

[102-e][327] NR_exto71GHz_Demod_NWM - Version 0.0.3

RAN4

3GPP TSG-RAN WG4 Meeting # 102-e R4-22XXXX

Electronic Meeting, 21 February – 03 March 2022

Agenda item: 10.16.10

Source: Moderator (Intel Corporation)

Title: Email discussion summary for [102-e][327] NR_exto71GHz_Demod_NWM

Document for: Information

Introduction

This thread will be used to guide and summarize the email discussion for the topic of Rel-17 extending current NR operation to 71GHz demodulation and CSI requirements (AI 10.16.10), with the email thread identifier [102-e][327] NR_exto71GHz_Demod_NWM”.

The scope of this email discussion is definition of Rel-17 NR FR2-2 demodulation and CSI performance requirements, and in particular the agenda items:

10.16.10 Demodulation and CSI requirements [NR_ext_to_71GHz-Perf]

10.16.10.1 General [NR_ext_to_71GHz-Perf]

10.16.10.2 UE Demodulation and CSI requirements [NR_ext_to_71GHz-Perf]

10.16.10.3 BS Demodulation and CSI requirements [NR_ext_to_71GHz-Perf]

RAN4#102-e has 0.5 TU allocated to performance part of NR_ext_to_71GHz-Perf [RP-212990].

Priority topics for the discussion are marked directly in the open issues’ summaries.

Discussion guidelines

- Please follow the “RAN4#102-e E-meeting Arrangements and Guidelines”, available on the reflector, for fundamental guidelines and deadlines.
- Delegates are strongly encouraged to provide comments/concerns asap.
- Silence within a reasonable timeframe means no objection.
- It is encouraged to give at least a short reasoning for each expressed view.

1 Topic #1: General

1.1 Companies' contributions summary

T-doc number	Company	Proposals / Observations
R4-2203530	Nokia, Nokia Shanghai Bell	<p>Observation 1: Operation in FR2-2 includes support of 120, 480, and 960 kHz SCS.</p> <p>Observation 2: Channel bandwidths of up to 2000 MHz are supported in FR2-2.</p> <p>Observation 3: In order to support FR2-2 operation, a UE has to support at least 120 kHz SCS.</p> <p>Observation 4: Initial access can be supported with SSBs using 120 kHz and 480 kHz SCS.</p> <p>Observation 5: In order to support one SCS in UL, the UE has to at least support the same SCS in DL.</p> <p>Observation 6: Support of one SCS in DL does not imply support of the same SCS in UL.</p> <p>Proposal 1: Specify new demodulation performance requirements for UE and BS for SCS 480 kHz and 960 kHz</p> <p>Observation 7: Scheduling and link adaptation typically allocates large SCS and MCS in situations with low delay spread.</p> <p>Observation 8: Distribution of the delay spread in typical scenarios for operation in FR2-2 are mostly concentrated below 30 ns, with a large part of the samples experiencing delay spread between 10 and 20 ns.</p> <p>Observation 9: Existing RAN4 requirements include TDLA30 as the minimum delay spread for fading channels.</p> <p>Proposal 2: RAN4 to study the use of TDLA10 and TDLA20 for demodulation requirements with large SCS and high MCS.</p> <p>Observation 10: Doppler shift is directly proportional to the carrier frequency, Hence, it should be higher in FR2-2 compared to FR2-1.</p> <p>Observation 11: Simulation assumption for FR2 was 30 GHz.</p> <p>Proposal 3: We propose to double the doppler shifts in FR2-2 than the ones already used for FR2-1. i.e., TDLAxx-150, and TDLAxx-300.</p> <p>Observation 12: Deployment scenarios agreed in RF and RRM already include FR2-2 only standalone and CA/NR-DC with FR1 anchor.</p> <p>Proposal 4: RAN4 to consider demodulation requirements including the following scenarios:</p> <ul style="list-style-type: none"> • Standalone FR2-2 only • CA and NR-DC with FR1 anchor and FR2-2
R4-2204031	Ericsson	<p>Proposal 1: Companies deliver two sets of ideal simulation results for requirement discussion. Result set#1 is without phase noise and set#2 is with phase noise. Phase noise model could use model set 1 defined in TR38.808.</p> <p>Proposal 2: Companies deliver trial simulation results based on channel model TDLA30, TDLA10 and TDLA5. Consider define new channel model TDLA10 or TDLA5 for FR2-2 demodulation requirement if they are feasible.</p> <p>Proposal 3: Companies deliver trial simulation results based on different maximum Doppler shift 200Hz (UE speed at 3km/h) and 2000Hz (UE at 30km/h) at 70GHz for further discussion.</p> <p>Proposal 4: Regarding possible outdoor deployment for FR2-2 BS, consider higher UE speed with more DM-RS configuration, such as 30km/h with 1+1 DM-RS, for the requirement if it is feasible.</p> <p>Proposal 5: Prioritize 120kHz SCS for both BS and UE demodulation requirement discussion. 480kHz and 960kHz SCS could be lower priority.</p> <p>Proposal 6: Prioritize the minimum and maximum supported bandwidth for each supported SCS for the demodulation discussion.</p> <p>Observation 1: If LBT is considered, test setup for shared spectrum access is different from NR SA, but there wouldn't be much performance difference from demodulation perspective.</p> <p>Observation 2: If LBT is not considered, only TDD patterns for 120kHz SCS are available.</p> <p>Proposal 7: Define one set of FR2-2 demodulation requirements to cover both</p>

1.2 Open issues summary

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

1.2.1 Sub-topic 1-1: Work plan

Sub-topic description:

The latest TU request for NR_ext_to_71GHz can be found in RP-212990, “Status Report to TSG; rapporteur: Qualcomm; Intel Corporation”, WI status report, RAN#94-e]. The target completion date for performance (NR_ext_to_71GHz-Perf) is September 2022. The following amount of TUs are allocated for this work:

- 0.5 TU at RAN4#102-e
- 0.5 TU at RAN4#103-e
- 1 TU at RAN4#104

Open issues and candidate options before e-meeting:

Issue 1-1: Work plan

- Proposals
 - Proposal 1 (Intel): Suggested workplan:
 - RAN4 #102e
 - Discussion and agreement on work plan
 - Discussion on performance requirements scope
 - Initial discussion on work split
 - Initial discussion on simulation assumptions
 - RAN4 #103e
 - Finish discussions on performance requirements scope per each physical channel
 - Finish discussions on simulation assumptions per each physical channel
 - Finish discussions on work split
 - Initial round of simulation results collection and alignment
 - Initial draft CRs for TS 38.104 Base Station (BS) radio transmission and reception
 - Initial draft CRs for TS 38.141-2 Base Station (BS) conformance testing Part 2: Radiated conformance testing

- Initial draft CRs for TS 38.101-4 User Equipment (UE) radio transmission and reception; Part 4: Performance requirements

- RAN4 #104

- Final round of simulation results collection and alignment
- CRs for TS 38.104 Base Station (BS) radio transmission and reception
- CRs for TS 38.141-2 Base Station (BS) conformance testing Part 2: Radiated conformance testing
- CRs for TS 38.101-4 User Equipment (UE) radio transmission and reception; Part 4: Performance requirements

- Recommended WF

- Collect views in 1st round

Feedback Form 1: Issue 1-1: Work plan

1 – Samsung Electronics Benelux BV

Samsung: In general, we are fine with work plan based on target completion date. For this meeting, we should focus on scope and general test setup, for details simulation assumption, we are not sure whether the agreement can be achieved,

2 – Intel Corporation (UK) Ltd

Based on the current schedule we do not see another possible way how to complete performance part on time.

