**3GPP TSG-RAN WG4 Meeting #94-e R4-~~2002387~~2002525**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 8.20.1

**Source:** Moderator (ZTE Corporation)

**Title:** Email discussion summary for RAN4#94e\_#96\_NR\_2step\_RACH\_Demod

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion and provide some guidelines for email discussion if necessary.*

This email thread is assigned to discuss BS demodulation for 2-step RACH.

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

* 1st round:
  + Collect views and comments on the listed open issues below
  + Discuss way forward based on the collected views.
* 2nd round:
  + Continue discussion on the main underlying key issues with the following focus

a. Application scenarios, e.g. whether or not to consider only small cell case? Whether 2 step RACH is only activated near to the centre of large cells ?

b. Can BS assume the same or different timing offsets among UEs?

c. Continue to discuss the impact on the performance of different timing offsets

# Topic #1: General aspects on performance requirements for preamble and MsgA demodulation

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000314 | Samsung | Proposal 1: No BS demodulation requirements for Rel-16 NR 2-step RACH. |
| R4-2000801 | ZTE | Observation: no additional standardization efforts is needed on 2-step RACH preambles. |
| R4-2001183 | Ericsson | Observation 1: Rel-15 PRACH detection requirements are sufficient for ensuring Rel-16 2 step RACH detection performance.  Observation 2: Rel-15 PUSCH demodulation requirements are sufficient for ensuring rel-16 2 step PRACH demodulation performance.  Proposal 1: Do not define any additional demodulation requirements for 2 step PRACH |
| R4-2001491 | Nokia | Proposal 1: Performance requirements should be specified for MsgA, which includes joint PRACH and PUSCH, before RAR/MAC CE based TA compensation.  Observation 6: 2-step RACH supports all the preamble formats from NR Rel-15.  Proposal 5: Choose subset of Rel-15 PRACH preambles for the requirements.  Proposal 11: Define requirements and tests for PRACH preambles 0, A2, and C2 as in Table 1.  Observation 8: Currently 2-step RACH procedure supports interlaced PUSCH in combination with NR-U.  Observation 9: SIB1 signalling also provides support of new 1151 and 571 long PRACH sequences with the 2-step RACH procedure.  Proposal 7: Assuming the usage of long PRACH sequences is not limited to unlicensed operation by the NR-U WI in the coming meetings, specify NR-U scenario for 2-step RACH performance requirements with interlaced PUSCH and new 1151 and 571 long PRACH sequences.  Observation 11: Typical use cases where 2-step RACH have traffic that comprises small RRC messages of 56 bits, e.g. RRCRequest, RRCReestablishmentRequest, and RRCResumeRequest with short I-RNTI, or 72 bits, e.g. RRCResumeRequest with Long I-RNTI. |

## Open issues summary

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

### Sub-topic 1-1

*Sub-topic description:*

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

**Issue 1-1: performance requirements on preamble and MsgA for 2-step RACH**

* Proposals
  + Option 1: Separate performance requirements for preamble detection and MsgA demodulation
  + Option 2: MsgA demodulation performance includes joint preamble and payload
* Recommended WF

### Sub-topic 1-2

*Sub-topic description*

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

**Issue 1-2: Are additional preamble detection performance requirements needed?**

* Proposals
  + Option 1: Yes
  + Option 2: No, current Rel-15 preamble detection performance requirements are sufficient
* Recommended WF
  + TBA

### Sub-topic 1-3

*Sub-topic description*

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

**Issue 1-3: Are additional demodulation performance requirements for MsgA needed?**

* Proposals
  + Option 1: Yes
  + Option 2: No, current Rel-15 PUSCH demodulation performance requirements are sufficient
* Recommended WF
  + TBA

**Issue 1-4: Should interlaced PUSCH design and long preambles be considered ?**

* Proposals
  + Option 1: No, leave to NR-U WID
  + Option 2: Yes, addressed within 2-step RACH WID
* Recommended WF

