**3GPP TSG-RAN WG4 Meeting # 96-e R4-2012559**

**Electronic Meeting, 17 – 28 Aug., 2020**

**Agenda item:** 7.18.3

**Source:** Moderator (ZTE Corporation)

**Title:** Email discussion summary for [96e][325] BS demodulation for 2-step RACH

**Document for:** Information

# Introduction

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

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

* 1st round: TBA
* 2nd round: TBA

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2010283 Discussion and simulation results for BS 2-step RACH requirement | Samsung | Proposal 1: 3 DMRS can be configured for MsgA PUSCH requirement  Proposal 2: Define the PUSCH mapping type A in FR1 and mapping type B in FR2 for NR 2-step RACH MsgA PUSCH requirement.  Proposal 3: 0.8us can be considered as the maximum timing offset for MsgA PUSCH  Proposal 4: MCS 0 can be selected for requirement with NR step RACH, to fulfill the targeting TBS with 56-72bits  Proposal 5: Using BLER 0.1 as the test metric for requirement of MsgA PUSCH  Observation 1: Similar BLER performance can be achieved with 2 DMRS and 3 DMRS configuration  Observation 2: With small value of TO, the impact on BLER performance of MsgA is minor without TO compensation  Observation 3: With TO larger than CP, even with TO compensation operation, large performance degradation is still existed  Proposal 6: Do not define the requirement with timing offset lager than CP |
| R4-2010783 Further discussion on BS demodulation performance requirements for 2-Step RACH | ZTE | Proposal 1: BS demodulation performance requirements are defined with TO compensation  Proposal 2: Change the lower end values for medium level TO cycling to 0µs as high level TO cycling.  Proposal 3: Scaling X:∆t:Y between two different SCSs for high level TO cycling as medium level TO cycling  Proposal 4: Set medium and high level TO cycling values as Table – 4 and Table – 5 respectively.  Proposal 5: Specify BS demodulation performance requirements for mapping type A and type B respectively.  Proposal 6: Set test metric to BLER 0.1 for BS demodulation performance requirements for 2-step RACH.  Proposal 7: Specify BS demodulation performance requirements with DMRS configuration 1+1+1.  Proposal 8: Specify BS demodulation performance requirements for 2-step RACH under FRC tables as Table-6 and Table-7 for FR1 and FR2 respectively. |
| R4-2010784 Draft CR for 38.104: Performance requirements for 2-Step RACH | ZTE |  |
| R4-2010785 Simulation results for 2-step RACH BS demodulation requirements | ZTE |  |
| R4-2010842 2-step RACH demodulation requirements | Ericsson | Proposal 1: Adopt option 2 (4 PRB, DM-RS 1+1, 7 symbol for FR1, 5 for FR2)  Proposal 2: Include a declaration whether “medium” T0 and associated requirements are supported or alternatively “high” T0 is supported. Only one set of requirements to be applicable/tested depending on declaration.  Proposal 3: 1% BLER |
| R4-2010906 2-step RACH BS demodulation simulation results | Nokia |  |
| R4-2010907 On 2-step RACH BS demodulation requirements | Nokia | Proposal 1: RAN4 not to deviate from current PUSCH applicability rules and BS needs to only comply for the mapping type declared to be supported in D.100.  Observation 1: Most of the PUSCH performance requirements use SNR at 70% throughput as a test metric, which maps to 30% BLER.  Observation 2: Simulation results from previous meetings show significant SNR differences when considering PUSCH performance with uncorrected TO at 10 % BLER and 70 % TPUT [4] [5] [6].  Proposal 2: RAN4 for define MsgA PUSCH performance requirements using a 10% BLER metric.  Observation 3: High Level TO cycling upper limit for the 30 kHz SCS test case is the most challenging one when compered to the C length.  Proposal 3: RAN4 to review the upper limit of the High Level TO cycling for the 30 SCS scenario, and use (X, ∆t, Y) as (0, 0.1, 1.9).  Observation 4: Medium TO level ranges and High TO ranges have similar average value.  Proposal 4: RAN4 to consider TO ranges starting at zero for Medium and High TO ranges.  Observation 5: 2-step RACH demodulation requirements relate mostly to the MsgA PUSCH performance, and has more relation to the existing PUSCH clauses than with the PRACH clauses.  Proposal 5: RAN4 to define 2-step RACH demodulation performances as a subclause in the clauses 8.2 for PUSCH requirement in 38.141-1 [4], 38.141-2 [5], and 38.104 [6] as:  -TS 38.141-1: 8.2.6 Performance requirements for MsgA PUSCH  -TS 38.141-2: 8.2.6 Performance requirements for MsgA PUSCH  -TS 38.104: 8.2.6 Requirements for MsgA PUSCH |
| R4-2011009 Discussion and simulation results on NR 2-step RACH BS performance requirements | Huawei | Observation 1: The performance between high level TO and medium TO level is negligible after TO compensation.  Observation 2:  – For 15kHz, 30kHz and 120kHz SCS, considering TO compensating or not, there is about 1~2dB performance differnece for medium level TO and about 6~7dB performance differnece for high level TO.  – For 120kHz SCS, considering TO compensating or not, there is about 3~6dB performance differnece for both medium level TO and high level TO.  Proposal 1: Only define high level TO cases for NR 2-step RACH.  Proposal 2: Define both Type A and Type B for both FR1 and FR2 for NR 2-step RACH demodulation requirements. Only the mapping type declared to be supported in D.100 shall be tested. If both mapping type A and type B are declared to be supported, the tests shall be done for either type A or type B.  Proposal 3: Define 1% BLER for 2-step RACH requirements definition.  Proposal 4: Only define DMRS 1+1 for NR 2-step RACH performance definition. |
| R4-2009739 Views on BS demodulation requirements for NR 2-Step RACH | Intel | Proposal #1: Consider Post FFT time offset compensation as a baseline receive processing for requirements definition (i.e. No per UE FFT window adjustment).  Proposal #2: Specify MsgA demodulation performance requirements only with medium level TO set.  Proposal #3: Specify MsgA demodulation performance requirements with 1+1 DMRS configuration.  Proposal #4: During the test update TO error per each RACH preamble + MsgA occasion.  Proposal #5: Specify MsgA demodulation performance requirements with 1% BLER metric. |