Baseline set of simulation assumptions should be discussed this meeting to provide initial results next meeting. This meeting we have a good set of proposed assumptions for each physical channel. Some selection can be made already. Also, since this is the first meeting, companies might need more time to check, so a note that “other options are not precluded” can be added for each assumption.

3 – Apple GmbH

Given the target completion date, we are fine with the work plan.

4 – HiSilicon Technologies Co. Ltd

we are fine with the work plan.

5 – Ericsson LM

Ericsson: We think it’s an ambitious plan to finish all discussion in 3 meetings regarding there are potentially many requirements would be defined.

The initial round of simulation results collection planned for 103e meetings will depend on how and which agreements will be set in this meeting (102e)

6 – Qualcomm Technologies Int

We see that given the timeline the schedule has to be compressed as proposed in the work plan, but we share other companies’ concern regarding completing the discussion in time

1.2.2 Sub-topic 1-2: General aspects of demodulation requirement definition

Sub-topic description

The purpose of this sub-topis is to define the general set of demodulation and CSI reporting requirements. Whether to define completely new set of requirements or reuse existing FR2-1 requirements, and detail scope of requirements are discussed in another issues.

Open issues and candidate options before e-meeting:

Issue 1-2-1: General scope of BS demodulation performance requirements

All contributions have discussed introduction of requirements for PUSCH, PUCCH, and PRACH UL physical channels. There are no proposals to deprioritize or skip one these physical channels.

- Proposals

- Option 1 (Huawei, Ericsson, Nokia, Intel): Define PUSCH, PUCCH, and PRACH performance requirements.

- Recommended WF

- Check whether Option 1 is agreeable.

Feedback Form 2: Issue 1-2-1: General scope of BS demodulation performance requirements

1 – Nokia Belgium

Nokia: we are fine with the WF

2 – Samsung Electronics Benelux BV

Samsung: OK with recommended WF

3 – Intel Corporation (UK) Ltd

Support Option 1.

4 – HiSilicon Technologies Co. Ltd

Support option 1

5 – Ericsson LM

Ericsson: Support Option 1.

Issue 1-2-2: General scope of UE demodulation and CSI reporting performance requirements

Based on the contribution review, it seems that all companies propose to define PDSCH, PDCCH, and CSI reporting requirements. There are different views on requirements introduction for PBCH and SDR. One important note that is mentioned in [R4-2205802] that there are no conformance test cases for PBCH due to some testability issues identified.

- Proposals

- Option 1 (Ericsson, Nokia): Define PDSCH, PDCCH, PBCH, and SDR performance requirements.
- Option 2 (Intel): Define PDSCH, PDCCH, and SDR performance requirements. Do not define PBCH performance requirements.
- Option 3 (Huawei): Define PDSCH, PDCCH and PBCH requirements. Don't define SDR performance requirements.

- Recommended WF

- Check whether it is agreeable to define PDSCH, PDCCH requirements.
- Collect views on whether to define requirements for PBCH and SDR

Feedback Form 3: Issue 1-2-2: General scope of UE demodulation and CSI reporting performance requirements**1 – Nokia Belgium**

We prefer Option 1.

We think it is important to include the PBCH requirements.

As for the SDR requirements we don't see the big gain in workload of precluding it.

2 – Intel Corporation (UK) Ltd

Data rate can be much higher in FR2-2 compared to FR2-1. Therefore, it is important to guarantee that L1 and L2 correctly process received packets corresponding to the maximum data rate. In this case we recommend defining SDR requirements for FR2-2. Similar test methodology as in FR2-1 can be reused with some required confirmation that is discussed in issue 3-6-1.

As for PBCH, we are not strongly against to define such requirements. We proposed to deprioritize them because PBCH test cases is just an informative requirement to show operating SNR points. RAN5 has not specified conformance test cases for PBCH neither for FR1 nor for FR2 because it is hard to define simple test due to lack of any feedback from UE on successful/non-successful PBCH decoding. Do we really need to spend RAN4 efforts right now to define the informative requirements?

3 – HiSilicon Technologies Co. Ltd

We prefer option 3. RAN 1 has defined new SSB transmission pattern and new SCS for PBCH which are import feature for demodulation part. We support define PBCH requirements. As for SDR test, we don't see any motivation to introduce it.

4 – Apple GmbH

We should define all requirements for FR2-2. It is important to define SDR requirements and PBCH demod. We can choose to only define PBCH decoding with unknown SSB index.

5 – Ericsson LM

Ericsson supports Option 1. PBCH demodulation requirements should be defined for FR2-2. About SDR requirements, FR2-2 is challenging for high MCS and rank should be examined to see whether rank 2 could be supported or not.

6 – Qualcomm Technologies Int

We are fine with Option 1, but we support Apple's opinion to define PBCH decoding only with unknown SSB index (and not with known SSB index)

Issue 1-2-3: Scenarios to be considered for requirements definition

- Proposals

- Proposal 1 (Nokia): RAN4 to consider demodulation requirements including the following scenarios:
 - Standalone FR2-2 only
 - CA and NR-DC with FR1 anchor and FR2-2
- Proposal 2 (Ericsson): RAN4 defines the UE demodulation and CSI reporting requirements with:
 - Both single carrier (FR2-2) and NR-DC FR1 + FR2-2 scenarios
- Proposal 3 (Intel): Do not define DL performance requirements for CA in FR2-2 in Rel-17

- Recommended WF

- Collect views in 1st round

Feedback Form 4: Issue 1-2-3: Scenarios to be considered for requirements definition

1 – Nokia Belgium

We prefer proposal 1.

This is in line with RF and RRM agreements. We would like to have demodulation requirements that are in line with the scenarios of proposal 1.

2 – Samsung Electronics Benelux BV

Samsung: For BS demodulation , only focus on FR2-2

3 – Intel Corporation (UK) Ltd

Definitely, RAN4 should address SA scenario. NR-DC with FR1 anchor performance can be also guaranteed by requirements defined for SA similar to FR2-1. Same time, it is premature to discuss CA requirements due to lack of the bands in FR2-2 and not clear max CBW that will be supported for demod test from testability perspective. Therefore, we suggest focusing on SA requirements, define applicability rule to guarantee NR-DC operation and postpone CA requirements definition to the next release.

4 – Apple GmbH

Fro Rel-17 we should introduce requirements for SA and NR-DC. In NR-DC the requirements will only apply to FR2-2. CA requirements can be introduced in later release.