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | Sub topic 1-1:  Issue 1-1: performance requirements on preamble and MsgA for 2-step RACH  Prefer: separate requirement with Msg A PRACH and Msg PUSCH if requirement needed  If RAN4 has identify the impact on demodulation performance of 2-step RACH based on the RAN1 feature, separate requirement with MsgA PRACH and MsgA PUSCH ( option 1) is preferred, we do not prefer to define the joint requirement with related preamble and Mag A.  MsgA PRACH is transmitted with preamble. With detection of preamble, the resource unit for MsgA PUSCH is indicated based on the mapping rule. There is no impact on the receiver process of MagA PUSCH.  From RAN4 demodulation requirement perspective, we do not define the joint requirements for each channel. Similarly for, PDCCH and PUSCH. The resource allocation, MCS,.HARQ information for PUSCH are carried with DCI 0-0 or 0-1  Generally, the working point of PUSCH is higher than PDCCH. From the test perspective, RAN4 always assume the detection of PDCCH is correct, when we test the requirement of PUSCH or PDSCH.  In that sense, we prefer option 1 if requirement are needed.  Sub topic 1-2:  Issue 1-2: Are additional preamble detection performance requirements needed?  Prefer option 2, no additional preamble detection performance  Based on the objective of 2-step RACH, the preamble design is only reusing the NR Rel-15 NR PRACH design. In Rel-15, RAN4 has specified the requirement of PRACH with related long and short PRACH preamble sequences. So, we think there is no new PRACH requirement.  Sub topic 1-3:  Issue 1-3: Are additional demodulation performance requirements for MsgA needed?  Prefer option 2, No, additional demodulation requirement, current Rel-15 PUSCH demodulation performance requirements are sufficient  Based on the RAN1 agreement of 2-step RACH, the MsgA PUSCH reuses the existing UL physical layer. In NR Rel-15, we have already specified the PUSCH requirement based RAN1 feature covering the different waveform, DMRS structure, TDRA, and MCS. In our view, we think the PUSCH requirement for NR 2 step RACH can be verified with Rel-15 NR PUSCH requirement  Issue 1-4: Should interlaced PUSCH design and long preambles be considered?  Prefer option 1. leave to NR-U WID  Regarding the interlace design, it should be applicable for unlicensed operation in Rel-16 NR-U WI.  Since the core part of NR-U is still on going, in our view, whether to define the requirement for interlaced PUSCH should be discussed in the performance part of NR-U.  Similarly with eLAA in LTE, RAN1 has also designed interlaced PUSCH design. The requirement of interlaced PUSCH is specified under WI of eLAA.  Meanwhile, the interlaced design is also considered for other channel in NR-U, such as PUCCH. Therefore, we prefer to discuss requirement for the related interlaced design in NR-U WI. |
| Ericsson | Sub topic 1-1: The answer to this will depend on what we agree on the need for preamble requirements and PUSCH requirements  Sub topic 1-2: We support option 2; Rel-15 requirements are sufficient as there are no new preambles  Sub topic 1-3: We support option 2; Rel-15 requirements are sufficient. Further explanation/justification is provided in responses to topic 2. Basically, we think that the 2 step RACH is applicable to small cells without significant propagation delay, and the timing is known once the preamble is detected, so there is no new PUSCH demod functionality needed.  Sub-topic 1-4: We support option 1.  ….  Others: |
| Nokia, Nokia Shanghai Bell | Sub topic 1-1: Choose option 2. Option 1 is no different than the existing tests for PRACH. Performance of MsgA preamble and payload should be evaluated together.  Sub topic 1-2: Option 2, since same preambles re-used. Would need to be re-discussed in case NR-U preambles are to be considered.  Sub topic 1-3: Option 1, yes, additional demod requirements are needed for MsgA.  Sub topic 1-4: Option 1. The NR-U performance part is not yet finished, so it is up to this WI to do the performance requirements for NR-U features. |
