, retransmission for the lost payload of MSGA for CFRA can be scheduled via fallbackRAR (i.e. no retransmission possible with C-RNTI based scheduling since HARQ buffer for HARQ process 0 is flushed) and new transmission can be scheduled using C-RNTI (NDI will be toggled).
2. Fix the MAC spec such that HARQ buffer for HARQ process 0 is not flushed for CFRA (this needs change to MAC spec, but seems a simple change).

We have a preference for option 2) above.[Intel] Based on Vivo’s understanding, we also do not see a strong view either way. It should be stick to whatever it is previously for Msg3.[QC] For 2-step CFRA, if preamble of msgA is received by network while payload of msgA is not decoded successfully, network should send fallbackRAR instead of absolute TA MAC CE. Based on the UL grant received from fallbackRAR, UE obtains the MAC PDU from MSGA/msg3 and do retransmission. (as 2-step CBRA)[OPPO] FallbackRAR can take care of this case. No change is needed.[Ericsson]: We would think that even if HARQ buffer is flushed, there would be a message in msgA/3 buffer. Open to discuss if to allow for retransmissions.[MTK] Firstly we could not find the relevant text (“or determined as specified in subclause 5.1.2a for the transmission of the MSGA payload”) in the running CR as Huawei also mentioned above. Could the rapporteur please clarify if this text is missing in the running CR (R2-2000997)?As for flushing the HARQ buffer, we agree with Nokia that when the UE receives fallbackRAR for retransmission of MsgA payload, the TB will be obtained from the MsgA buffer, not from the HARQ buffer. Therefore toggling the NDI for the HARQ buffer when an UL grant addressed to C-RNTI will not cause loss of MsgA payload.[CATT] The option of ‘do nothing’ is OK for us. |
| 3 | **Proposals from [9]:** * During the random access resource selection, the MAC entity may exclude the preambles not mapped to valid PUSCH occasions when selecting the random access preamble.
* The MAC entity may exclude the PRACH occasions not mapped to valid PUSCH occasions when determining the next available PRACH occasion corresponding to the selected SSB.
* Upon transmitting MsgA with only PRACH preamble in a PRACH occasion where PRACH occasion is not mapped to a valid PUSCH occasion:
	+ UE monitors PDCCH addressed to MsgB-RNTI in MsgB reception window for fallbackRAR.
	+ MsgB reception window starts at the first PDCCH occasion that is at least one symbol away from the end of PRACH occasion in which preamble is transmitted.

**Proposals from [25]:*** In case of the selected preamble without associated PUSCH occasion, the UL grant and the associated HARQ information is not delivered to the HARQ entity
* In case of the selected preamble without associated PUSCH occasion, the MAC entity does not indicate the associated PUSCH resource.
 | [9], [25] | Rapporteur* Proposals in Green: It seems L1 specs already specify that UE does not transmit on PUSCH if it is not mapped to a valid resource, so may be nothing more is needed?
* The proposals in Red are optimizations
 | [HW] For [9], Proposal 1: we think the proposal is needed from MAC prespective, since, during preamble selection, we only say that preamble should be randomly selected within the selected group of preamble. At least we should try to align with the RAN1 spec if it already has it. Proposal 2: This is also necessary. But if RAN1 has defined what does “valid” PRACH occasion mean and change it to “the PRACH occasion that can be mapped to valid PUSCH occasion”, probably, nothing is needed from RAN2 point of viewProposal 3: I think this is covered by the email discussion organized by IDC in NRU sessionFor [25],Proposal 1: this is natural and causal because if there is not PUSCH, there is no HARQ information can be delivered to the HARQ entityProposal2: this scenario is possible according to the Ran1 discussion. Like proposal 1, this also looks very natural[Samsung]: Proposals in green from [9] are not covered by L1 specs. So we disagree with rapporteur. These proposals are needed so that UE can avoid situation where preamble/ROs selected by it are not mapped to a valid PRU.Proposals in red from [9] are not optimization. As per RAN1, UE may only transmit preamble and not PUSCH if there is no valid PUSCH. In case question is when to start the response window. This is needed unless we agree and inform RAN1 that if there is no valid PUSCH resource, UE will not transmit MsgA preamble. [Nokia]: We think simplest would be not to even consider the preamble as valid, ie., why not wait for the next valid MSGA occasion? In any case, it seems this does not have any MAC impact.[Potevio]: No, agree with the rapporteur.[vivo]: We agree with the rapporteur. In the previous RAN1#98bis/99 meeting, the following agreement has been achieved:* The starting of msgB window should follow that defined for 2-step RACH regardless of failure of LBT for msgA PUSCH.
* (Working Assumption) The preambles without associated PRUs can be used for msgA transmission (preamble only) for 2-step RACH.