# Topic #1: Setup for specifying BS demodulation requirements for 2-step RACH

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

## Companies’ contributions summary

## 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 on configurations*

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

**Issue 1-1: DMRS configuration**

* Proposals
  + Option 1: 1+1+1
  + Option 2: 1+1
* Recommended WF
  + Option 1?

**Issue 1-2: Mapping type**

* Proposals
  + Option 1: both mapping type A and B for both FR1 and FR2
  + Option 2: mapping type A for FR1, and mapping type B for FR2
* Recommended WF
  + Option 1?

**Issue 1-3: TO compensation**

* Proposals
  + Option 1: with TO compensation
  + Option 2: without TO compensation
* Recommended WF
  + Option 1?

**Issue 1-4: Starting value for medium level TO cycling**

* Proposals
  + Option 1: set 0 µs as starting value for SCSs for medium level TO cycling
  + Option 2: keep current starting values
* Recommended WF
  + Option 1?

**Issue 1-5: Should maximum value for TO cycling be larger than CP?**

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

**Issue 1-6: Scaling X:∆t:Y with SCSs between 15k and 30k, and between 60k and 120k**

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

**Issue 1-7: Test metric**

* Proposals
  + Option 1: BLER = 0.1
  + Option 2: BLER = 0.01
* Recommended WF
  + Option 1?

**Issue 1-8: MCS**

* Proposals
  + Option 1: keep current agreement MCS 1 for FR1 and MCS 3 for FR2
  + Option 2: set MCS 0 for both FR1 and FR2
* Recommended WF
  + Option 1?

**Issue 1-9: Combination of number of PRBs and number of symbols**

* Proposals
  + Option 1: keep current agreement (2 PRBs, 14 symbols) for FR1, and (2 PRBs, 10 symbols) for FR2
  + Option 2: (4 PRBs,7 symbols) for FR1 and (4 PRBs, 5 symbols) for FR2.
* Recommended WF
  + Option 1?

**Issue 1-10: Should requirements for both medium and high level TO cycling be defined?**

* Proposals
  + Option 1: Yes, keep current agreement
  + Option 2: No, only define requirement for high level TO cycling
  + Option 3: No, only define requirements for medium level TO cycling
* Recommended WF
  + Option 1?