| Huawei, HiSilicon | Issue 1-1: We prefer Option 1: separate performance requirements for preamble detection and MsgA demodulation if RAN4 agrees to define 2-step RACH related performance requirements. Actually we think RAN4 should first discuss whether related requirements need to be defined or not before discuss joint or separate requirements definition.  Issue 1-2: We prefer Option 1: No additional preamble detection performance requirements is needed. For our understanding, there is no difference on preamble detection demodulation requirements between 2-step RACH and normal 4-step RACH. It is not meaningful to define new requirements, the existing Rel-15 requirements can be reused.  Issue 1-3: We prefer Option 2: Current Rel-15 PUSCH demodulation performance requirements are sufficient. For single UE cases, UE can derive timing for PUSCH after preamble has been detected. Therefore, there is no difference on PUSCH demodulation between 2-step RACH and normal 4-step RACH. It is not meaningful to define new requirements, the existing Rel-15 requirements can be reused.  Issue 1-4: We prefer Option 4. leave to NR-U WID. |
| Intel | Issue 1-1: performance requirements on preamble and MsgA for 2-step RACH  We think it is necessary to define 2-step RACH performance requirements since BS receive processing can be differ compare to 4-step RACH. In 4-step RACH since each UE transmit message 3 after TA, BS use only one FFT window and can decode each message 3 even they use same time/frequency resources. Same time in 2-step RACH MsgA are not synchronized between different UEs and to decode them BS can use multiple FFT windows which affect BS implementation. To verify proper processing for 2-step RACH procedure we should define performance requirements for MsgA including joint preamble and payload. Prefer option 2.  Issue 1-2: Are additional preamble detection performance requirements needed?  Not needed since 2-step RACH preambles are subset of 4-step RACH preambles. Prefer Option 2.  Issue 1-3: Are additional demodulation performance requirements for MsgA needed?  Prefer option 1 to define performance requirements for MsgA verifying performance of preamble detection and payload decoding. Even if 2-step RACH procedure is mostly applicable for small cells timing difference between different UEs can be larger than CP length due to timing offsets. In this case new functionality on BS side might be needed to avoid possible performance losses. Therefore, we need to define specific performance test cases for 2-step RACH procedure.  Issue 1-4: Should interlaced PUSCH design and long preambles be considered ?  Prefer Option 1. |
| ZTE | In general, one key point is to ensure BS proper processing for decoding contentious MsgA sent by multiple asynchronous UEs, though the target is to specify the requirements for single user case. Furthermore, RAN1 agreed that all preamble formats should be supported for 2-step RACH, therefore Other scenarios than small cell should also be considered.  Issue 1-1: Option 1, for the sake of simplicity, and preamble requirements can be reused.  Issue 1-2: Option 2. Reusing current preamble requirements.  Issue 1-3: Option 1, need to specify MsgA performance requirements to tackle the difference between 2-step RACH and 4-step RACH.  Issue 1-4: Option 1, leave it to NR-U WID. |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | Tentative observations:   1. Well aligned views on performance requirements for preamble, interlaced PUSCH and long preamble. 2. Sided views on whether or not to specify MsgA performance requirements. The main underlying points are whether there are application valid scenarios in which MsgA PUSCH transmissions may be asynchronous to regular PUSCH reception are relevant, and if so how and whether to ensure BS processing when UE timing differs from the regular UL (i.e. whether this is a performance and/or just a functional issue), even the intended requirements are for single user case. 3. Different views on 2-step RACH application scenarios, mainly for small cell or not.   Tentative agreements:   1. Reusing preamble performance requirements and no additional preamble performance requirement for preamble is needed. 2. Leave performance requirements for interlaced PUSCH design and long preamble to NR-U WID.   Recommended WF:   1. Continue discussion with the focus on the following points:    1. Application scenarios, e.g. whether or not to consider only small cell case? Whether 2 step RACH is only activated near to the centre of large cells?    2. Can BS assume the same or different timing offsets among UEs?    3. ~~If different timing offsets are assumed, how is BS supposed to use the information on known timing offset for each UE during the MsgA decoding?~~    4. Continue to discuss the impact on the performance of different timing offsets   *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
|  |  |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Wayforward on BS demodulation requirements for 2-step RACH | ZTE |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