In our understanding, the case proposed by Samsung is similar to the NR-U case that msgA preamble is transmitted while LBT fails for msgA PUSCH. The starting point of msgB response window is crystal clear in the current MAC specification (i.e. it is started once the msgA preamble is actually transmitted).[Fujitsu]: We think proposals in green from [9] should not be captured in spec, UE may or may not avoid selecting the preamble or RO mapping to invalid PUSCH occasions. Because RAN1 has assumed preambles without associated PRUs are not forbidden just as vivo pointed out. The first proposal in red from [9] and proposals from [25] are related to the case that the preamble is associated to an invalid PRU, we think the case is quite similar to NR-U that preamble is sent with LBT failure to PUSCH. In NR-U there is an open issue whether UE should only monitor MSGB-RNTI, i.e. should not monitor C-RNTI, when PUSCH is LBT failure. We can wait for the result of NR-U discussion on that open issue.[LG]: Agree with the rapporteur and Nokia. Simple way is that UE performs the same operation regardless of whether PUSCH is valid or not.[ZTE]: RAN1 specs already has the following: **213 section 8.1A**"*A UE does not transmit a PUSCH in a PUSCH occasion if the PUSCH occasion is not mapped to a valid PRACH occasions. A UE can transmit a PRACH in a valid PRACH occasion if the PRACH occasion is not mapped to a valid PUSCH occasion.*"So, according to the above, if PUSCH resource is not valid, the L1 will simply skip the PUSCH transmission. Then, we don’t need to do anything in MAC (we simply rely on fallback). Starting MSGB window early in this case is an optimization which can wait. We also agree with Nokia that in this case we can also allow the UE to wait for the next valid MSGA resource, but this need not be specified (i.e. no changes to MAC spec as Nokia clarify). [Intel] We also think there should not be restriction to not use PRACH occasion without an associated PRU. This should be not visible from MAC pov and the UE MAC will follow the fallback case, similar to PUSCH failure due to LBT.[QC] RAN1 already specified this. Agree with ZTE.[OPPO] For proposes in green of [9], As specified in 38.213 ‘A UE does not transmit a PUSCH in a PUSCH occasion if the PUSCH occasion is not mapped to a valid PRACH occasions. A UE can transmit a PRACH in a valid PRACH occasion if the PRACH occasion is not mapped to a valid PUSCH occasion.’. Thus, MAC does not need to take whether there is PRUs associated with the selected preamble.For proposal in red of [9], the MAC entity should start msgB-ReponseWindow at the first PDCCH occasion from the end of the MsgA transmission. I think UE does not need to set aside this time interval.Agree with the proposal in green of [25].[Ericsson]: For us it would seem odd if RAN1 first introduce the possibility of having these invalid PUSCH occasions and then RAN2 introduce the possibility of allowing the UE to not consider them. Furthermore to introduce the proposals in red does not seem particularly beneficial, and that the current way that RAN1 defined the start of msgB-ResponseWindow also works for this case even when there are invalidated PUSCH occasions. [MTK] For [9], P1 and P2: Leave it to UE implementation to select or skip preambles/ROs not mapped to POs. For P3, a clarification may be needed on when to start the MsgB-window. For [25], agree that these proposals are normal consequences if we allow the UE to transmit preamble without PUSCH (i.e. as per RAN1 assumption).[CATT] Agree with ZTE.To change previous agreement regarding starting point of RAR reception window is not justified. |
| 4 | * Differentiate between RNTI for CFRA and RNTI for CBRA in Rel-16 by employing offset values of symbol index (s\_offset) and slot index (t\_offset) into the equation of msgB-RNTI as follows:

