**3GPP TSG-RAN WG1 Meeting #104-e R1-210xxxx**

**e-Meeting, Jan 25th – Feb 5th, 2021**

**Agenda Item: 7.2.1**

**Source: Moderator (ZTE)**

**Title: Summary of email discussion for [104-e-NR-2step-RACH-01]**

**Document for: Discussion**

# Introduction

This document is intended to address the following corrections for 2-step RACH by email discussion.

[104-e-NR-2step-RACH-01] Corrections of 2-step RACH related issues till 1/28 – Li (ZTE)

* CR in R1-2008785, CR in R1-2101526, and TP in R1-2101573

# Correction on DMRS configuration for MsgA in 38.214

In R1-2100243, it is proposed to clarify that for MsgA PUSCH transmission, if a UE is not configured with *msgA-PUSCH-NrofPort*, the UE shall assume that it is only for the case of double-symbol DM-RS that 4 ports are configured per DM-RS CDM groups, because it should be clear that for single-symbol DM-RS case, there can be at most 2 ports configured per DM-RS CDM group.

And for MsgA PUSCH transmission, only PUSCH DM-RS configuration type 1 is supported, and there is no higher layer parameter “*dmrs-Type*”. It is proposed to make the correction in 38.214, similar to what has been provided in 38.211.

***Proposal 1:***

* Adopt the following TP#1 in 38.214, to clarify that it is “for double-symbol DM-RS” for MsgA PUSCH transmission when the UE is not configured with *msgA-PUSCH-NrofPort*, and remove the higher layer parameter “*dmrs-Type*” for MsgA PUSCH transmission.

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| **Reasons for change**1. It is clear that there can be at most 2 ports configured per DM-RS CDM group for single-symbol DM-RS case. Then for MsgA PUSCH transmission, if a UE is not configured with *msgA-PUSCH-NrofPort*, the UE shall assume that it is only for the case of double-symbol DM-RS that 4 ports are configured per DM-RS CDM groups. This is also aligned with the possible DMRS configuration defined in TS 38.211 and TS 38.212.2. For MsgA PUSCH transmission, only PUSCH DM-RS configuration type 1 is supported, and there is no higher layer parameter “*dmrs-Type*”. The corresponding correct description is already provided in TS 38.211.**Summary of changes**1. Clarify that it is “for double-symbol DM-RS” for MsgA PUSCH transmission, when the UE is not configured with *msgA-PUSCH-NrofPort*.2. Delete “For MsgA PUSCH transmissions, *dmrs-Type* is type 1.”**Consequences if not approved:**Incorrect number of ports is specified for single-symbol DM-RS case. Incorrect use of a non-applicable higher-layer parameter for PUSCH DM-RS configuration type.**Specs/Sections impacted**TS 38.214, Section 6.2.2------------------------- **Start of Text Proposal #1 for TS 38.214** ----------------------------6.2.2 UE DM-RS transmission procedure<Unchanged Text Omitted>When transmitted PUSCH is scheduled by DCI format 0\_1 with CRC scrambled by C-RNTI, CS-RNTI, SP-CSI-RNTI or MCS-C-RNTI, or corresponding to a configured grant, or being a PUSCH for Type-2 random access procedure,- the UE may be configured with higher layer parameter *dmrs-Type* in *DMRS-UplinkConfig*, and the configured DM-RS configuration type is used for transmitting PUSCH in as defined in Clause 6.4.1.1 of [4, TS 38.211]. <Unchanged Text Omitted>For MsgA PUSCH transmission, if the UE is not configured with *msgA-PUSCH-DMRS-CDM-group,* the UEshall assume that 2 DM-RS CDM groups are configured. Otherwise, *msgA-PUSCH-DMRS-CDM-group* indicates which DM-RS CDM group to use from the set of {0,1}. For MsgA PUSCH transmission, if the UE is not configured with *msgA-PUSCH-NrofPort,* the UEshall assume that 4 ports are configured per DM-RS CDM groups for double-symbol DM-RS. Otherwise, *msgA-PUSCH-NrofPort* with value of 0 indicates the first port per DM-RS CDM group, while a value of 1 indicates the first two ports per DM-RS CDM group.<Unchanged Text Omitted>------------------------- **End of Text Proposal #1**------------------------------- |

Any comments?