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1:  Sub topic 1-2:  ….  Others: |
| Ericsson | Issue 1-1: In case 5/7 symbols would be selected, then the DM-RS should be 1+1. In case all symbols (i.e. 14/10) are selected, then 1+1+1 may make more sense because, although there is not a large performance difference 1+1+1 is the default configuration and so may be the one more often used.  Issue 1-2: For FR2, Rel-15 requirements consider mapping type B only. For FR1, in case fewer than 14 symbols are used then type B may be appropriate. If 14 symbols are used, A or B with an applicability rule is OK.  Issue 1-3: Our understanding is that the point of the requirement is to verify that T0 compensation is done properly (so option 1)  Issue 1-4: We’re OK to start from 0 (but don’t have a strong view)  Issue 1-5: This should be the difference between the “medium” and “high” T0; the “medium” is always within the CP.  Issue 1-6: For the “medium” T0; this relates to CP size and should scale with the SCS. For the “high” T0, this relates to largest expected cell size, which does not scale with T0.  Issue 1-7: We propose 1% BLER, since 10% probability of needing to go to 4-step RACH seems like 10% of the time missing the point of 2-step, which is rather high.  Issue 1-8: No strong view, but depends on the number of PRBs and the numberof symbols. Decide after considering 1-9.  Issue 1-9: Our understanding from the previous meeting was that 4 PRB would be associated with using half of the number of symbols (so that the TBS is the same for both 2 and 4 PRBs). Our simulations showed that performance could be better with 4 PRBs and half the symbols. Also, using half the symbols leaves room for T0 whilst avoiding colliding with the next slot. So we see some advantage from using 4 PRB and half the symbols, but we do not have a very strong view and would like to see the issue decided in this meeting. |
| Samsung | Issue 1-1: DMRS configuration  We prefer option 1  Generally, the timing offset estimation and compensated are performed per symbol by symbol. Since the current scenario is not targeting with high speed scenario, therefore, either configure 2 DMRS or 3 DMRS configuration can fulfil the requirement. As indicated in our initial results, the similar performance can be achieved with two different DMRS configurations.  In current Rel-16 NR HST WI, the related requirement for UL timing adjustment was specified, where the 3 DMRS configuration is configured. Since there is no new PHY design for NR 2 step RACH, we prefer to align with DMRS configuration for UL timing adjustment requirement.  From future improve manner, configure more DMRS can benefit for Doppler or frequency offset tracking to against the high Doppler scenario.  Meanwhile, based on RAN1 agreement about DMRS configuration for 2 step RACH, in case that there is no RRC configuration, the UE will apply the default value with “pos2”  Again, since the number of PRB allocated is limited for msgA PUSCH, considering the target information bit. The accuracy of timing estimation can be improved with configured more DMRS symbols  Issue 1-2: Mapping type  We prefer option 1  In Rel-15 eMBB, the related with PUSCH requirement was specified for both type A and type B in FR1, and Type B for FR2. As indicated, the performance with configured mapping type A and type B is very similar. In that sense, it is not necessary to replicate the test cases defined in NR Rel-15.    Again, from BS receiver processing, there should be no different for both mapping type A and type B.  To reduce the test effort, only mapping type A for FR1 and mapping type B for FR2 should be fulfill the test coverage.  Issue 1-3: TO compensation  With TO compensation operation, the MsgA PUSCH performance can be improved.  My understanding whether TO compensation or no should be the BS implementation issue. We do not think BS should be forced to do TO compensation operation no matter what is the value of TO.  Issue 1-4: Starting value for medium level TO cycling  We are fine with option 1. 2 step TA includes both preamble detection and MsgA PUSCH detection  For preamble detection, there is no PHY change. So the related test procedure can use the Rel-15 PRACH detection with 4 step RACH operation.  Issue 1-5: Should maximum value for TO cycling be larger than CP?  We prefer option 2.  In our view, we should identify the useful scenario for 2 step RACH, whether larger CP is available for 2 step RACH  In RAN1, both SLS and LLS simulation are introduced for the determination of payload size and mapping designs, etc. For SLS simulation assumptions, the targeting cell size is very small with round 200m, up to 25km. With agreed link-level simulation, format A1 is applied, where the use case for A1 is targeting for small cell.  Meanwhile, whether 2 step RACH or 4 step RACH applied is depending on RSRP threshold, according to 38.321 spec. The UE selected 2 –step random access type to perform random access based on this threshold. If Random Access Resources and the RSRP of the downlink pathloss reference is above *msgA-RSRP-Threshold,* UE will apply the 2-setp RACH. In that sense, 2 step-RACH is targeting with cell-centres UE, cell-edge UE will be fullback to 4 step RACH procedure.  From the BS receiver aspects, the motivation introducing TO is to discriminate the practical BS implementation. Based on our initial results, there is enough performance gap existed between without TO compensation and TO compensation.  2-Step RACH performance including both preamble detection and MsgA PUSCH detection. The MsgA PUSCH is detected by assuming the preamble detection is successfully. Since there is no limitation for RACH, a unified timing offset should be considered for all the preamble formats to guarantee the preamble detection  During the Rel-15 PRACH test, the maximum timing offset is 0.8us,  From our initial result, with the TO larger than CP, the BLER performance is still worse even with TO compensation operation, where the PUSCH detection error comes from the ISI.  In that sense, it is not practical to define the requirement with high level TO cycling.  Issue 1-6: Scaling X:∆t:Y with SCSs between 15k and 30k, and between 60k and 120k  We prefer option 1  Issue 1-7: Test metric  We prefer with option 1. 1% BLER is targeting with initial transmission. Since there is no HARQ transmission for MsgA PUSCH, we prefer to follow the same approach for test metric.  Issue 1-8: MCS  We prefer with option 2  If we need to fulfill the target TBS with 56~72bit, MCS 0 can be selected for requirement with 2 PRB, where the related TBS is 64 for 2 DMRS configuration, and 56 for 3 DMRS configuration  Issue 1-9: Combination of number of PRBs and number of symbols  We are fine with current agreement with option 1. If we apply option 2, the number of DMRS is less, the accuracy of TO estimation cannot be guaranteed  Issue 1-10: Should requirements for both medium and high level TO cycling be defined?  We prefer option 3, only define the requirements for medium level TO cycling, similar reason with issue 1-5. |