5 – HiSilicon Technologies Co. Ltd

We propose to keep it open and discuss it next meeting

6 – Ericsson LM

Ericsson: Proposal 2 also encloses Proposal 3, because the WID only includes CA between FR1 and FR2-2 (band 263), so we cannot talk right now on CA in FR2-2 (as stated in Proposal 3). Therefore, we believe that Proposal 2 is accurate and complete.

Issue 1-2-4: Shared spectrum access requirements

- Proposals

- Proposal 1 (Huawei):
 - Not consider LBT failure for PUSCH, PUCCH and PRACH cases
 - Define two set of PDSCH requirements for license band without LBT mechanism and unlicensed band with LBT mechanism
- Proposal 2 (Ericsson): Define one set of FR2-2 demodulation requirements to cover both NR SA deployment and shared spectrum access deployment if possible.
- Proposal 3 (Intel): Define FR2-2 UE demodulation requirements that cover licensed and unlicensed operations

- Recommended WF

- Collect views in 1st round

Feedback Form 5: Issue 1-2-4: Shared spectrum access requirement

1 – Nokia Belgium

For this issue we think it would be better to split the discussion in UE and BS demod.

For BS demod we don't see the reason to use LBT failure in the requirements, and we could follow NR-U approach.

For UE demod NR-U has defined requirements with LBT failures. However, since in this frequency range the probability of failures is smaller there is no big need to define requirements considering failures, and we are mostly neutral about defining requirements with LBT for UE demod.

So I propose discussing based on Proposal 4:

- Proposal 4 (New):

- For PUSCH, PUCCH and PRACH requirements, single set of requirements without LBT are defined
- For PDSCH requirements
 - Option 1: define requirements without LBT
 - Option 2: define requirements with and without LBT

2 – Samsung Electronics Benelux BV

Samsung: Similar view with Nokia, for BS requirement, single set of requirements without LBT are defined

3 – Intel Corporation (UK) Ltd

For BS we agree to define requirements without LBT failure.

For UE we also propose to define requirements without LBT failure due to the following reasons:

- 1) LBT failure does not have impact on PDSCH performance. It was confirmed by many companies during the NR-U Rel-16 discussion.
- 2) LBT mechanism is not mandated in all regions for FR2-2.
- 3) LBT failure rate potentially quite small in FR2-2 due to quite directive beams. So it is not really critical to verify LBT procedure in FR2-2.

4 – Apple GmbH

Define the same requirements that are applicable to both licensed and unlicensed bands. We don't see huge performance impact due to LBT failure modeled. Hence we propose to only introduce requirements without LBT failure modeled.

5 – HiSilicon Technologies Co. Ltd

We understand some companies' concern that LBT failure may not be usually happened in FR2-2 with directional channel listening and no corresponding performance difference is observed. We can compromise to not consider LBT failure for both BS and UE side. Meanwhile, we should add the clarification that all the requirements can be apply for both licensed band and unlicensed band.

6 – Ericsson LM

Ericsson: Support Option 2 and also think it could be better to define one set of requirements to cover licensed and unlicensed operations. We think LBT is not so relevant to demodulation performance and it is not typical for FR2-2 unlicensed operation considering very small cell and very narrow beam.

7 – Qualcomm Technologies Int

For UE demod, the NR-U discussion in Rel.16 showed that for unlicensed operations LBT did not have a direct impact the demod performances, but in case of LBT failure the UE has to be able to skip periodic TRS scheduled (which was not transmitted over the air). This has a potentially unbound impact on performances, and it was a strong reason to introduce LBT in the test. Given that it can be controlled with a parameter that can be set to 0 for licensed tests for example, we can think of introducing requirements also with LBT.

1.2.3 Sub-topic 1-3: Channel model for requirements definition

Sub-topic description

Several contributions highlighted necessity of channel model revision for FR2-2 compared to FR2-1 in terms of RMS delay spread and max Doppler frequency.

Open issues and candidate options before e-meeting:

Issue 1-3-1: Propagation conditions

- Proposals

- Proposal 1 (Nokia): Both static propagation condition and Multi-path fading propagation conditions could be considered when defining new requirements and test cases.

- Recommended WF

- Collect views in 1st round

Feedback Form 6: Issue 1-3-1: Propagation conditions

1 – Nokia Belgium

We would like to clarify that proposal.

This proposal is based on the existing FR2-1 requirements for PRACH, which include AWGN and fading channel.

2 – Samsung Electronics Benelux BV

Samsung: we are fine with option 1 for PRACH requirement

3 – Intel Corporation (UK) Ltd

Support to consider multi-path fading + also static conditions that are required for PRACH performance verification

4 – Apple GmbH

Consider static and multi-path propagation conditions.

5 – HiSilicon Technologies Co. Ltd

We are fine with this proposal if refers to PRACH requirements

6 – Ericsson LM

Ericsson: For PRACH and CQI report, both AWGN and multi-path fading channel can be applied if necessary. For other physical channels, only multi-path fading channel could be enough. [KT1]

Likewise, for UE side, we will need static propagation condition only for CSI reporting requirements. [KT1]I agree on this as well.

Issue 1-3-2: RMS delay spread

- Proposals

- Proposal 1 (Nokia): RAN4 to study the use of TDLA10 and TDLA20 for demodulation requirements with large SCS and high MCS.
- Proposal 2 (Ericsson): Companies deliver trial simulation results based on channel model TDLA30, TDLA10 and TDLA5. Consider define new channel model TDLA10 or TDLA5 for FR2-2 demodulation requirement if they are feasible
- Proposal 3 (Intel): Define FR2-2 performance requirements with TDLA 10ns RMS delay spread value and with 200 and 650 Hz max Doppler frequency.

- Recommended WF

- Collect views on the applicable RMS delay spread in 1st round

Feedback Form 7: Issue 1-3-2: RMS delay spread

1 – Nokia Belgium

We are fine with proposal 1 or 2.

Maybe it is too early to decide on TDLA10 as in proposal 3.

2 – Samsung Electronics Benelux BV

Samsung: We wonder if the actual channel of FR2-2 is similar to TDL-A. we would like to discuss the channel model of FR2-2 such as TDL-D.

3 – Intel Corporation (UK) Ltd

It is not clear for us how to choose RMS delay spread based on link-level results. Definitely, performance will be different due to different diversity gains and channel estimation qualities. The typical set for RMS delay spread for FR2-2 is from 30 to 5 ns according to RAN1 assumptions. Can we converge on some value from this range this meeting and save time avoiding evaluation of several options? For higher SCS it is preferable to consider lower delay spread. For 120 kHz we are fine with 20,10 ns and for 480 and 960 kHz we suggest considering either 10 or 5 ns.

As for TDL channel model, according to RAN1 SI on supporting NR from 52.6 to 71 GHz (TR 38.808), TDL A channel model was considered for link-level analysis. We prefer to consider it also at least as a baseline. If some SNR limits will be identified for high CBWs, LOS channel model as TDL-D can be used for these cases.