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| Company | Comments |
| Samsung | Seems fine. |
| CATT | We are fine with proposal 1. |
| Apple | We are ok with proposal 1. |
| Huawei | Fine with FL proposal. |
| Nokia | We are OK with proposal 1 |
| Ericsson | Agree on the first part of the TP (deletion of the text related to *dmrs-Type*).For the 2nd part, agree that some updates for clarification are needed to reflect what we agreed.One comment is:If we add “for double-symbol DM-RS”, should we also mention that “**2** ports are configured per DM-RS CDM groups are configured for **single-symbol** DM-RS” when the “*msgA-PUSCH-NrofPort*” is not configured?According to following agreements and text in 38.331, it seems a double-symbol is always required to be configured to make sure 4 ports are available when “*msgA-PUSCH-NrofPort*” is not configured, i.e. “*msgA-MaxLength*” must be configured to be ‘len2’.Agreements RAN1 #99:* The following parameter(s) are included in *msgA-DMRS-Configuration*
	+ 1-bit indication of index(-es) of CDM group(s): *msgAPUSCHDMRSCDMgroup* INTEGER (0,1); if not configured then both CDM groups are used; and
	+ 1-bit indication of port number *msgAPUSCHNrOfPort* INTEGER (0,1); 0 indicates 1 port per CDM group, 1 indicates 2 ports per CDM group, if not configured then 4 ports per CDM group are used;

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| 38.331 V16.3.1: msgA-MaxLength-r16 ENUMERATED {len2} ***msgA-PUSCH-NrofPort***0 indicates 1 port per CDM group, 1 indicates 2 ports per CDM group. If the field is absent then 4 ports per CDM group are used (see TS 38.213 [13], clause 8.1A). |

So maybe the text proposal can be changed to (note that “*msgA-MaxLength* is configured” means ‘len2’ is used):

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| For MsgA PUSCH transmission, if the UE is not configured with *msgA-PUSCH-NrofPort,* the UEshall assume that 4 ports are configured per DM-RS CDM group and *msgA-MaxLength* is configured. Otherwise, *msgA-PUSCH-NrofPort* with value of 0 indicates the first port per DM-RS CDM group, while a value of 1 indicates the first two ports per DM-RS CDM group. |

Another editorial comment is (already reflected in above TP): “per DM-RS CDM groups” should be “per DM-RS CDM group~~s~~”? |
| Intel | We are fine with proposal 1. |
| Qualcomm | OK with Proposal 1  |
| Spreadtrum | Fine with Proposal 1 |
| DOCOMO | We are fine with proposal 1. |
| vivo | We are fine with proposal 1. |
| Moderator (ZTE) | If I understand correctly, the original TP and Ericsson’s version are meaning the same thing. So if the majority are ok with the original TP I would prefer to keep it as it is. The editorial change made by Ericsson seems reasonable.Therefore, it is propose to revise the second part of TP#1 as follows:Revised TP#1For MsgA PUSCH transmission, if the UE is not configured with *msgA-PUSCH-NrofPort,* the UEshall assume that 4 ports are configured per DM-RS CDM group for double-symbol DM-RS. |
| Ericsson | The revised TP is fine to us given the majority view. |

# Correction on the transmission timing adjustment procedure in 38.213

R1-2101526 pointed out that a 12-bit absolute TA can be in a DL-SCH with Absolute Timing Advance Command MAC CE which is already specified in 38.321 from 2-step RACH work item in NR R16. But in 38.213, the 12 bits absolute TA is only assumed to be in RAR, and only 6-bit TA is assumed for all other cases. So it should be clarify that in the description of the transmission timing adjustment procedure, the 12-bit absolute TA can be also in a DL-SCH with Absolute Timing Advance Command.

***Proposal 2:***

* Adopt the following TP#2 in 38.213, to clarify that the 12-bit absolute TA can be also in a DL-SCH with Absolute Timing Advance Command.