 msgB-RNTI-CFRA = 1 + s\_new\_id + 14 × t\_new\_id + 14 × 80 × f\_id + 14 × 80 × 8 × ul\_carrier\_id+ 14 × 80 × 8 × 2;where s\_new\_id = (s\_id + s\_offset) modulo 14, and s\_offset is an offset value (0 <s\_offset< 14) from the legacy starting OFDM symbol s\_id, and t\_new\_id = (t\_id + t\_offset) modulo 80, and t\_offset is an offset value (0 ≤t\_offset< 80) from the legacy slot index with PRACH occasion t\_id. Other parameters can be same as defined by the legacy equation for msgB-RNTI.* The offset values of symbol index (s\_offset) and slot index (t\_offset) for CFRA are configurable and signalled to the UE while in RRC connected mode.
 | [18] | Rapporteur* Seems this issue is also being discussed for legacy 4-step RACH too.
* Seems any fixes agreed for 4-step RACH can be absorbed into 2-step RACH if needed (otherwise no changes).
 | SONY: We believe this is a big issue and needs to be fixed for 2-Step RACH first, because to fix 4-Step RACH may take time due to slow progress inNR TEI16.[HW] Agree with the rapporteur that this has been extensively discussed during R15 and LTE. Hence no need[Samsung]: We have discussed this issue in R15 for 4 step CFRA. It was agreed that this can be handled by network implementation (e.g. appropriate allocation of CFRA preamble).[Nokia]: So far we have not agreed the CFRA could be configured with dedicated RACH occasions to CBRA, hence, the issue should not exist? On the other hand, similar to Rel-15 with 4-step RACH, this should be firstly considered as up for NW to resolve.SONY2: Responding to the above comments. We agreed today that “Dedicated msgA PRACH occasions are optionally configured for 2-step CFRA. If not configured, msgA PRACH occasions for 2-step CBRA are used”, so the issue exists.In addition, we identified many PRACH configurations that network implementation cannot resolve.[Potevio]: No, the proposal is an optimization.[vivo]: Agree with the rapporteur.[Fujitsu]: Agree with rapporteur.[LG]: Agree with Samsung.[ZTE]: Since the issue also exists for 4-step RA, we think this should be fixed there first (and we can copy the solution into 2-step at the same time). [QC]: Agree with rapporteur.[OPPO] Agree with rapporteur. No proposed fix.[Ericsson]: We tend to agree with the other comments. If this was not pursued in rel-15, then see no reason why 2-step RA should pursue it. [MTK] Agree with rapporteur. |
| 5 | * RAN2 to agree not to have preamble partitioning for 2-step RA procedure in Rel-16
 | [27] | Rapporteur: Network has to know the TB configuration of PUSCH and hence the current frame work was agreed. | [HW] agree with the rapporteur[Nokia]: Agree with rapporteur.[vivo]: Agree with the rapporteur.[LG]: Agree with rapporteu[ZTE]: Agree with the rapporteurr.[QC]: Agree with rapporteur.[OPPO] Agree with rapporteur[MTK] Agree with the rapporteur. Note also that preamble partitioning is optional. |
| 6 | * When a new RA procedure for 2-step RA type is initiated, UE may postpone performing the RA procedure if HARQ process ID ‘0’ is being used for the payload which has been transmitted via UL grant received in response to CFRA.
 | [30] | * Rapporteur: Seems this issue also exists then for 4-step RACH? If this is the case then no need to discuss this.
 | [HW] Still can be based on UE implementation[Samsung]: Agree with Rapporteur[Nokia]: Agree with rapporteur.[Potevio]: No, in our opinion, at any moment, there is only one ongoing RA procedure, then the scenario described in this issue is not reasonable.[vivo]: Same view with Huawei.[Fujitsu]: Agree with rapporteur.[LG] For 4-step RA, this case happens when UE sends msg3 (at third step) in new RA procedure. However, for 2-step RA, this case happens when UE sends msgA (at first step) in new RA procedure. Thus, this case can happen more frequently in 2-step RA than 4-step RA. This issue needs to be addressed.[ZTE]: Agree with rapporteur. [OPPO] Agree with rapporteur.[Ericsson]: Agree with rapporteur.[MTK] Agree with Huawei, leave it to UE implementation. |
| 7 | * for both 2-step CFRA and CBRA, if fallbackRAR is received with Temporary C-RNTI set to the UE’s C-RNTI, the RA procedure is completed and the UL grant in the fallbackRAR is used for new transmission; otherwise the UL grant is used for retransmission of the MSGA payload.
 | [37] | Rapporteur: The agreement was to use fallbackRAR for retransmission (if reception of payload fails), but seems the proposal is to use fallbackRAR also for new transmission. Then this seems to be an optimization? For retransmission, the only issue seems to be with flushing of HARQ buffer in case of CFRA upon RA completion – see #2 above, is this issue related?  | [HW] For 2-step CFRA, current spec already uses this for new transmission. What needs to be changed?For 2-step CBRA, receiving TC-RNTI in fallback doesn’t mean RA procedure is completed[Samsung]: We have agreed that in case MsgA payload is not received Fallback RAR is sent. UE will retransmit MsgA payload in this case. So we do not agree with proposed enhancement.[Nokia]: The HARQ buffer is flushed but not the MSGA buffer in case of CFRA, hence, there is no issue of buffer flush – see our comment to #2. The proposal is to use the fallbackRAR to provide UE with TAC along with UL grant that can be used to transmit new data/BSR when the TC-RNTI field matches with the C-RNTI field. When it does not match, the UE sends re-transmission of MSGA payload and uses TC-RNTI for possible re-tx grant.[Potevio]: No, agree with rapporteur, the proposal is an optimization.[vivo]: For simplicity, we prefer to unify the UE behavior for the reception of the FallbackRAR.[Fujitsu]: Not quite understand what’s the advantage for fallback RAR to schedule new data. New data can be sent after completion of RA.[LG] Fallback RAR is used only if preamble is detected but payload is not successfully received.[ZTE]: We are not sure about the usecase. Why can’t the network terminate RACH procedure and scehedule new transmission (instead of using the grant in fallbackRAR for new transmission)? We don’t think this is needed. [Intel] The UL grant in fallback should be used for this case for the retransmission of MsgA PUSCH. We do not see why we need to block this case.[QC]: This optimization can be discussed in Rel-17.[OPPO] No proposed fix. For 2-step CBRA, when more than one UE select the same preamble and RO, they will detect and decode the same MsgB and the same fallbackRAR. If the fallbackRAR is scheduling a new transmission for one UE while other UEs may treat it as a retransmission indication. The proposed enhancement may affect the normal fallback scheduling in 2-step RACH procedure.[MTK] Agree with the rapporteur that this is an optimization. We prefer not to change the existing fallback purpose/procedures.[CATT] Not so sure about the motivation of this proposal. |