4 – Apple GmbH

We should define requirements with LOS channel model for FR2-2. If NLOS channels are used, the delay spread should be small ≤ 10 ns as we can expect very narrow beams in FR2-2 that reduce the delay spread greatly.

5 – HiSilicon Technologies Co. Ltd

According to R4-2203079, RAN 4 session RF has agreed to consider TDL-A channel model with RMS delay spread as in range of 5-20 ns and with 3 km/h UE mobility as starting point for test methodology for FR2-2 UE modeling and CSI. Therefore, we don't see the need to consider LOS channel model and follow the RF agreements to limit the RMS into 5-20 ns. As this is the first meeting, we prefer to keep it open and discuss in the next meeting.

6 – Ericsson LM

Ericsson: We suggest companies consider different delay spread and Doppler shift combinations to cover several typical scenarios, i.e., coverage scenario (large DS + medium Doppler + low MCS) and capacity scenario (small DS + low Doppler + high MCS). Simulations could be needed for further discussion.

We also want to bring up an issue about the delay resolution for delay profile. Currently, 5 ns resolution is used for all channel model delay profile. It indicates the maximum correlation bandwidth is up to 200 MHz. For larger BW with much higher sampling rate, the channel correlation will be repeated in frequency domain if we still use 5 ns resolution. It would be better to scale the resolution based on larger BW (i.e., 0.5 ns resolution for up to 2 GHz BW) to get a better delay profile.

Issue 1-3-3: Max Doppler frequency

- Proposals

- Proposal 1 (Nokia): We propose to double the Doppler shifts in FR2-2 than the ones already used for FR2-1, i.e., TDLA_{xx}-150, and TDLA_{xx}-300.
- Proposal 2 (Ericsson): Companies deliver trial simulation results based on different maximum Doppler shift 200 Hz (UE speed at 3 km/h) and 2000 Hz (UE at 30 km/h) at 70 GHz for further discussion.
- Proposal 3 (Ericsson): Regarding possible outdoor deployment for FR2-2 BS, consider higher UE speed with more DM-RS configuration, such as 30 km/h with 1+1 DM-RS, for the requirement if it is feasible.

- Proposal 4 (Intel): Define FR2-2 performance requirements with TDLA 10ns RMS delay spread value and with 200 and 650 Hz max Doppler frequency.

- Recommended WF

- Collect views on the applicable max Doppler frequency in 1st round

Feedback Form 8: Issue 1-3-3: Max Doppler frequency

<p>1 – Nokia Belgium</p> <p>We propose to double the doppler shifts and frequency shift in the test cases designed using previous use cases. regardless on the assumed UE speed and assumed frequency.</p> <p>For example for PRACH test cases for FR2-1, Table 11.4.2.2.2-2 of use TDLA30-300 and 4000 Hz frequency offset.</p> <p>Therefore we propose to use 8000 Hz as Frequency offset and TDLA30-600 as a propagation condition.</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: The maximum Doppler frequency value is pending on UE speed and Carrier frequency. We can apply the doppler value in FR2-1 as starting point</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>We are fine with Nokia proposal just to double max Doppler frequency for corresponding requirement. FR2-1 requirements are applicable up to 52.6 GHz. Since limit for FR2-2 is 71GHz, double Doppler frequency will cover the whole FR2-2 range even with some margin.</p>
<p>4 – Apple GmbH</p> <p>We think 650Hz Doppler is rather high. What is the assumed UE speed? We doubt if we can consider higher UE speeds for FR2-2. From the SI, the assumed speed is 3kmph. Assuming max carrier frequency of 71GHz, we think max Doppler should be 200 Hz.</p>
<p>5 – HiSilicon Technologies Co. Ltd</p> <p>We propose to at least consider 200Hz (3 km/h) and further discuss whether to consider higher Doppler spread in next meeting.</p>
<p>6 – Ericsson LM</p> <p>Ericsson: Suggest companies considering low and medium UE speed (3km/h and 30km/h) regarding indoor and outdoor deployment. Simulations should be needed for feasibility investigation.</p>

1.2.4 Sub-topic 1-4: Phase noise

Sub-topic description

Several companies highlighted higher phase noise impact on demodulation performance in FR2-2 compared to FR2-1

Open issues and candidate options before e-meeting:

Issue 1-4-1: Study on phase noise impact for requirements derivation

- Proposals
 - Proposal 1 (Ericsson): Companies deliver two sets of ideal simulation results for requirement discussion. Result set#1 is without phase noise and set#2 is with phase noise. Phase noise model could use model set 1 defined in TR38.808.
- Recommended WF
 - Collect views in 1st round regarding the proposed methodology in Proposal 1.

Feedback Form 9: Issue 1-4-1: Study on phase noise impact for requirements derivation

1 – Nokia Belgium

We are fine with the idea of Proposal 1, however we would like to make the choice of phase noise model flexible.

We agree that companies provide results without phase noise model and then results with phase noise without specifying which model each company is using

Therefore we propose an alternative option as Proposal 2:

- Proposal 2 (new): Companies deliver two sets of ideal simulation results for requirement discussion. Result set#1 is without phase noise and set#2 is with phase noise. Phase noise model could use model set 1 or 2 defined in TR38.808.

2 – Samsung Electronics Benelux BV

Samsung: we think the PN model is important in this test cases. Current there are two kinds of PN model in TS38.808. For alignment purpose, we think it is better to select one of model either option 1 or option 2

3 – Intel Corporation (UK) Ltd

Two sets of results were delivered for definition of FR2-1 requirements : with and without phase noise. The main purpose is to define band agnostic requirements considering different phase noise impact on different carrier frequencies. To do this, RMC configuration that has less phase noise impact was selected. The following assumptions were used in FR2-1 discussion:

- No Tx phase noise is modelled
- Phase noise is explicitly modelled for Rx.
- Rx Phase noise is modelled only to find feasible FRC configuration (i.e. achieve maximum throughput and loss in comparison to scenarios without Rx phase noise is less than 1 dB).

We suggest using the similar methodology for FR2-2 with additional clarification that 70 GHz carrier frequency should be assumed. Our proposal is:

Companies deliver two sets of ideal simulation results for requirement discussion. Result set#1 is without phase noise and set#2 is with phase noise

- No Tx phase noise is modelled
- Phase noise is explicitly modelled for Rx
- Rx Phase noise is modelled only to find feasible RMC configuration (i.e. achieve maximum throughput and loss in comparison to scenarios without Rx phase noise is less than 1 dB)
- 70 GHz carrier frequency is assumed

4 – Apple GmbH

We are fine with using the same methodology as FR2-1 as suggested by Intel.

5 – Ericsson LM

Ericsson: Prefer Option 1 to easily align companies' simulations.