**Reasons for change**

A 12-bit absolute TA can be in a DL-SCH with Absolute Timing Advance Command MAC CE which is already specified in 38.321 from 2-step RACH work item in NR R16.

But in 38.213, the 12 bits absolute TA is only assumed to be in RAR, and only 6-bit TA is assumed for all other cases.

**Summary of changes**

Clarify in the description of the transmission timing adjustment procedure that the 12-bit absolute TA can be also in a DL-SCH with Absolute Timing Advance Command.

**Consequences if not approved:**

The 12 bits Timing Advance Command carried in Absolute Timing Advance Command MAC CE in a DL-SCH will be treated as a 6-bit TA in “other cases” in 38.213.

**Specs/Sections impacted**

TS 38.213, Section 4.2

-----------------------**Start of Text Proposal #2 for TS 38.213** ----------------------------

4.2 Transmission timing adjustments

<Unchanged Text Omitted>

In case of random access response or Absolute Timing Advance Command MAC CE, a timing advance command [11, TS 38.321], , for a TAG indicates values by index values of  = 0, 1, 2, ..., 3846, where an amount of the time alignment for the TAG with SCS of  kHz is . is defined in [4, TS 38.211] and is relative to the SCS of the first uplink transmission from the UE after the reception of the random access response.

In other cases, a timing advance command [11, TS 38.321], , for a TAG indicates adjustment of a current value, , to the new value, , by index values of  = 0, 1, 2,..., 63, where for a SCS of  kHz, .

<Unchanged Text Omitted>

-------------------------**End of Text proposal #2** ----------------------------

Any comments?

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| Company | Comment |
| Samsung | Seems fine. |
| CATT | we are fine with the principal of proposal 2 but we would modify proposed text as below:In case of random access response ~~or Absolute Timing Advance Command MAC CE~~, a timing advance command or an absolute timing advance command [11, TS 38.321], |
| Apple | We are ok with the proposal 2. In addition, we would like to clarify “in case of random access response”, whether it includes the successRAR and fallbackRAR. If it is common understanding that random access includes successRAR and fallbackRAR, then the proposal is enough.  |
| Huawei | Fine with FL proposal or CATT’s modification. |
| Nokia | We have a concern related to the proposal with its current formulation, as it relates all the actions to the “… reception of the random access response.”, which may not always be the case when investigating section 5.1.4a (MSGB reception and contention resolution for 2-step RA type). In our preference it would be better if there is a completely new paragraph capturing this:In case of Absolute Timing Advance Command MAC CE, a timing advance command [11, TS 38.321], , for a TAG indicates values by index values of  = 0, 1, 2, ..., 3846, where an amount of the time alignment for the TAG with SCS of  kHz is . is defined in [4, TS 38.211] and is relative to the SCS of the first uplink transmission from the UE after the reception of the Absolute Timing Advance Command MAC CE.Using this approach the specifications become agnostic to how the absolute timing advance command MAC CE is delivered to the UE. |
| Ericsson | Fine with the updates from Nokia, considering the first uplink transmission should be the one after the reception of MAC CE being discussed here.One comment to CATT’s modification is that the TAC field is also called “timing advance command” in the absolute timing advance command MAC CE, so to keep the original “timing advance command” field term, we prefer to use “absolute timing advance command MAC CE” used in the original CR. The main reason to mention “absolute timing advance command MAC CE” is that it is a DL-SCH different from RAR (normal RAR, fallback RAR, success RAR), defined in section 6.2.1 of 38.321.  |
| Intel | We are fine with the proposal in principle. But the wording may need to be improved. We slightly prefer the proposal from CATT. For Nokia’s update, it seems that “absolute timing advance command MAC CE” is also part of Random Access Response reception, as captured below from Section 5.1.4a in 38.321.