| Huawei | **Issue 1-1: DMRS configuration**  Firstly, there is negligible performance difference between DMRS 1+1 and 1+1+1, it is no need to use DMRS 1+1+1 considering extra DMRS overhead.  Secondly, DMRS 1+1 is more commonly used for all NR BS performance cases except HST scenario although DMRS pos2 is default if no RRC configuration. In HST scenario we use DMRS 1+1+1 since the huge frequency offset cannot be handled with DMRS 1+1.  Therefore, we don't see any reasonable reason to use DMRS 1+1+1.  **Issue 1-2: Mapping type**  We prefer Option 1, i.e. both mapping type A and B for both FR1 and FR2  Or Option 3: mapping Type A and B for FR1, Type B for FR2 to align with Rel-15 requirements.  **Issue 1-3: TO compensation**  Option 1 to keep current agreements.  **Issue 1-4: Starting value for medium level TO cycling**  We are OK with Option 1. Set 0 µs as starting value for SCSs for medium level TO cycling.  **Issue 1-5: Should maximum value for TO cycling be larger than CP?**  As per our evaluation, the performance difference between high TO level and medium TO level is negligible after TO compensation and the performance difference is obvious between performing TO compensation or not for both high TO level and medium TO level, so it is feasible to set TO cycling larger than CP.  **Issue 1-6: Scaling X:∆t:Y with SCSs between 15k and 30k, and between 60k and 120k**  We are OK with Option 1, i.e. Scaling X:∆t:Y with SCSs between 15k and 30k, and between 60k and 120k  **Issue 1-7: Test metric**  We are OK with Option 2 (1% BLER).  There is no discussion in RAN1 design that how much proportion is more proper for NR 2-step RACH to fall back to normal 4 step RACH. For our understanding, the purpose of using 2-step RACH is to reduce the access time for applicable scenarios while fallback procedure costs more time comparing to normal 4 step RACH. So we prefer to define stricter performance requirements to reduce fallback occurring. Also, 1% BLER can observe more errors caused by TO compensation rather than low SNR.  **Issue 1-8: MCS**  We are OK with the recommended WF, keep current agreements.  **Issue 1-9: Combination of number of PRBs and number of symbols**  We are OK with the recommended WF, keep current agreements.  **Issue 1-10: Should requirements for both medium and high level TO cycling be defined?**  At last meeting, an agreement is achieved that if essential difference will be observed – requirements will be defined for both. However, as per our evaluation, the performance between high TO level and medium TO level is negligible after TO compensation and the performance difference is obvious between performing TO compensation or not for both high TO level and medium TO level. So we prefer only define one set of requirements, i.e. only high TO level. |
| Nokia | Issue 1-1: DMRS configuration  Depends on the outcome of Issue 1-9.  For 4 PRBs and 5/7 symbols DMRS should be 1+1, with 2 PRBs and 10/14 symbols we would prefer 1+1+1.  Issue 1-2: Mapping type  We support **Option 1.**  Both mapping types should have requirements which are tested based on applicability rule.  Issue 1-3: TO compensation  We support **Option 1**  TO compensation is expected in MA and WA BS implementations.  Issue 1-4: Starting value for medium level TO cycling  We support **Option 1**.  In our view it makes more sense to use TO values starting from 0 us.  Issue 1-5: Should maximum value for TO cycling be larger than CP?  We support **Option 2**.  The BS has the option to define RSRP threshold to limit the use of 2-step RACH for UEs that at not on the cell edge. Therefore, when considering minimum operation requirements, TOs within the CP length can already cover a significant portion of the cell area for 15 and 30 kHz SCS.  Issue 1-6: Scaling X:∆t:Y with SCSs between 15k and 30k, and between 60k and 120k  We support **Option 1**.  We believe a practical BS implementation will probably configure RSRP thresholds in accordance to SCS, limiting the applicable cell area for 2-step RACH depending on the SCS.  Issue 1-7: Test metric  We support **Option 1**.  This option is more in line with typical PUSCH performance requirements.  Issue 1-8: MCS  We support **Option 1,** but MCS should be reviewed if the outcome of issue 1-9 is 4 PRBs.  Issue 1-9: Combination of number of PRBs and number of symbols  We support **Option 2**.  The larger number of PRBs and increased frequency diversity can be beneficial for MsgA demodulation.  Issue 1-10: Should requirements for both medium and high level TO cycling be defined?  We support **Option 3**.  The Medium level TO should be enough for most of the practical deployment scenarios of 2-step RACH. |
| Intel | **Issue 1-1: DMRS configuration**  No strong preference on this issue. Based on our evaluations enough accurate TOE can be achieved even with 1+1 DMRS configuration. Configured Doppler spread during the test is too small to perform performance degradation with 1+1 DMRS. From payload point of view both configurations correspond to payload sizes which are inside or near the range of typical 2-step RACH PUSCH payload.  **Issue 1-2: Mapping type**  Prefer Option 3 to simply reuse Rel-15 procedure: Mapping type A and Type B for FR1 and only type B for FR2. Rel-15 requirements reflect typical configurations in that sense we do not see necessity to define requirements with mapping type A for FR2. Same time for FR1 it is typical that different BS may declare different mapping types.  **Issue 1-3: TO compensation**  The main motivation to define 2-step RACH performance requirements is to verify proper TOE/TOC since with wrong TOE/TOC implementation reliable performance cannot be provided. Submitted simulation results from companies can confirm this.  **Issue 1-4: Starting value for medium level TO cycling**  Do not see reason to test performance with zero or enough small TO values since impact of such TO values is negligible and there will be no difference between proper and wrong BS implementation. From technical perspective it leads to only increased test time to collect enough error statistic. If there is no strong motivation from companies which support Option 1, we suggest using initial range which consist of values which can impact demodulation performance: prefer Option 2.  **Issue 1-5: Should maximum value for TO cycling be larger than CP?**  If we correctly understand the motivation of high level TO range (emulate 2-step RACH operation for cell-edge UEs) the answer should be Yes. Same time this answer does not related to requirements definition for High TO range.  **Issue 1-6: Scaling X:∆t:Y with SCSs between 15k and 30k, and between 60k and 120k**  Option 1 to have unified solution for all SCSs. Medium TO range does not restrict ISD for which 2-step RACH might be applicable.  **Issue 1-7: Test metric**  Prefer Option 2. High Tx reliability is a main use case of 2-step RACH to reduce latency. Beside that PRACH preamble right detection requirements use 0.01 metric, in that sense since joint Preamble + PUSCH performance will be tested it is reasonable to align test metrics between PRACH preamble and PUSCH.  **Issue 1-8: MCS**  Slightly prefer to not revert previous agreement (Option 1), but open for further discussion  **Issue 1-9: Combination of number of PRBs and number of symbols**  Prefer Option 1. If we agree on Option 2, we should consider only mapping type B for FR1 to configure additional DMRS symbol. Considering our preference to have both Mapping type A and B for FR1 we support previous agreement with 14 symbols.  **Issue 1-10: Should requirements for both medium and high level TO cycling be defined?**  As minimum performance requirements it is enough to consider only Medium TO range for requirements definition. Based on our evaluations there is no need to use enhanced demodulation processing on such low MCS value to provide reliable performance with TO values larger than CP length. In this case it is unlikely that different BSs will declare supporting of different 2-step RACH application ranges since conventional BS implementation allows to configure 2-step RACH operation for cell-edge UEs without demodulation performance impact. Same time as we see even in RAN1 2-step RACH was discussed mainly for cell-center UEs and it will be more convenient if minimum performance requirements will also not consider High level TO range. **As way forward we suggest defining requirements only with Medium TO range but clearly capture in WF that performance requirements do not restrict applicable BS-UE distance for 2-step RACH which only depends on configured threshold (msgA-RSRP-Threshold).** |
| ZTE | **Issue 1-1 DMR Configuration**  We slightly prefer Option 1 (1+1+1), which may provide more robustness and optimization.  Issue 1-2 Mapping Type  We can follow NR PUSCH: Type A and B for FR1, and Type B for FR2, or Option 2 is fine.  Issue 1-3 TO compensation  Option 1 (with TO compensation)  Issue 1-4 Starting value for medium level TO  Option 1 (starting from 0)  Issue 1-5 maximum value for TO cycling  For high level TO cycling, it should be larger than a CP  Issue 1-6 Scaling  Option 1 Yes  Issue 1-7 Test metric  Option 1 (0.1)  Issue 1-8 MCS  Option 1 keep current agreement  Issue 1-9 Combination of PRB# and symbol #  Option 1 to keep current agreement, but no strong view, and are open to other options  Issue 1-10 both medium and high level TO cycling be defined  Option 1 and 3 are fine, but for Option 3, we need to emphasize that 2-step RACH can be used for cell-edge users depending on the network configuration |