# Conclusion and proposals

The following proposals are made:

TBD

# References

Note: All the references in Red are part of discussions that are captured in the running CR open issues in[31], [32] and [33] or already reflected in the running MAC CR. So, these are not considered in the summary.

1. R2-2000141 Simultaneous BWP Switching and Contention Resolution in 2-step RACH vivo discussion
2. R2-2000142 Resource Selection for 2-step RACH Considering Measurment Gap vivo discussion R2-1914377
3. R2-2000143 Handling of the Collision Between MsgA Grant and Another UL Grant vivo discussion
4. R2-2000144 Discuession on the MsgB Response Window for 2-step CFRA vivo discussion
5. R2-2000220 Handling PDCCH Order Initiated CFRA Samsung Electronics Co., Ltd discussion Rel-16 NR\_2step\_RACH-Core
6. R2-2000221 NDI Toggling Aspects Samsung Electronics Co., Ltd discussion Rel-16 NR\_2step\_RACH-Core
7. R2-2000222 Preamble Group Selection upon switching from 2 step CFRA to 2 step CBRA Samsung Electronics Co., Ltd discussion Rel-16 NR\_2step\_RACH-Core
8. R2-2000223 Preamble Group Selection upon switching from 2 step to 4 step RA Samsung Electronics Co., Ltd discussion Rel-16 NR\_2step\_RACH-Core
9. R2-2000225 Handling Preambles not associated with PRUs Samsung Electronics Co., Ltd discussion Rel-16 NR\_2step\_RACH-Core
10. R2-2000388 Preamble group selection and 2-step failure reporting Ericsson discussion Rel-16 NR\_2step\_RACH-Core
11. R2-2000389 Combined Back-off and 4-step switch Ericsson discussion Rel-16 NR\_2step\_RACH-Core
12. R2-2000391 Use of 2-step resources on different BWPs Ericsson discussion Rel-16 NR\_2step\_RACH-Core
13. R2-2000408 Issues on preamble group selection for 2-step RACH OPPO discussion Rel-16 NR\_2step\_RACH-Core
14. R2-2000409 Measurement gap impacts on MSGA transmission OPPO discussion Rel-16 NR\_2step\_RACH-Core
15. R2-2000777 Discussion on preamble group selection for 2step RACH initiated by HO Fujitsu discussion Rel-16 NR\_2step\_RACH
16. R2-2000812 Views on Remaining MAC Issues for 2-Step RACH CATT discussion NR\_2step\_RACH-Core
17. R2-2000831 Differentiating between MsgB carrying RRC and other messages Sony discussion Rel-16 NR\_2step\_RACH-Core R2-1915240
18. R2-2000833 msgB-RNTI ambiguity for CFRA and CBRA of 2-Step RACH Sony discussion Rel-16 NR\_2step\_RACH-Core
19. R2-2000852 2-step CBRA preamble group selection Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_2step\_RACH-Core
20. R2-2000853 Need for ra-MsgASizeGroupA parameter Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_2step\_RACH-Core
21. R2-2000951 Remaining issues on the msgA transmission Huawei, HiSilicon discussion Rel-16 NR\_2step\_RACH-Core
22. R2-2000952 Remaining issues on MsgB reception Huawei, HiSilicon discussion Rel-16 NR\_2step\_RACH-Core
23. R2-2000953 Draft LS to RAN1 on LSBs of SFN Huawei, HiSilicon discussion Rel-16 NR\_2step\_RACH-Core
24. R2-2000954 Open issues on MAC spec for 2-stepRACH Huawei, HiSilicon discussion Rel-16 NR\_2step\_RACH-Core
25. R2-2000955 MAC handling of MsgA with invalid PUSCH Huawei, HiSilicon discussion Rel-16 NR\_2step\_RACH-Core
26. R2-2001017 Remaining issues on 2-step CBRA Qualcomm Incorporated discussion Rel-16 NR\_2step\_RACH-Core
27. R2-2001125 Preamble grouping for 2-step RA NEC Telecom MODUS Ltd. discussion
28. R2-2001510 Further discussion on preamble group selection LG Electronics discussion NR\_2step\_RACH-Core
29. R2-2001512 Draft 38.321 CR on preamble group selection for 2-step RA type LG Electronics draftCR Rel-16 38.321 15.8.0 C NR\_2step\_RACH-Core
30. R2-2001529 Remaining issue on user plane aspects LG Electronics discussion NR\_2step\_RACH-Core