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| 4> if a downlink assignment has been received on the PDCCH for the C-RNTI and the received TB is successfully decoded:5> if the MAC PDU contains the Absolute Timing Advance Command MAC CE subPDU:6> process the received Timing Advance Command (see clause 5.2);6> consider this Random Access Response reception successful;6> stop the *msgB-ResponseWindow*;6> consider this Random Access procedure successfully completed and finish the disassembly and demultiplexing of the MAC PDU. |

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| Qualcomm | FL’s proposal is good enough.  |
| Spreadtrum | Fine with FL’s proposal |
| DOCOMO | We are fine with FL’s proposal or the updates from Nokia. |
| vivo | We agree with the intention for this TP. We are fine with FL proposal or CATT’s modification. |
| Moderator (ZTE) | Based on the comments from CATT and Ericsson, the TP is updated as follows. Hopefully intel’s response can address Nokia’s comment on whether it is part of the random access.Revised TP#2In case of random access response, a timing advance command or an absolute timing advance command MAC CE [11, TS 38.321], , for a TAG indicates values by index values of  = 0, 1, 2, ..., 3846, … |
| Apple | The revised TP#2 seems still confusing that the absolute timing advance command MAC CE is part of the random access response. In addition, the timing advance command and absolute timing advance command MAC CE are not on the same level, there is timing advance command field in absolute timing advance command MAC CE. The wording can be improved.A timing advance command ~~In~~ in case of random access response~~, a~~ ~~timing advance command~~ or in an absolute timing advance command MAC CE [11, TS 38.321], , for a TAG indicates values by index values of  = 0, 1, 2, ..., 3846, … |
| Ericsson | Although absolute timing advance command MAC CE is used for response to the MsgA in R16 as Intel pointed out, it may be used for other purposes in future which is why RAN2 defines such MAC CE in DL-SCH (section 6.2.1 of 38.321) independently from RAR, the proposals from Nokia and Apple in our view is more future proof and avoids any further updates if this MAC CE is to be used for other purposes/procedures.Given above we slightly prefer the revision from Nokia or Apple. Or maybe a simpler way can be:In case of random access response or Absolute Timing Advance Command MAC CE, a timing advance command [11, TS 38.321], , for a TAG indicates values by index values of  = 0, 1, 2, ..., 3846, where an amount of the time alignment for the TAG with SCS of  kHz is . is defined in [4, TS 38.211] and is relative to the SCS of the first uplink transmission from the UE after the reception of the random access response or Absolute Timing Advance Command MAC CE. |

# Multiplexing between MsgB and unicast PDSCH

In R1-2101573, it was proposed to add some restriction on the multiplexing between MsgB and other unicast PDSCH, i.e. the UE is not expected to be scheduled a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI, and another PDSCH in the same cell scheduled with MSGB-RNTI in a slot.

The motivation was questioned by several companies during the preparation phase, and the proponent company provided some further clarifications.

[Spreadtrum]

For TP in R1-2101573, we want to provide further elaborations on why we should consider the restriction on MsgB.

* The payload size of MsgB could be much larger than Msg2 and/or Msg4 when including RRC payload for multiple UEs. It poses more challenge and difficulty for UE processing for the case when MsgB and unicast PDSCH TDMed multiplexing in a slot than the case for Msg2 and unicast PDSCH TDMed multiplexing in a slot.
* In our understanding, the processing capability requirement for MsgB could be equivalent to one unicast PDSCH. In Rel-15, for msg4, actually there are some restrictions in UE feature session, i.e., when UE not support more than 1 unicast PDSCHs in a slot per CC, UE is not expected to be scheduled with msg4 and unicast PDSCH in a slot per CC.



In our opinion, similar to msg4, UE should be not expected to be scheduled with MsgB and unicast PDSCH in a slot per CC when UE not supporting FG5-11/5-11a/5-11b. Otherwise, it is possibly that the UE could not process MsgB when one MsgB and one unicast PDSCH TDMed multiplexing in a slot. Then, the latency would be increased (always fallback to 4-step RACH) and the benefit of 2-step RACH would loss.

Thus, we have the following proposal:

**The UE is not expected to be scheduled a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI, and another PDSCH in the same cell scheduled with MSGB-RNTI in a slot.**

***Proposal 3:***

* Adopt the following TP#3 in 38.214, to restrict that MsgB and unicast PDSCH TDMed in a slot should not be supported.

