**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 already discussed 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 of optimisations (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**

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| **#** | **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. |
| 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.  |
| 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] |  |
| 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] |  |
| 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] |  |
| 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?) |
| 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] |  |
| 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.  |
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| **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) |
|  |  |

# 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).

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| **#** | **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 to leave this to network implementation (i.e. why should network initiate 4-step CFRA on a BWP where there are no 4-step ROs?) |  |
| 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). |  |
| 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
 |  |
| 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).
 |  |
| 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. |  |
| 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.
 |  |
| 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?  |  |

# Details of preamble grouping

For the preamble grouping, it is not clear whether companies have the same understanding on the current implementation in the running CR and whether all companies agree on the basic requirements. Given that this might generate more discussion, the recommendation from the chairman was to discuss the details further in this email discussion (although we will try to agree this during the online session on Wednesday the 26th Feb).

Firstly, based on the agreements made so far, the following design principles apply for 2-step RACH:

1. When CFRA is configured, UE shall be able to use the CFRA based PUSCH payload for MSGA (even after switching to CBRA temporarily) – this is same as in 4-step RACH
2. When switching between CBRA and CFRA there shall be no rebuilding (this is an agreement made during 2-step RACH discussion)

Q 2.3.1 First question is whether companies agree with the above principles

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| **Q 2.3.1: Do companies agree with the principles in a) and b) above?**  |
| Company | Yes/No (explain why, in case your answer is No) |
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If we assume a) and b) are agreeable, then it seems we have only 2 options so far:

1. When CFRA is configured; if the UE needs to select a preamble group (e.g. upon switching to CBRA), the UE selects the preamble group based only on the payload size of CFRA and the payload sizes (s) of CBRA preamble groups (i.e. pathloss criterion is not evaluated).
2. Network configures the preamble group to be used in CFRA signaling.

Note that in a way, option 1) and option 2 are not too different. Even if we go with option 1), by indicating a payload size for the CFRA PUSCH payload grant the gNB is implicitly making the preamble group choice on behalf of the UE. So, in the end, the only difference between option 1) and option 2) is that option 1) requires no additional signaling but option 2) will require this.

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| **Q 2.3.2: Do you prefer option 1 or option 2?**  |
| Company | Option 1 or option 2? (and any comments) |
|  |  |

Finally, the proposal is to use the same option (whichever is chosen above) when the UE switches to 4-step RACH (after N failures). This may be needed in case the UE uses only CFRA attempts N number of times and then switches to 4-step RA, then the UE will need to perform preamble group selection after having switched to CBRA. So, the final question is whether we can use the same principle when UE switches to 4-step RACH.

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| **Q 2.3.3: Do companies agree that we use the same option as the one chosen in Q2.3.2 for the case when UE switches to 4-step RA (after N failures of 2-step CFRA if configured)** |
| Company | Yes/No (and any comments) |
|  |  |

# 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**