Chronological order (from oldest to newest):

Moderator/ZTE: Kick-off the 2nd discussion with the focus on timing offset issue, and the very initial draft WF provided

Ericsson: we need to agree how large would be a relevant size/offset at which 2 step RACH would be operated. We also need more discussion on why, if the T0 would be large it would be a performance issue. Even if we would create a requirement, we would need to discuss what T0 to assume for the requirement. So in the WF I propose to establish what are relevant T0 and scenarios in order to decide on the need and scope of a requirement. The slides with the diagram and table I think provide useful information but are not for agreement, so I moved them to an Annex. For the table, I calculated slightly different numbers. I include a simple Excel sheet how I did the calculation so you can check (The numbers could be tidied up… just to check we have the same calculation first…)

ZTE: 2-step RACH can be used for any scenario where the normal 4-step RACH applies, thus I am not sure if RAN4 needs to impose such limitations on the scenario. So our preference is not to impose limitatiion on the application scenario in RAN4. For the TO values, 25km is just an example :-) Your excel sheet is appreciated. In our original calculation, 200m/500m... are ISD, not cell radius. With this alignment, I think our calculations are identical. For your convenience, I also upload the excel sheet with our calculation. And for TO handling, I would say that BS cannot compensate TO for each UE with a UE-wise FFT. So this would rather be a issue for performance requirements.