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| Reason for change:The payload size of MsgB is much larger than Msg2 and/or Msg4. The processing capability requirement for MsgB could be equivalent to unicast PDSCH. For UEs not supporting two unicast PDSCHs TDMed in a slot per CC, MsgB could not be treated. The accessing latency would be increased and the benefit of 2-step RACH would loss.Summary of change:Not support MsgB and unicast PDSCH TDMed multiplexing in a slot.Consequences if not approved:The benefit of 2-step RACH would loss, and even 2-step RACH could not be supported for UEs not supporting 2 unicast PDSCHs TDMed in a slot per CC. Clauses affected:TS38.214, Section 5.1-----------------------**Start of Text Proposal #3 for TS 38.214** ----------------------------5.1 UE procedure for receiving the physical downlink shared channel<Unchanged Text Omitted>The UE is not expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI if another PDSCH in the same cell scheduled with RA-RNTI or MSGB-RNTI partially or fully overlap in time. The UE is not expected to be scheduled a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI, and another PDSCH in the same cell scheduled with MSGB-RNTI in a slot.<Unchanged Text Omitted>-----------------------**End of Text Proposal #3** ---------------------------- |

Please companies double-check if the above clarifications make sense, and if the TP is agreeable.

Any comments?

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| Company | Comment |
| Samsung | Technically speaking, simply not allowing msgB and other PDSCH in one slot is a bit too much. For example, if a UE is with more than one PDSCH capability, then gNB can schedule one unicast PDSCH in the same slot which contains the MSGB. It only may matters to these UE who only holds single PDSCH capability. Even in this case, it can be up to gNB scheduling to avoid this, because when gNB schedules the unicast PDSCH, gNB knows the UE capability already.My preferred handling will be we draw a RAN1 conclusion, saying:*It’s up to gNB scheduling to handle the case that unicast PDSCH(s) TDMed with msgB in a slot per CC for different UE capability.* |
| CATT | Scheduling both MSGB and 1 unicast PDSCH or only MSGB message in a slot depends on gNB implementation. Certainly when gNB schedules MSGB and PDSCH for UE, gNB also refers to UE capability such as 5-11 etc.So proposed text in proposal 3 isn’t required. If we have common understanding on multiplexing between MsgB and unicast PDSCH, maybe RAN1 conclusion isn’t necessary. |
| Apple | As no UE capability indicating multiplexing between MsgB and unicast PDSCH, scheduling restriction seems reasonable. We are open to capture the proposed text in the spec or as the conclusion. |
| Huawei | One critical issue mentioned in previous discussion in RAN2 related to UE capability, is that gNB does not know the UE capability before RRC setup complete. So the UE capability may not be useful and will anyway be up to gNB scheduling. |
| Nokia | We are not supportive of the proposal, as it puts restrictions on the gNB operation (dictates what can be transmitted from the gNB side). Either this proposal is not needed, can be captured as a conclusion or will need significant modification/softening. |
| Ericsson | Share similar view as other companies, there’s no need to introduce this limitation for MsgB transmission. We’re also fine to draw a conclusion if all other companies think it necessary. |
| Intel | We also do not think this change is needed. Note that MsgB may only include Msg2, but not Msg4. In this case, we may not need such limitation on the TDM’ed multiplexing of unicast and MsgB.  |
| Qualcomm | OK to capture TP#3 in the spec. Alternatively, clarification can be made by a conclusion.  |
| Spreadtrum | In Rel-15, from the perspective of UE processing, Msg4 would be not allowed TDMed multiplexing with unicast PDSCH when UE not capable of supporting FG5-11/11a/11b.In light of previous discussions in RAN2, size of MsgB with RRC payload could be comparable to Msg4. At least for this case, from the perspective of UE processing, as UE vendor, we expect the same restriction on Msg4 should be applied for MsgB. Considering whether MsgB carrying RRC payload is transparent to RAN1 spec, one unified solution is preferred, i.e., the scheduling restriction on Msg4 should be applied for MsgB, no matter whether carrying RRC payload.For MsgB scheduled with C-RNTI, it belongs to unicast PDSCH, and following FG5-11/11a/11b is enough for gNB scheduling within UE’s capability. But for MsgB scheduled with MsgB-RNTI, there is no any UE capability or spec restriction in current spec. Thus, at least for MsgB scheduled with MsgB-RNTI, we think scheduling restriction could be considered.* Alt.1: Capture the above proposal in the spec.