### 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 – FRC related and mapping type** | *Tentative agreements:*   * *Considering the decisions on (DMRS configuration, number of PRB, number of symbols, MCS, mapping type) together*   *Candidate options:*   * *Option 1: (1+1+1,2,14,2,A&B) for FR1, (1+1+1,2,10,3,B) for FR2* * *Option 2: (1+1,4,7,0,A&B) for FR1, (1+1,4,5,0,B) for FR2* * *~~Option 3: (1+1,2,14,2,A&B) for FR1, (1+1,2,10,3,B) for FR2~~*   *Recommendations for 2nd round:*   * Further discuss the above options and select one option as a baseline. * If being justified, DMRS configuration for FR2 can be different from that for FR1 on top of the selected baseline |
| **Medimum and high level TO cycling** | *Tentative agreements:*  *Recommendations for 2nd round:*   * *Discuss further the implications of adopting medium only or medium/high T0 on test coverage* |
| **Test metric** | *Observation: Still no consensus (4 companies for 1%, 2 companies for 10%)*  *Tentative agreements:*   * *Keep it open and companies are encouraged to provide SNRs for both 1% and 10%* |
| **TO and TO cycling values** | *Tentative agreements:*   * *For TO compensation, keep the current agreement that TO compensation is assumed at BS side* * *For TO cycling values for medium level TO (scaling between 15k and 30k SCS, and between 60k and 120k SCS, and starting from 0):*   + *15k SCS: [0:0.2:2], 30k SCS: [0:0.1:1]*   + *60k SCS: [0:0.05,0.5], 120 SCS: [0:0.025,0.25]*   *Recommendations for 2nd round:*   * *Review and conclude TO cycling values shown above* |
|  |  |