6 – Qualcomm Technologies Int

We think we should follow FR2-1 methodology to select cases where the impact of Rx Phase Noise is limited

Issue 1-4-2: Phase noise model

- Proposals
 - Option 1 (Ericsson): PN model set 1 in TS 38.808.
 - Option 2 (Huawei): PN model example 2 defined in TS 38.803
- Recommended WF
 - Collect views in 1st round

Feedback Form 10: Issue 1-4-2: Phase noise model

1 – Nokia Belgium

Same view as in the previous issue.

Therefore we propose Option 3 and 4:

- Option 3: PN model set 2 in TR 38.808
- Option 4: Free choice between PN model set 1 and 2 from TR 38.808.

<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: Similar comments in Issue 1-4-1</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>We do not support to consider phase noise models from TR 38.803 since they were proposed for FR2-1 long time ago. Free choice between PN model set 1 and 2 from TR 38.808 can lead to quite diverse results. For alignment we suggest considering only one model. Companies may add additional margin to their impairment results if they think that the real PN impact is higher. Either PN model set 1 or set 2 from TR 38.808 is fine for us.</p>
<p>4 – Apple GmbH</p> <p>PN model set 1 for study of phase noise impact on requirements and for down selection of simulation assumptions/ FRCs.</p>
<p>5 – Ericsson LM</p> <p>Ericsson: Prefer Option 1. However, we believe that companies can deliver ideal simulation results without phase noise to get alignment at the first. Then deliver results with phase noise model to see the impact. As a starting point, each company can opt for a PN model for initial results' assessment. However, we have to agree on a model for the sake of fairness in comparison.</p>
<p>6 – HiSilicon Technologies Co. Ltd</p> <p>We can compromise to option 1</p>
<p>7 – Qualcomm Technologies Int</p> <p>Given that this is the first meeting and we don't have results shared yet we are fine to follow other companies' view and start from model 1 for the alignment in the next meeting only, but we share the concern that these models were derived for FR2-1 and a long time ago, so we should keep other options open and discuss this once we get a round of results</p>

Issue 1-4-3: TDD pattern

- Proposals

- Proposal 1 (Ericsson): Define new TDD patterns for 480kHz and 960kHz SCS. Following patterns can be considered:
 - Option 1: Same as FR2-120-1, 3D1S1U, S=10D:2G:2U.
 - Option 2: Use the same DL/UL duration as 120kHz SCS to keep sufficient processing timeline.
 - 480kHz SCS: 12D4S4U, S1=S2=14D:0G:0U, S3=12D:2G:0U, S4=0D:6G:8U
 - 960kHz SCS: 24D8S8U, S1=S2=S3=S4=S5=14D:0G:0U, S6=10D:4G:0U, S7=0D:12G:2U, S8=0D:0G:14U.

- Recommended WF

- Collect views in 1st round

Feedback Form 11: Issue 1-4-3: TDD pattern

<p>1 – Nokia Belgium</p> <p>We tend to prefer Option 2.</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: we should discuss whether requirements should be defined for 480KHz and 960KHz, we prefer to further discussion, other options are not precluded</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>TDD pattern does not really effect demodulation performance. We prefer more time to check which option is more appropriate. Same time, as a baseline simulation assumption for PN impact study, either Option 1 or 2 can be considered.</p>
<p>4 – Apple GmbH</p> <p>Option 1 as baseline. Option 2 for 480/960 SCS.</p>
<p>5 – HiSilicon Technologies Co. Ltd</p> <p>Same views with Samsung and Intel. We prefer to keep it open and for the simulation assumption for PN impact only, we can use option 1 for 120 kHz SCS and option 2 for 480/960 kHz SCS</p>
<p>6 – Ericsson LM</p> <p>Ericsson: We prefer to define new TDD pattern for 480/960kHz SCS which is helpful for requirement definition and test setup. We are open for the discussion.</p>

1.2.5 Sub-topic 1-5: Implementation of FR2-2 requirements into specification

Sub-topic description

FR2-2 performance requirements should be integrated to the current specifications defined for the original FR2 frequency range. From WID:

Note 5: FR2 is extended to cover 24.25GHz to 71GHz with FR2-1 for 24.25-52.6GHz and FR2-2 for 52.6-71GHz.

- The related UE capabilities and their applicability to the frequency range 52.6 to 71 GHz will have to be analyzed on a case by case basis
- The application of any of the UE feature introduced for 52.6-71 GHz to existing FR1/FR2 should be discussed case by case.
- TSG RAN specifications shall make it very clear (to readers) that frequency bands in the 52.6-71GHz range are only Release-independent from Rel-17 onwards, to ensure that there is clear industry understanding about which FR2 features are applicable for operation in 52.6-71GHz range.

NOTE 5a: Whenever the FR2 is referred, both FR2-1 and FR2-2 frequency sub-ranges shall be considered in this release, unless otherwise stated.

NOTE 5b: The designations FR2-1 and FR2-2 should only be used when needed

Issue 1-5-1: Implementation of FR2-2 requirements into specification

- Proposals

o For BS demodulation:

- Proposal 1 (Intel): Reuse existing sections in TS 38.104 and TS 38.141-2 for FR2-2 BS performance requirements definition.
- Proposal 2 (Ericsson): Follow RF FR2-2 requirement structure, capture FR2-2 demodulation requirement into same section as FR2-1 but with different tables if possible. Adding extra phrase as “for FR2-1” and “for FR2-2” to requirement tables for differentiation

o For UE demodulation and CSI

- Proposal 1 (Intel): Reuse existing sections in TS 38.104-1 for FR2-2 UE performance requirements definition.
- Proposal 2 (Ericsson):

- Recommended WF

o Collect views in 1st round

Feedback Form 12: Issue 1-5-1: Implementation of FR2-2 requirements into specification

1 – Nokia Belgium

We are fine with both approaches.

We slightly prefer to keep the same clauses as much as possible.

2 – Samsung Electronics Benelux BV

Samsung: we suggest to discuss this issue later to check current RF FR2-2 structure

3 – Intel Corporation (UK) Ltd

We prefer to reuse the same clauses for both UE and BS since we should avoid distinguishing on FR2-1 and FR2-2 as much as possible. In addition, if new sections will be defined, sections with FR2-1 should be re-named that is not encouraged by MCC.

4 – Apple GmbH

We should introduce requirements in section 7 without separating requirements for FR2-1 and FR2-2 into different sections. The applicability of requirements, common test parameters should be updated accordingly.

Table 1 Specification structure for UE Demodulation performance requirements in FR2-2 (Radiated requirements).

Section number	Section name	Note
7.2	PDSCH demodulation requirements	
7.2.1	1RX requirements	
7.2.2	2RX requirements	
7.2.2.2	TDD	
7.2.2.2.[4]	Minimum requirements for UEs in FR2-2	New section
7.3	PDCCH demodulation requirements	
7.3.1	1RX requirements	
7.3.2	2RX requirements	
7.3.2.2	TDD	
7.3.2.2.1	1 Tx Antenna performances	Updates on FR2-2
7.3.2.2.2	2 Tx Antenna performances	Updates on FR2-2
7.4	PBCH demodulation requirements	
7.4.1	1RX requirements	
7.4.2	2RX requirements	
7.4.2.2	TDD	Updates on FR2-2 UEs

Table 2 Specification structure for UE CSI reporting requirements in FR2-2 (Radiated requirements).