  *The UE is not expected to be scheduled a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI, and another PDSCH in the same cell scheduled with MSGB-RNTI in a slot.** Alt.2: Formulate one conclusion. Copy Samsung’s proposal with some revisions.

*Conclusion: It’s up to gNB scheduling to handle the case that unicast PDSCH(s) TDMed multiplexing with ~~m~~MsgB in a slot per CC ~~for~~ based on ~~different~~ UE’s capability (i.e., FG5-11/5-11a/5-11b), where MsgB could be included as one unicast PDSCH.* *Note: MsgB could be scheduled with MsgB-RNTI, or C-RNTI.*Alt.1 could be applied for the case where gNB does not know the UE capability. Even if gNB knows UE capability, the restriction could be accepted for the sake that RACH procedure with MsgB scheduled with MsgB-RNTI is not frequent. Alt.1 is one unified solution. Thus, we prefer Alt.1. |
| DOCOMO | We do not see the need of such restriction, and it is up to gNB. |
| vivo | It may be too restricted to introduce such scheduling restriction for gNB on multiplexing between MsgB and unicast PDSCH. It can be up to gNB implementation for the MsgB scheduling. |
| Moderator (ZTE) | It seems the majority view is to leave this issue to gNB implementation without specification changes. And making a conclusion for clarification purpose seems to be acceptable.Based on the above, the updated proposal is to drop the TP#3 and instead draw a RAN1 conclusions as follows, using Spreadtrum’s wording as starting point. Please double-check if this is agreeable.***Conclusion****:* * *It’s up to gNB scheduling to handle the case that unicast PDSCH(s) TDMed multiplexing with MsgB in a slot per CC based on UE capability (i.e., FG5-11/5-11a/5-11b), where MsgB could be included as one unicast PDSCH.*
	+ *Note: MsgB could be scheduled with MsgB-RNTI, or C-RNTI.*
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| CATT | We are fine with making a conclusion. But motivation of “Note” description isn’t clear to us. So we suggest removing “Note” in the conclusion as below***Conclusion****:* * *It’s up to gNB scheduling to handle the case that unicast PDSCH(s) TDMed multiplexing with MsgB in a slot per CC based on UE capability (i.e., FG5-11/5-11a/5-11b), where MsgB could be included as one unicast PDSCH.*
* *~~Note: MsgB could be scheduled with MsgB-RNTI, or C-RNTI.~~*
 |
| Spreadtrum | Regarding CATT concern, we would like to provide some clarifications .As we have explained above that from the perspective of UE processing, as UE vendor, we expect the restriction on Msg4 also should be applied to MsgB scheduled with MSGB-RNTI other than scheduled with C-RNTI. Note just is used to clarify that the Conclusion could be applied for both MsgB scheduled with MSGB-RNTI and MsgB scheduled with C-RNTI. To solve the concern, we suggest the following small revision:***Conclusion****:* * *It’s up to gNB scheduling to handle the case that unicast PDSCH(s) TDMed multiplexing with MsgB in a slot per CC based on UE capability (i.e., FG5-11/5-11a/5-11b), where MsgB could be included as one unicast PDSCH.*
	+ *Note: Here MsgB could be scheduled with MsgB-RNTI, or C-RNTI.*
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| Ericsson | We’re fine with a conclusion but the proposed conclusion from Samsung seems enough in our view. |

# Summary

The final proposals and the potential CRs are to be updated…

# References

1. R1-2100243 Correction on DMRS configuration for MsgA in 38.214 Huawei, HiSilicon
2. R1-2101526 Draft CR to 38.213 on corrections for 2-step RACH Ericsson
3. R1-2101573 Discussion on remaining issues on 2-step RACH Spreadtrum Communications