Nokia: I think it is good to have the timing offset table for reference, but I have two comments about it. I understand that the Toffset should be twice the propagation delay, not only one time. The first term is because the internal UE detection of the frame boundary should be shifted by the propagation delay (the UE is synchronized to the downlink resource grid, which is already “behind” by one propagation delay at the UE). The second term is because the propagation delay between the UE and BS in UL. I also think that the table would be better represented using proportion of the CP instead of the symbol length.

Depending on the channel model, there might be many paths that drop out of the CP and cause interference.

So there is a possibility of performance impact, that should at least be studied and, if found to be true, lead to new requirements.

From our perspective, we have problems agreeing with the proposed agreements after the last edit. In particular the following points:

RAN4 should establish whether application scenarios in which the timing offset of the msgA PUSCH is large enough to merit a possible performance requirement are useful scenarios

If the answer to (1) by RAN4 is yes, then RAN4 should establish whether the impact to the receiver is functional or performance

If the answer to (2) is performance, RAN4 should establish the maximum expected timing offset,

We think it should read like this:

RAN4 should determine relevant application scenarios for MsgA performance evaluation

(Including a request to all companies to contribute parameters needed for analysis, e.g., cell size of the use cases.)

RAN4 should study if new requirements for MsgA performance should be defined be it functional or performance

## Ericsson: Regarding the RAN1 spec, the fact that something is possible in RAN1 does not mean that we have to create RAN4 requirements. We create RAN4 requirements for scenarios that are relevant and which are not already covered by other requirements. In this discussion, I guess we all agree that e.g. 25km is not relevant (Other examples; we do not define requirements for e.g. trains at >500km/h); so the discussion will be what scenario is relevant for requirements.

## Our current view is that where the TO would be large, the 2 step RACH would anyhow bring about a capacity loss and so the scenarios do not seem immediately relevant (and also that the time adjustment for PUSCH is functional).

## Regarding the table, I think it is a good suggestion to consider CP. However, I think that the values you show below are a factor 2 too high. The reason is that the largest distance of the UE from a BS will be half of the ISD. Then as you say the RTT is double the distance of the UE from the BS; i.e. 2 \* 0.5 \* ISD = ISD.

## We would also prefer to add a couple of shorter distances to the table for illustration

For your proposed WF, we are generally OK, although we do not think that we should agree to define requirements if they are just functional; our view is that the BS requirements capture algorithm performance. We could update as follows:

1. RAN4 should determine relevant application scenarios for MsgA performance evaluation

(Including a request to all companies to contribute parameters needed for analysis, e.g., cell size of the use cases.)

1. RAN4 should study if new requirements for MsgA performance should be defined~~be it functional or performance~~.

## ZTE: It is a good idea to show TO values in terms of CP. In a hexagonal model, cell radius is {2/sqrt(3) \* (ISD/2)}=ISD/sqrt(3), which is the largest distance between UE and BS. I also insert the updated excel sheet in the slides, in addition to some other revisions

Nokia: I have few comments here.

On slide 5:

If the timing offset between different UEs is larger than a CP, then the msgA PUSCH from those UEs will not be orthogonal in the frequency domain and will not be orthogonal with regular PUSCH

This may restrict the system capacity

I think the problem would be the combination of the timing offset and the channel impulse response. SO I suggest to improve that like this:

If the timing offset between different UEs is large in comparison to the CP length, then some taps of the channel impultse response may fall outside of the CP and the msgA PUSCH from those UEs will not be orthogonal in the frequency domain and will not be orthogonal with regular PUSCH

This may restrict the system capacity

On slide 9, I would like to reiterate what I stated in the last email.

I believe maybe you could have missed it, since it is not showing in the the previous email text from your email.

About the requirements, functional requirements are also being defined for other features, like URLLC.

We don’t see why at this stage of the discussion we should prevent having that kind of requirement.

In any case, we expect 2step PO to be “normal” performance requirements.

Therefore, we would rather keep the text as I proposed earlier that does not exclude functional requirements.

RAN4 should determine relevant application scenarios for MsgA performance evaluation

(Including a request to all companies to contribute parameters needed for analysis, e.g., cell size of the use cases.)

RAN4 should study if new requirements for MsgA performance should be defined be it functional or performance.