Section number	Section name	Note
8.2	Reporting of Channel Quality Indicator (CQI)	
8.2.2	2RX requirements	
8.2.2.2	TDD	
8.2.2.2.1	CQI reporting definition under AWGN	Updates on FR2-2
8.2.2.2.2	CQI reporting under fading conditions	Updates on FR2-2

Figure 2: Proposal 2 (Ericsson): For UE demodulation and CSI

5 – Ericsson LM

Ericsson: There is no clear confliction between Option 1 and 2 in both BS and UE. We suggest to follow RF approach.

1.3 Summary for 1st round

1.3.1 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.

Table 1: First round summary for Topic #1

	Summary
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<p>Sub-topic #1-1: Work Plan</p>	<p><u>Issue 1-1: Work Plan</u> All companies commented in 1st round that the proposed work plan can be agreed. Two companies suggested checking whether initial simulation results can be prepared next meeting considering progress of 2nd round discussion. Tentative agreement: Agree the work plan. Recommendations for 2nd round: Continue discussion on simulation assumptions and define initial set.</p>
<p>Sub-topic #1-2: General aspects of demodulation requirement definition</p>	<p>Issue 1-2-1: General scope of BS demodulation performance requirements All companies agreed with option 1. Tentative agreement: Define PUSCH, PUCCH, and PRACH performance requirements. Candidate options: NA Recommendations for 2nd round: NA</p>

	<p><u>Issue 1-2-2: General scope of UE demodulation and CSI reporting performance requirements</u></p> <p>All companies agreed to define requirements for PDSCH and PDCCH. Five companies support to define SDR requirements and one company do not see motivation to do this. Five companies support to define PBCH requirements and one company prefer to deprioritize it. Two companies proposed to define PBCH requirements only with unknown SSB index.</p> <p>Tentative agreement:</p> <ul style="list-style-type: none"> - Define PDSCH, PDCCH, PBCH performance requirements. <ul style="list-style-type: none"> o FFS on PBCH requirements definition only for unknown SSB index - FFS on SDR requirements definition <p>Candidate options: PBCH requirements:</p> <ul style="list-style-type: none"> - Option 1: Only with unknown SSB index - Option 2: Both know and unknown SSB index <p>SDR requirements</p> <ul style="list-style-type: none"> - Option 1: Define SDR requirements - Option 2: Do not define SDR requirements <p>Recommendations for 2nd round: Discuss candidate options.</p>
	<p><u>Issue 1-2-3: Scenarios to be considered for requirements definition</u></p> <p>Five companies agreed on proposals 1,2,3. One company preferred to further check.</p> <p>Tentative agreement: RAN4 defines demodulation requirements for the following scenarios:</p> <ul style="list-style-type: none"> - SA FR2-2 - NR DC or CA with FR1 anchor and FR2-2 <p>RAN4 does not consider FR2-2 CA scenario in Rel-17</p> <p>Candidate options: NA</p> <p>Recommendations for 2nd round: Confirm tentative agreement</p>

	<p>Issue 1-2-4: Shared spectrum access requirements</p> <p>Six companies agreed to define both BS and UE requirements without LBT. One company proposed to define UE requirements with and without LBT.</p> <p>Tentative agreement:</p> <ul style="list-style-type: none"> - Define BS requirements without LBT - Define UE requirements without LBT - Note: It is assumed that these requirements cover both NR SA and shared spectrum access deployments <p>Candidate options: NA</p> <p>Recommendations for 2nd round: Confirm tentative agreement</p>
<p>Sub-topic 1-3: Channel model for requirements definition</p>	<p>Issue 1-3-1: Propagation conditions</p> <p>All companies agreed that multi-path fading and static propagation conditions should be considered.</p> <p>Tentative agreement: Both static propagation condition and Multi-path fading propagation conditions are considered.</p> <p>Candidate options: NA</p> <p>Recommendations for 2nd round: NA</p>

	<p><u>Issue 1-3-2: RMS delay spread</u></p> <p>Most of the companies suggest continue discussion next meeting on the appropriate RMS delay spread. Two companies proposed to consider TDL-D channel model instead of TDL-A.</p> <p>Tentative agreement: NA</p> <p>Candidate options:</p> <ul style="list-style-type: none"> - TDL channel model: <ul style="list-style-type: none"> o Option 1: TDL-A o Option 2: TDL-D - RMS Delay spread: <ul style="list-style-type: none"> o Option 1: 5ns o Option 2: 10ns o Option 3: 20ns - Note: Definition of requirements with different channel models is not precluded <p>Recommendations for 2nd round: Discuss candidate options.</p>
	<p><u>Issue 1-3-3: Max Doppler frequency</u></p> <p>Most of the companies agreed to consider at least 3km/h. More discussion is needed on higher UE speed. Two companies support just to double FR2-1 max Doppler frequency and frequency shift for FR2-2 requirements.</p> <p>Tentative agreement:</p> <ul style="list-style-type: none"> - Consider 3 km/h UE speed ([200] Hz). - FFS on higher UE speed. <p>Candidate options:</p> <ul style="list-style-type: none"> - Option 1: 10 km/h (650 Hz) - Option 2: 30 km/h (2000 Hz) <p>Recommendations for 2nd round: Discuss applicable Doppler frequency for 3 km/h. Discuss necessity of requirements with higher UE speed and corresponding candidate options.</p>

<p>Sub-topic 1-4: Phase noise</p>	<p><u>Issue 1-4-1: Study on phase noise impact for requirements derivation</u></p> <p>Methodology on requirements definition was discussed and some additional clarifications were suggested to the original proposal 1. Applicable Phase noise model is captured in issue 1-4-2.</p> <p>Tentative agreement: Companies deliver two sets of ideal simulation results for requirement discussion. Result set#1 is without phase noise and set#2 is with phase noise.</p> <ul style="list-style-type: none"> - No Tx phase noise is modelled - Rx Phase noise is modelled only to find feasible FRC configuration (i.e. achieve maximum throughput and loss in comparison to scenarios without Rx phase noise is less than 1 dB) - 70 GHz carrier frequency is assumed <p>Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement</p>
	<p><u>Issue 1-4-2: Phase noise model</u></p> <p>Almost all companies agree to get initial alignment results with phase noise model Option 1. One company prefer to have flexible choice. Same time several companies mentioned that single model allows to easily align results.</p> <p>Tentative agreement: Consider PN model set 1 in TS 38.808 for initial simulation results alignment.</p> <p>Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement.</p>