*Recommendations on WF/LS assignment*

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

Ericsson comments to WF:

Slide 4: Regarding the PRB and symbol number, option 2 seems to give a better performance and leaves space for timing misalignment, so we see that as slightly better. We do not have a strong view though since option 1 with all symbols may also have some reasoning.

Slide 7: Our proposal is option 3: Test either the medium T0 *or* the high T0 (but never both) depending on vendor declaration.

Our reasoning is: If T0 compensation is only performed up to the CP and cannot be extended further then there will be a performance loss if a UE further than the minimum CP would be operated. Unlike the situation with the RAN preamble, in this case it is not reasonable to assume that an algorithm that can compensate up to the CP length would also compensate for larger T0, since the implementation may be limited (whereas for the preamble, such limits are not expected),

We think the easiest way is the declaration; otherwise we would need to state something in the spec like the requirements are defined for distances corresponding to T0 up to the CP length, and where the 2-step RACH is operated for larger distances, the RAN4 requirement and test does not guarantee performance (or something similar)

Slide 10 is a copy of slide 8.

Samsung comments to WF:

Slide 4:

Regarding with DMRS configuration, we still prefer to discuss for FR1 and FR2 separately. We agree that 3 DMRS configuration is default, if no RRC configuration.

For FR1, we are ok with 3 DMRS

As for FR2, based on the current assumption, it is not targeting for high speed scenario, we do not think the necessary to define requirement with 3 DMRS. Meanwhile, in Rel-15 eMBB, only 2 DMRS is configured

To compact the test cases with different BS receiver processing with and without RRC configuration

Therefore, we prefer to define requirement with 1+1+1 DMRS for FR1, and 1+1 for FR2

Regarding the number of PRB, number of symbols, and MCS, if my understanding is correctly, the number of CRC bits is not included within the targeting TBS of 56bit~72bits. In that sense, based on current configuration, the TBS is 96 for MCS 2 with 2 PRB and 14 OFDM under 3 DMRS configuration, and the TBS is 104 for MCS 2 with 2 PRB and 14 OFDM under 3 DMRS configuration.

Based our calculation, the TBS is 56 for (MCS 0, 2 PRB, 14 OFDM and 3 DMRS), and 64 for (MCS 0, 2 PRB, 14 OFDM and 2 DMRS) for FR1, and 56 for (MCS 0, 2PRB, 10 OFDM and 2 DMRS)

As for option2, 56 bit for (MCS 0, 4 PRB, 7 OFDM and 2 DMRS) and 32 bit for (MCS 0, 4 PRB, 5 OFDM and 2 DMRS)

Based on above analysis, we prefer option 3

Option 3: (1+1+1, [2], [14], [0], A&B) for FR1, (1+1, [2], [10], [0], B) for FR2

Slide 5: we are ok with medium level TO, while there are still some unclear issues to clarify

Based on our initial results, the performance gap with small TO cycling size (for example, 0.2us, total 11 TO values), is minor, thus, should will still need to define the requirement with small TO step size? We do not see the need to define the requirement with very small TO value step size

To reduce the test effort, maybe the following TO is preferred

15 KHz SCS: [0:0.4:2]

30 KHz SCS: [0:0.2:1];

60 KHz SCS: [0:0.1:0.5];

120 KHz SCS: [0:0.05:0.25]

Regarding the SNR requirement for targeting, based on these value, if my understanding is correctly, we need to introduce 11 test cases with different timing offset in the core spec (104), then derive the SNR requirement for each timing offset.

Slide 6: As commented in 1st round, we do not think high level TO cycling TO offset is realistic scenario for 2 step RACH

Whether 2 step RACH or 4 step RACH applied is depending on RSRP threshold, according to 38.321 spec. The UE selected 2 –step random access type to perform random access based on this threshold. If Random Access Resources and the RSRP of the downlink path loss reference is above msgA-RSRP-Threshold, UE will apply the 2-setp RACH. In that sense, 2 step-RACH is targeting with cell-centers UE, cell-edge UE will be fullback to 4 step RACH procedure. With cell edge-UE, it can only apply 4 step RACH

Therefore, we are not ok to define requirement with high level TO cycling values. Meanwhile, the value in 30 KHz is large then the cell coverage calculated by CP of PRACH preamble, it is not valid.

Slide 7: we prefer option1, as mentioned, we do not prefer to define requirement with high level cycling TO

Slide 10: we are ok with CR work split. Based on guidance of Chairman, considering there is still open issues for test parameters, it may not proper to provide the draft CR in the 2nd round discussion. We suggest to focus on the discussion of open issue in 2nd round. Companies can provide the draft CR in the next meeting.

As for section title, although this requirement is targeting for 2 step RACH, only MsgA PUSCH requirement is specified, there is no additional requirement for preamble detection. Therefore, it may be more proper with changing title as

Requirements for MagA PUSCH

Regarding the section number, as commented in 1st round, it should be reserved for other WIs to avoid the collision, such as URLLC, which the structure also is under discussion

Huawei’s comments on r1 version:

Slide#4:

We shared all our technical concerns on selection of DMRS 1+1+1 by email in the 1st round, we copied here for convenience:

As per the submitted results, almost all companies observed that there is negligible performance difference between DMRS configuration of 1+1 and 1+1+1, we really can’t understand why additional useless DMRS symbol is configured, it will bring additional overhead without performance gain.

As per the DM-RS configuration for NR Rel-15 PUSCH performance requirements, DM-RS 1+1 is configured for normal PUSCH performance requirements, DMRS 1+1 is more often used, DMRS 1+1+1 is only considered for high speed train to support higher Doppler shift. The agreed UL TA requirements for scenario Y and Z are also for high speed train instead of for normal scenario.

Our option is added in the WF: Option 3: (1+1,2,14,2,A&B) for FR1, (1+1,2,10,3,B) for FR2

Slide#7:

Considering no performance difference after TO compensation for either medium or high level TO, we think it is enough to only test requirements for high level TO cycling to reduce the number of test cases.