Ericsson:

The proposal for slide 5 is OK.

For the slide 9, we do not see where functional requirements are included in the BS specifications.

I do not like the current wording as it implies that it is somehow normal to define functional requirements. I suggest either remove the slide (I think we all now know what to do, we may have better things to do than discuss on the details of the wording on this, and there are some other things we can agree on preambles etc.) or reword as follows:

1. RAN4 should determine relevant application scenarios for MsgA performance evaluation

(Including a request to all companies to contribute parameters needed for analysis, e.g., cell size of the use cases.)

1. RAN4 should establish whether requirements relating to MsgA performance with T0 offset are functional or performance
2. RAN4 should conclude on the need for new requirements

My aim with this wording is to leave you room to argue that there is some reason to introduce a functional requirement if that is what we decide.

Nokia:

I just noticed one new version of the WF which was not announced on the email reflector.

The file has time indicating it was done after the emails from Thomas and me with file name “draft\_R4-2002389 Wayforward on BS demodulation requirements for 2-step RACH\_r2\_Huawei”.

There are two documents in the draft folder marked as coming from Huawei, however we have not received any email from Huawei on the reflector under this discussion identifier.

Following the explicit chair guidance: Could the author of these documents please identify themselves?

For all we know these documents could have been uploaded by a third party.

I would like to know how we can handle these feedback coming from different sources (meaning email and ftp).

I personally think it is more transparent for everyone to request changes on the reflector, since ppt does not have nice version control like work documents.

I understand everyone here is busy to be constantly checking for new version of files in the ftp server, and that is why announcing updates helps our work.

From our perspective, we don’t agree with the text on the file I mentioned earlier, and we would prefer to consider the text as was discussed in the previous emails.

Intel:

We also do not agree with wording in the latest version and since it were not discussed prefer to keep previous version of WF with changes on Page 9 proposed by Thomas.

ZTE:

Trying to consolidate different views as much as possible. The simple principle is that if we cannot reach consensus on a specific point, then let's leave it open. Therefore, the updated "draft\_R4-2002389 Wayforward on BS demodulation requirements for 2-step RACH\_r3" under the folder contains the following (highlighted in orange texts in the pptx):

- Page 5: Rafael's wording replaces the previous one.

- Page 9: We definitely need this page for further discussion in next meeting. Since there are different views on whether functional or performance requirements, we just leave it open as FFS.

Ericsson:

Unfortunately we cannot agree to the wording you propose in \_r3 for slide 9. We think that we should first of all discuss and agree whether the requirements are functional or performance, then whether new requirements are needed.

I have uploaded a \_r4 with Rafaels wording on slide 5 and my wording on slide 9; I understand that this is agreeable for at least us, Intel and Nokia.

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX  R4-2002389 | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”*  *Based on the discussions during 2nd round, the current version seems stable and agreeable.* |

# Topic #2: Aspects on MsgA demodulation

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000314 | Samsung | Proposal 1: No BS demodulation requirements for Rel-16 NR 2-step RACH. |
| R4-2000801 | ZTE | Proposal: RAN4 to take into account Table-1 to specify BS demodulation performance requirements for 2-step RACH single user case. |
| R4-2001183 | Ericsson | Proposal 1: Do not define any additional demodulation requirements for 2 step PRACH |
| R4-2001491 | Nokia | Observation 1: One important aspect of 2-step RACH performance is that PUSCH Msg3 should be decoded before time-alignment compensation feedback.  Observation 2: The MsgB may contain successRAR, fallbackRAR, and backoff indicator. The fallbackRAR response is used, if MsgA PRACH was successfully received, but MsgA PUSCH not. The case of the fallbackRAR is already implicitly tested in the existing 4-step RACH procedures. For that reason, when test procedure is considered, MsgA transmission should be considered successful only if the gNB answers/transmits a successRAR message using MsgB.  Observation 10: Retransmissions of MsgA do not increment the redundancy version number of PUSCH as defined in clause 8.1A of 38.213 [3]. Therefore, the missed detection rate statistics should not be influenced by the choice of the number of retransmissions msgA-TransMax.  Proposal 2: The performance requirement should consider only MsgA transmissions that trigger a successRAR response on MsgB as correctly demodulated.  Proposal 8: Use as evaluation metric the SNR at which the joint PRACH/PUSCH missed detection rate is below 1%. Fallback to 4-step procedure is considered as an error.  Proposal 9: Evaluation metric should consider all the transmissions and retransmissions of MsgA for the calculation of the missed detection rate.  Observation 3: PO slot time allocation is determined based on a time-offset configuration with respect to the RO (msgAPUSCH-timeDomainOffset), which is between 1 to 32 slots [8].  Observation 4: More than one UE may be using the same PUSCH resource, depending on the configured preamble to PRU mapping. A one to one mapping can be possible, if the number of configures PRACH occasions is not larger than the number of configured PUSCH occasions.  Observation 5: The 2-step RACH objectives of the WI [1] include BS demodulation requirements for a PUSCH resource assigned to single UE only.  Proposal 4: Define requirements and test cases where only one PRACH preamble is mapped to one PRU, or N\_pre = N\_pru.  Observation 7: MsgA PUSCH supports MCSs from 38.214 [6] Table 6.1.4.1-1 for DFT-s-OFDM and Table 5.1.3.1-1 for CP-OFDM.  Proposal 6: Focus on CP-OFDM and MCS index IMCS = 2.  Proposal 10: Define requirements and tests for transport block sizes of 56 bits.  Proposal 12:One possible configuration of the 2-step RACH feature, that fulfils our previous observations and proposal, is detailed in Table 2. It can serve as a basis for discussion for simulation alignment. |