	<p><u>Issue 1-4-3: TDD pattern</u> Moderator: this issue should be discussed under scope of sub-topic 1-2 but by mistakenly was added to sub-topic 1-4. All companies agreed to further discuss this issue but for results alignment some baseline assumption can be reached. Tentative agreement: Consider the following TDD pattern as a baseline for simulation results alignment:</p> <ul style="list-style-type: none"> - 120 kHz: 3D1S1U, S=10D:2G:2U - 480 kHz: 12D4S4U, S1=S2=14D:0G:0U, S3=12D:2G:0U, S4=0D:6G:8U96 - 960 kHz: 24D8S8U, S1=S2=S3=S4=S5=14D:0G:0U, S6=10D:4G:0U, S7=0D:12G:2U, S8=0D:0G:14U <p>Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement.</p>
<p>Sub-topic 1-5: Implementation of FR2-2 requirements into specification</p>	<p><u>Issue 1-5-1: Implementation of FR2-2 requirements into specification</u> Four companies agreed to reuse the same clauses for FR2-2 requirements as used for FR2-1. Several companies proposed to follow RF room approach. Same time more discussion is needed what RF room approach means if companies want to reach such agreement. Tentative agreement:</p> <ul style="list-style-type: none"> - Capture FR2-2 demodulation requirement into same section as FR2-1 but with different tables if possible. Adding extra phrase as “for FR2-1” and “for FR2-2” to requirement tables for differentiation if needed. <p>Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement</p>

1.4 Discussion on 2nd round (if applicable)

TBA

2 Topic #2: BS performance requirements

2.1 Companies' contributions summary

T-doc number	Company	Proposals / Observations
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R4-2204032 Ericsson

Proposal 1: Start with 1/2Tx and 2Rx antenna configuration for FR2-2 BS demodulation requirements

Proposal 2: FR2-2 could take [20dB] SNR limit at current stage. New test cases and method should be defined if it is finally approved that FR2-2 SNR limit is much lower than 20dB.

Proposal 3: Take simulation assumptions in Table 2-1 as the start point for PUSCH demodulation to check the phase noise impact and configuration feasibility. Down selection is needed based on simulation results.

Table 2.2-1: Simulation parameters for FR2-2 PUSCH demodulation

Parameter		Value
Transform precoding		Disabled
Default TDD UL-DL pattern (Note 1)		120kHz SCS: 3D1S1U, S=10D:2G:2U
HARQ	Maximum number of HARQ transmissions	4
	RV sequence	0, 2, 3, 1
DM-RS	DM-RS configuration type	1
	DM-RS duration	single-symbol DM-RS
	Additional DM-RS symbols	pos0, pos1
	Number of DM-RS CDM group(s) without data	2
	Ratio of PUSCH EPRE to DM-RS EPRE	-3 dB
	DM-RS port(s)	{0}, {0, 1}
Time domain resource	DM-RS sequence generation	$N_{ID} = 0, n_{SCID} = 0$
	PUSCH mapping type	B
	Start symbol index	0
Frequency domain resource	Allocation length	10
	RB assignment	Full applicable test bandwidth (100MHz and 400MHz)
Frequency hopping		Disabled
TPMI index for 2Tx two-layer spatial multiplexing transmission		0
Code block group based PUSCH transmission		Disabled
PT-RS configuration	Frequency density (K_{PT-RS})	2, Disabled
	Time density (L_{PT-RS})	1, Disabled
Test metric	Normalized throughput	70%
Antenna	Tx and Rx configuration	1Tx 2Rx 2Tx 2Rx
Channel model		TDLA30-200/2000 TDLA10-200/2000 TDLA5-200/2000
MCS	64QAM MCS table index	4/16/20
Phase noise	Model sets in TR38.808	Set 1 (Note)

Note: Companies are suggested to deliver ideal simulation results with and without phase noise.

Proposal 4: RAN4 consider define FR2-2 BS demodulation requirements for PUSCH repetition type A.

Proposal 5: Define new requirements for FR2-2 PUCCH performance.

Proposal 6: Take simulation assumptions in Table 2.3-1 and 2.3-2 as the start point for PUCCH demodulation to check the phase noise impact and configuration feasibility. Other PUCCH format could be lower priority.

Table 2.3-1: Simulation Parameters for FR2-2 PUCCH format 1

Parameter	Test
Number of information bits	2
Number of PRBs	1
Number of symbols	14
First PRB prior to frequency hopping	0
Intra-slot frequency hopping	enabled
First PRB after frequency hopping	The largest PRB index – (nrofPRBs – 1)
Group and sequence hopping	neither
Hopping ID	0
Initial cyclic shift	0
First symbol	0
Index of orthogonal cover code (timeDomainOCC)	0

2.2 Open issues summary

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

2.2.1 Sub-topic 2-1: SCS/CBW combinations

Sub-topic description:

New SCS and CBWs were introduced for FR2-2. RAN4 needs to discuss SCS/CBW combinations for requirements definition. Moderator suggest discussing separately SCS and CBW to converge on the required SCS/CBW combinations.

Open issues and candidate options before e-meeting:

Issue 2-1-1: SCS for UL requirements definition

- Proposals
 - Option 1 (Nokia): 480, 960 kHz.
 - Option 2 (Ericsson): Prioritize 120kHz and 480 kHz.
 - Option 3 (Huawei, Intel): 120, 480 and 960 kHz.
- Recommended WF
 - Collect views in 1st round on required SCS for UL test cases

Feedback Form 13: Issue 2-1-1: SCS for UL requirements definition

1 – Nokia France

We support option 3.

480, 960 kHz are new SCS introduced by this WI. Hence, any BS that claims their support should be tested to verify that they conform with the minimum performance requirements. Hence, we propose to consider these SCS from the beginning without any de-prioritization. Performance requirements with 120 kHz in FR2-1 are already existing with their corresponding test cases. However, since the carrier frequency is increased in FR2-2 then the phase noise become more severe. Hence, the minimum performance requirements need to be evaluated using this SCS in FR2-2.

2 – Samsung Electronics Benelux BV

Samsung: we prefer 120KHz SCS firstly, even performance requirements with 120 kHz in FR-1 is defined in existing spec, while CBW requirement is only up to 200MHz, there is no requirement with 400MHz requirement for 120KHz,

3 – Intel Corporation (UK) Ltd

Considering limited number of meetings on performance part we do not support any prioritizations for SCS. We share similar view as Nokia and support Option 3.

4 – Ericsson LM

Ericsson prefers Option 2 and considers SCS 120kHz and 480kHz as a high priority. Since SCS 960kHz is optional, we would like to reduce the simulation efforts in this early stage.

5 – HiSilicon Technologies Co. Ltd

Option 3

Issue 2-1-2: CBW for UL requirements definition

- Proposals

- SCS 120 kHz
 - Option 1 (Ericsson, Intel): 100 and 400 MHz
 - Option 2 (Huawei): 400 MHz
- SCS 480 kHz
 - Option 1 (Nokia): 400, 800 and 1600 MHz
 - Option 2 (Ericsson): 400 and 1600 MHz
 - Option 3 (Huawei): 1600 MHz
 - Option 4 (Intel): 400 MHz
- SCS 960 kHz
 - Option 1 (Nokia): 400, 800, 1600 and 2000 MHz
 - Option 2 (Ericsson): 400 and 2000 MHz
 - Option 3 (Huawei): 2000 MHz
 - Option 4 (Intel): 400 MHz

- Recommended WF

- Collect views in 1st round on required CBWs for UL test cases.