Slide#8:

SNR for both 1% and 10% are encouraged to provide for the next meeting, we would like to know what is the principle to decide which one to be selected for final performance requirements definition? Otherwise still diverge views on the test metric.

Slide#10:

Thanks for the CR work split.

As moderator suggested in the email body to encourage company to draft CR during this week, considering the upcoming deadline for comment on open issues, we do not think that it is feasible to do this work during this meeting, but we would like to hear other companies’ view on this.

## 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 #2: Declaration and test aspects

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

## Companies’ contributions summary

## 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

*Sub-topic description: Declaration item(s) for BS demodulation for 2-step RACH*

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

**Issue 2-1-1: Should be the support of medium or high level TO cycling declared?**

* Proposals
  + Option 1: Yes, either support of medium or high level TO cycling should be declared
  + Option 2: Yes, only the support of high level TO cycling should be declared. Support of medium level TO cycling is mandatory
  + Option 3: Yes, only the support of medium level TO cycling should be declared. Support of high level TO cycling is mandatory
  + Option 4: No, both medium and high level TO cycling should be mandatory
* Recommended WF
  + Option 1?

### Sub-topic 2-2

*Sub-topic description: test aspects for BS demodulation for 2-step RACH*

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

**Issue 2-2: Should TO error be updated per each RACH preamble+MsgA occasion during the test?**

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

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 2-1:  ….  Others: |
| Ericsson | Issue 2-1-1: Our understanding, and looking at results from Intel is that if the T0 is larger than the CP and timing compensation is not done correctly then performance is degraded. If the requirement would be set considering medium T0 only, then that would mean that a BS claiming to cover the whole cell with 2-step RACH could achieve the requirement but have incorrectly implemented timing compensation and have a performance loss outside of the CP area. If on the other hand only the high T0 would be used, then all BS would be forced to implement the timing compensation for high T0, which may include some re-sampling. To ensure correct requirement coverage whilst not forcing any implementation, we think the best approach is to declare whether medium or high T0 is met; i.e. option 1.  Issue 2-2: Our understanding is that what is meant is “Apply the same T0 to both PRACH preamble and msgA”. If this is correct, we would like to update the wording of the option for clarity, and can agree with it. |
| Samsung | **Issue 2-1-1: Should be the support of medium or high level TO cycling declared?**  This issue depends on whether to define the requirement for both medium and high level TO cycling.  Firstly, UE supported 2 step RACH is optional with capability signaling. Therefore, the requirement with MsgA PUSCH is optional, based on BS declaration. As mentioned, we do not prefer to define requirement with High level TO cycling considering the useful scenario for 2 step RACH.    **Issue 2-2: Should TO error be updated per each RACH preamble+MsgA occasion during the test?**  We are fine with option 1, we have the similar view with Ericsson, and the wording should be further clarified  Regarding the timing offset, the following is agreed in RAN1   |  | | --- | | * The timing for MsgA PRACH and PUSCH transmission should be both assumed as N\_TA =0. |   Based on RAN1 agreement, at least gNB will assume the same transmission timing for UE with MsgA PRACH and PUSCH to process preamble for timing and use that information for MsgA PUSCH demodulation. Therefore, it is reasonable to have the same TO for preamble and MsgA PUSCH. |
| Huawei | **Issue 2-1-1: Should be the support of medium or high level TO cycling declared?**  We prefer only define one TO level and there is no declaration issue. If finally two TO levels are defined, the corresponding applicability rule should be defined, i.e. medium level cases are not applicable to BS that has passed high level TO case. Therefore, only one declaration about TO level need to be specified with the choice of either medium or high.  **Issue 2-2: Should TO error be updated per each RACH preamble+MsgA occasion during the test?**  We are OK with the recommended WF. |
| Nokia | Issue 2-1-1: Should be the support of medium or high level TO cycling declared?  The decision on this issue should depend on the decision on Issue 1-10.  Issue 2-2: Should TO error be updated per each RACH preamble+MsgA occasion during the test?  I also share the confusion on the wording for this issue.  We agree that MsgA PRACH and MsgA PUSCH should be sent with the same TO, which is how we understand **Option 1**. |
| Intel | **Issue 2-1-1: Should be the support of medium or high level TO cycling declared?**  Same views as Samsung, that requirements should be optional. Based on our view on Issue 1-10 prefer to define requirements and corresponding declaration only for Medium TO range.  **Issue 2-2: Should TO error be updated per each RACH preamble+MsgA occasion during the test?**  Sorry for confusion from our side – obviously, wording should be updated. |
| ZTE | **Issue 2-1-1: Should be the support of medium or high level TO cycling declared?**  We are OK with Option 2 and 4.  **Issue 2-2: Should TO error be updated per each RACH preamble+MsgA occasion during the test?**  Option 1 yes. |

### 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**  **Declaration** | *Tentative agreements:*  *Candidate options:*  *Discuss further whether lack of test coverage for large cell operation is OK*  *Recommendations for 2nd round:*   * Conclude this issue |
| **TO error update** | *Tentative agreements:*  *Recommendations for 2nd round:*   * *Finalize wording* |

*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: CRs

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

## Companies’ contributions summary

## 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 3-1

*Sub-topic description: CR for TS 38.104*

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

**Issue 3-1: Add a new section 8.2.6 to capture the requirements of BS demodulation for 2-step RACH in TS 38.104**

* Proposals
  + Option 1: Yes
  + Option 2: Other options not precluded
* Recommended WF
  + Option 1?