1. R2-2000390 BSR over 2-step RA Ericsson discussion Rel-16 NR\_2step\_RACH-Core
2. [R2-2000392](file:///C%3A%5Cevutukuri%5Cwork%5C5G%5CRAN2%5Cdocs%5CR2-2000392.zip) Beam specific 2-step RA support Ericsson discussion Rel-16 NR\_2step\_RACH-Core

1. [R2-2000393](file:///C%3A%5C%5CUsers%5C%5Cpanidx%5C%5CDocuments%5C%5CRAN2%5C%5CTSGR2_109_e%5C%5CDocs%5C%5CR2-2000393.zip) MsgA transmission for NR-U Ericsson discussion Rel-16 NR\_2step\_RACH-Core
2. [R2-2000916](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2000916.zip) Discussion on the release of the PUSCH resources CMCC discussion Rel-16
3. [R2-2000917](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2000917.zip) Remaining issues on 2-step CFRA CMCC discussion Rel-16
4. [R2-2000926](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2000926.zip) Open issues for 2-step CFRA CMCC discussion Rel-16 Revised

1. R2-2000943 MSGB for CFRA Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_2step\_RACH-Core
2. [R2-2000956](file:///C%3A%5Cevutukuri%5Cwork%5C5G%5CRAN2%5Cdocs%5CR2-2000956.zip) Prioritized 2-step RACH Huawei, HiSilicon discussion Rel-16 NR\_2step\_RACH-Core
3. [R2-2001032](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2001032.zip) Remaining issues on 2-step CFRA Qualcomm Incorporated discussion Rel-16 NR\_2step\_RACH-Core
4. [R2-2001095](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2001095.zip) RAN2 aspect of UE capability for 2-step RACH Intel Corporation discussion Rel-16 NR\_2step\_RACH-Core
5. [R2-2001102](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2001102.zip) Discussion on MsgB PDCCH Potevio Company Limited discussion Rel-16 NR\_2step\_RACH-Core
6. [R2-2001471](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2001471.zip) Further discussion on 2-Step CFRA CMCC discussion Rel-16 [R2-2000926](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2000926.zip)
7. [R2-2001514](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2001514.zip) Releasing CFRA resources for 2-step RA type LG Electronics discussion NR\_2step\_RACH-Core
8. [R2-2001515](file:///C%3A%5CUsers%5Cpanidx%5CDocuments%5CRAN2%5CTSGR2_109_e%5CDocs%5CR2-2001515.zip) Draft 38.321 CR on release of CFRA resource for 2-step RA type LG Electronics draftCR Rel-16 38.321 15.8.0 B NR\_2step\_RACH-Core
9. R2-2001518 Draft 38.331 CR on release of CFRA resource for 2-step RA type LG Electronics draftCR Rel-16 38.331 15.8.0 NR\_2step\_RACH-Core

**Summary documents**

1. **R2-2000995 Summary of open issues in MAC running CR - Updated ZTE Corporation (email discussion rapporteur) discussion Rel-16 Late**
2. **R2-2000992 Summary of running MAC CR review issue list - phase 1 ZTE Corporation (email discussion rapporteur) report Rel-16**
3. **R2-2000993 Summary of running MAC CR review issue list - phase 2 ZTE Corporation (email discussion rapporteur) report Rel-16**