## Open issues summary

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

### Sub-topic 2-1 handling of TAO (timing offset)

*Sub-topic description:*

Although the performance part of 2-step RACH is only for single user case, how to handle TO during demodulating MsgA is one of the key points to discuss.

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

**Issue 2-1: Should TO be considered for specifying MsgA demodulation performance requirements?**

* Proposals
  + Option 1: Yes, multiple UEs may contest for the same resources with different TOs
  + Option 2: No, the timing is known after BS detects the preamble
* Recommended WF
  + TBA

### Sub-topic 2-2 DMRS configuration

*Sub-topic description*

All 4 different DMRS configurations are supported for 2-step RACH including *pos1* and *pos2*. The existing Rel-15 PUSCH demodulation performance requirements assume DMRS *pos1*. Since there is contention among UEs in 2-step RACH, the demodulation of MsgA may require more reliable channel estimation. Furthermore, if the additional DMRS configuration is not indicated, the default *pos2* is assumed.

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

**Issue 2-2: Whether or not to specify performance requirements for additional DMRS configuration pos2 ?**

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

Notes: other parameters related to MsgA demodulation, e.g., MCS, payload information bits, are subject to the outcome of the 1-st round discussion

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | Sub topic 2-1:  Issue 2-1: Should TA be considered for specifying MsgA demodulation performance requirements?  Prefer option 2, no TA considered for single UE to MsgA demodulation performance  The requirement of PUSCH specified in Rel-15 NR is based on single UE. From RAN4 perspective, for a single UE based, the TA for each UE can be derived from the PRACH preamble detection, then BS can adjust the TA for MsgA demodulation performance requirement.  While for multi-UE case, in order to handle the intra-cell/inter-cell interference, the TA should be considered for interference modeling. RAN4 has considered the multi-UE and  Considering it is no objective in the WI of 2-step RACH to specify the requirement with advanced receiver to handle the interference, we do not think it is necessary to modeling TA for specifying MsgA demodulation performance requirement.  Sub topic 2-2:  Issue 2-2: Whether or not to specify performance requirements for additional DMRS configuration pos2?  Prefer option 2, no addition DMRS configuration.  Based the objective of 2 step RACH, there is no changed with physical layer structure. In NR Rel-15, we have already specified the PUSCH requirement based RAN1 feature covering the different waveform, DMRS structure, TDRA, and MCS.  For the DMRS configuration, as indicated with RAN1 agreement   * + msgA-dmrs-AdditionalPosition, ENUMERATED{pos0, pos1, pos3}, indicates the position for additional DM-RS. If the field is absent, the UE applies value ‘pos2’.   The DMRS can be configured with different position based on the deployment scenario. From RAN4 perspective, it is not practical to verify and specify the requirement of all the RAN1 feature.  Meanwhile, in terms of functionality verification of DMRS pos2, we have specified the related requirement in the HST WI. Current PUSCH demodulation performance requirements are sufficient. No need to additional requirement and test. |
| Ericsson | Sub topic 2-1: We support option 2 (and also propose not to create a requirement… ). The reason for this is that we think that the 2 step RACH only operates in small cells. In large cells, if there would be multiple UEs simultaneously then the PUSCHs would not align in time. Also, even with 1 UE, the PUSCHs would not align in time with any RBs used for regular PUSCH. So orthogonality would be lost, and the options for deployment would be limited. In small cells, there is anyhow no need for TA. With or without TA, the timing of the PUSCH is known once the preamble is detected. So demodulation of the PUSCH does not differ from regular PUSCH demodulation. |
| Nokia, Nokia Shanghai Bell | Sub topic 2-1: Option 3: Timing offset (TO) error needs to be considered.  Even a single UE did not yet receive a (or ignores the pervious) TA command before sending MsgA. The application of TOE (TO estimation) and TOC (TO compensation) onto the MsgA-PRACH/PUSCH is possibly a new algorithmic capability and needs to be tested.  Sub topic 2-2: Option 2. The small payloads require only few PUSCH symbols in the PO, so more than 2 DM-RS is not an expected use-case. |
| Huawei, HiSilicon | Issue 2-1: We prefer Option 2. The timing is known after BS detects the preamble.  Issue 2-2: Need to discuss Issue 2-1 first. |
| Intel | Prefer to come back to this discussion after agreements on whether we need or not performance requirements |
| ZTE | Issue 2-1: Option 1. As stated before, multiple asynchronous UEs may content the same resources with different timing offsets. This is one of the key issues.  Issue 2-2: pos2 DMRS may be needed in some cases. |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | Tentative observations:  For Issue 2-1, this is one of the key issues underlying. Combined in the continued discussion in Topic #1.  For Issue 2-2, and other related parameters, we can wait the outcome of the continued discussion in Topic #1.  Recommended WF:   * Combine issue 2-1 in the continued discussion in Topic #1, and wait the outcome of the discussion.   *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: Test aspects for 2-step RACH performance requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000314 | Samsung |  |
| R4-2000801 | ZTE |  |
| R4-2001183 | Ericsson |  |
| R4-2001491 | Nokia | Proposal 3: Define test setup with msgAPUSCH-timeDomainOffset = 5, to aligned with previously used default TDD UL-DL patterns.  Observation 12: 2-step RACH is not a mandatory feature.  Proposal 13: 2-step RACH requirements are to be marked as optional.  Proposal 14: 2-step RACH test applicably is to be based on manufacturer declaration. |

## Open issues summary

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

The test aspects will be further elaborated subject to the outcome of the 1-st round discussion.

### Sub-topic 1-1 Applicability

*Sub-topic description:*

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

**Issue 3-1: test applicability**

* Proposals
  + Option 1: Vendor declaration based
  + Option 2: …
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Samsung | Sub topic 1-1:  Issue 3-1: test applicability  Prefer to vendor declaration based.  Since 2-step is not mandatory feature, the related requirement for BS side is optional and can be declared by manufacturer. |
| Huawei, HiSilicon | Issue 3-1: We prefer Option 1 if there are any performance requirement is introduced. |
| Ericsson | Sub topic 3-1: As discussed above, we do not see the need for requirements, but if any would be introduced they should be optional and vendor declared. |
| Nokia, Nokia Shanghai Bell | Sub topic 3-1: Option 1, Nokia agrees to introduce manufacturer declarations. 2-step RACH is an optional feature. |
| ZTE | Issue 3-1: Option 1. This is declared by BS vendor. |

### CRs/TPs comments collection

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

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

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | Tentative observations:  Well aligned views on the test applicability.  Tentative agreements:   * Optional based on BS vendor declaration   *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #4: Work plan for BS demodulation performance requirements for 2-step RACH

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000802 | ZTE | RAN4#94-e:   1. Approve the workplan 2. Initiate discussion on demodulation of 2-step RACH Msg A payload   RAN4#94bis:   1. Simulation configuration alignments for 2-step RACH MsgA payload 2. Simulation results collection and alignment   RAN4#95:   1. Final round of simulation results collection and alignment 2. CR for TS 38.104 Demodulation performance requirements for 2-step RACH Msg A payload 3. CR for TS 38.141-1 Conducted conformance tests for 2-step RACH Msg A payload   CR for TS 38.141-2 Radiated conformance tests for 2-step RACH Msg A payload |
|  |  |  |
|  |  |  |

## Open issues summary

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

Hold until consensus is reached on BS demodulation performance requirements for 2-step RACH.

### Sub-topic 1-1

*Sub-topic description:*

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