### Sub-topic 3-2

*Sub-topic description: CR for TS 38.141-1*

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

**Issue 3-2: Add a new section 8.2.6 to capture the requirement test of BS demodulation for 2-step RACH in TS 38.141-1**

* Proposals
  + Option 1: Yes
  + Option 2: Other options not precluded
* Recommended WF
  + Option 1?

### Sub-topic 3-3

*Sub-topic description: CR for TS 38.141-2*

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

**Issue 3-3: Add a new section 8.2.6 to capture the requirement test of BS demodulation for 2-step RACH in TS 38.141-2**

* Proposals
  + Option 1: Yes
  + Option 2: Other options not precluded
* Recommended WF
  + Option 1?

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 3-1:  ….  Others: |
| Ericsson | OK to add new sections; should we do a CR split ? (We can volunteer for one CR) |
| Samsung | **Issue 3-1: Add a new section 8.2.6 to capture the requirements of BS demodulation for 2-step RACH in TS 38.104**  Generally, we are ok to add new sections.  We think new sections included both FR1 and FR2 should be added. As for the section number, my understanding it should be aligned with other WIs related BS demodulation, i.e, Rel-16 URLLC.  The current spec structure is also under discussion. Considering the test parameters for MsgA PUSCH is not stable, we prefer to focus the details test parameters finalization in this meeting.  Regarding the CR itself, if we do a CR split, we also can volunteer for one CR  **Issue 3-2: Add a new section 8.2.6 to capture the requirement test of BS demodulation for 2-step RACH in TS 38.141-1**  Similar comment with issue 3-1  **Issue 3-3: Add a new section 8.2.6 to capture the requirement test of BS demodulation for 2-step RACH in TS 38.141-2**  Similar comment with issue 3-1 |
| Huawei | **Issue 3-1/2/3**  Ok with the recommended WF. Additionally the new sections for FR2 should also be added in section 11.2.1 and section 11.2.2 of TS 38.104.  For CR split, we can also volunteer for one CR. |
| Nokia | Issue 3-1: Add a new section 8.2.6 to capture the requirements of BS demodulation for 2-step RACH in TS 38.104  We agree to **Option 1**, and we volunteer for one CR when we do the CR split.  Issue 3-2: Add a new section 8.2.6 to capture the requirement test of BS demodulation for 2-step RACH in TS 38.141-1  We agree to **Option 1**, and we volunteer for one CR when we do the CR split.  Issue 3-3: Add a new section 8.2.6 to capture the requirement test of BS demodulation for 2-step RACH in TS 38.141-2  We agree to **Option 1**, and we volunteer for one CR when we do the CR split. |
| Intel | **Issue 3-1/2/3**  Agree with Option 1 and can also volunteer for one CR. |
| ZTE | **Issue 3-1/2/3**  The total CR drafting may consist of:   1. Section 8.2.6 in TS 38.104 2. Section 11.2.1 in TS 38.104 3. Section 11.2.2 in TS 38.104 4. FRC Annex in TS 38.104 5. Section 8.2.6 in TS 38.141-1 6. FRC Annex in TS 38.141-1 7. Section 8.2.6 in TS 38.141-2 8. FRC Annex in TS 38.141-2   We propose to perform a CR split as:  ZTE: (1) (4)  Ericsson: (5)  Huawei: (2) (3)  Nokia: (6)  Samsung: (7)  Intel: (8) |

### 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** |
| R4-2010784 Draft CR for 38.104 | 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 agreements:*  *CR work split:*  ZTE: Section 8.2.6 in TS 38.104, FRC Annex in TS 38.104  Ericsson: Section 8.2.6 in TS 38.141-1  Huawei: Section 11.2.1 in TS 38.104 and Section 11.2.2 in TS 38.104  Nokia: FRC Annex in TS 38.141-1  Samsung: Section 8.2.6 in TS 38.141-2  Intel: FRC Annex in TS 38.141-2  *Candidate options:*  *Recommendations for 2nd round:*   * Drafting CRs according to the CR work split and agreements on FRC configurations. |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Draft CR to TS 38.104 BS demodulation requirements for 2-step RACH (Section 8.2.6 and Annex) | ZTE |
| #2 | Draft CR to TS 38.141-1 BS demodulation requirements for 2-step RACH (Section 8.2.6) | Ericsson |
| #3 | Draft CR to TS 38.104 BS demodulation requirements for 2-step RACH (Section 11.2.1 and 11.2.2) | Huawei |
| #4 | Draft CR to TS 38.141-1 BS demodulation requirements for 2-step RACH (Annex) | Nokia |
| #5 | Draft CR to TS 38.141-2 BS demodulation requirements for 2-step RACH (Section 8.2.6) | Samsung |
| #6 | Draft CR to TS 38.141-2 BS demodulation requirements for 2-step RACH (Annex) | Intel |

### 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** |
| R4-2010784 Draft CR for 38.104 | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”*  *To be revised to proposed assignment #1 in Section 3.4.1* |

## 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: Simulation results

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

## Companies’ contributions summary

## Open issues summary

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

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | ….  Others: |

### 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 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”* |