Feedback Form 14: Issue 2-1-2: CBW for UL requirements definition

<p>1 – Nokia France</p> <p>We support option 1 or option 2.</p> <p>We think it is important to define the performance requirements and test cases for all the CBW. However, testing with min and max CBW can be seen as a good comprise.</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: For 120KHz, SCS, we support 400MHz, since there is no requirement for it in FR2-1. If 480KHz is introduced, we prefer to define the min and max CBW requirements, there is no need to test and define requirements for all CBW</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>Min and Max CBW can be a good starting point. Only confirmation from testability aspects is needed on max CBW in terms of max SNR during the test. It can be discussed next meeting. We support Option 1 for 120 kHz and Option 2 for 480 and 960 kHz also in addition to our original proposed Option 1 for 120 kHz and Option 4 for 480 and 960 kHz.</p>
<p>4 – Ericsson LM</p> <p>Ericsson: We prefer considering the minimum and maximum BW for each SCS. But we also want to remind companies to notice that the testability for maximum BW at such high frequency, i.e., 2GHz BW. Further investigation on link budget on larger BW would be needed, but currently, RF don't have clear conclusion on the test method. Maybe we could start with the minimum BW for 480kHz and 960kHz (if agreed to introduce) at current stage.</p>
<p>5 – HiSilicon Technologies Co. Ltd</p> <p>We prefer to only consider max supported CBWs</p>

2.2.2 Sub-topic 2-1: General issues

Sub-topic description

General aspects regardless of UL Physical channel

Open issues and candidate options before e-meeting:

Issue 2-2-1: FR2-1 requirements reuse

- Proposals
 - Proposal 1 (Intel): Do not reuse FR2-1 performance requirements for FR2-2.
- Recommended WF
 - Collect views in 1st round.

Feedback Form 15: Issue 2-2-1: FR2-1 requirements reuse

<p>1 – Nokia France</p> <p>We agree with this proposal. But we think it is applied for both UE and BS so we think this issue can be removed to the general section.</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung</p> <p>we are ok with this proposal</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>We agree to consider this issue as a general aspect.</p>
<p>4 – HiSilicon Technologies Co. Ltd</p> <p>we are ok with this proposal</p>
<p>5 – Ericsson LM</p> <p>Ericsson: Not sure about the meaning of “reuse” in Proposal 1. We think FR2-1 requirements should not be directly applied for FR2-2 product basically, because the channel model might be different while the phase noise impact should be considered.</p>

Issue 2-2-2: General simulation assumptions

- Proposals

- Proposal 1 (Ericsson): Start with 1/2Tx and 2Rx antenna configuration for FR2-2 BS demodulation requirements
- Proposal 2 (Intel): Define FR2-2 performance requirements with normal CP only, with up to 2 demodulation branches, and with 1 and 2 Tx antennas.

- Recommended WF

- Collect views in 1st round.

Feedback Form 16: Issue 2-2-2: General simulation assumptions

<p>1 – Nokia France</p> <p>We agree with both proposals.</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: OK with option 1 and option 2, for option 2, only 2Rx demodulation branches are considered</p>

<p>3 – Intel Corporation (UK) Ltd</p> <p>Support both proposals</p>
<p>4 – HiSilicon Technologies Co. Ltd</p> <p>Support both proposals</p>
<p>5 – Ericsson LM</p> <p>Ericsson: We support starting with 1/2Tx and 2Rx for demodulation. We also agree to define requirements using normal CP for 120kHz SCS, but we are open for 480kHz and 960kHz SCS and considering the very short duration on normal CP.</p>

Issue 2-2-3: Test SNR limit

- Proposals
 - Proposal 1 (Ericsson): FR2-2 could take [20dB] SNR limit at current stage. New test cases and method should be defined if it is finally approved that FR2-2 SNR limit is much lower than 20dB
- Recommended WF
 - Collect views in 1st round

Feedback Form 17: Issue 2-2-3: Test SNR limit

<p>1 – Nokia France</p> <p>We agree with this proposal.</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: we can go option 1 as start point</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>We support this proposal.</p>
<p>4 – Ericsson LM</p> <p>Ericsson: We are open for further discussion.</p>
<p>5 – HiSilicon Technologies Co. Ltd</p> <p>Need more time to check</p>

2.2.3 Sub-topic 2-3: PUSCH performance requirements

Sub-topic description

Details of PUSCH performance requirements

Open issues and candidate options before e-meeting:

Issue 2-3-1: Scope of PUSCH performance requirements

- Proposals

- Proposal 1 (Ericsson): RAN4 consider define FR2-2 BS demodulation requirements for PUSCH repetition type A
- Proposal 2 (Ericsson): The waveform could only consider CP-OFDM. Regarding the potential high PAR caused by worse PA linearization, DFT-s-OFDM could be considered later after the discussion on CP-OFDM
- Proposal 3 (Intel): Define FR2-2 performance requirements with transform precoding disabled with 70% and 30% throughput; requirements with transform precoding enabled; requirements with UCI multiplexed on PUSCH.
- Proposal 4 (Intel): Do not define in Rel-17 FR2-2 performance requirements for 2-step RA type, PUSCH performance requirements with repetition type A, and PUSCH performance requirements with mapping type B with non-slot transmission.
- Proposal 5 (Intel): Define FR2-2 PUSCH performance requirements according to Tables 2-5.

- Recommended WF

- Collect views in 1st round

Feedback Form 18: Issue 2-3-1: Scope of PUSCH performance requirements

1 – Nokia France

We agree with proposals 1, 2, 3, and 4. Regarding propagation condition proposed in proposal 5 we think we should use what will be agreed in the general section in sub-topic 1-3.

2 – Samsung Electronics Benelux BV

Samsung:

In general, we agree with option 2, 3 and 4. For option 5, the channel condition can be further discussed. we prefer to use TDL-D as start point

3 – Intel Corporation (UK) Ltd

From requirements scope perspective, we suggest considering only minimum required test cases based on Rel-15 discussion for FR2-1. Repetition type A is beneficial feature, but can be deprioritized in Rel-17 to focus on minimum functionality. UCI multiplexing is not precluded in FR2-2 but considering processing issue raised by Ericsson, we are fine to also deprioritize such requirement definition. Therefore, we recommend to define FR2-2 performance requirements with transform precoding disabled with 70% and 30% throughput and requirements with transform precoding enabled in Rel-17.

4 – Ericsson LM

Ericsson: We think PUSCH with repetition type A could be useful for FR2-2 for coverage. It would be worthy to define requirements for it. For UCI multiplexing on PUSCH, we don't see much benefit but open for discussion.

5 – HiSilicon Technologies Co. Ltd

We propose to only define FR2-2 performance requirements with transform precoding disabled with 70%

Issue 2-3-2: PUSCH performance requirements for multi-PUSCH scheduling

- Proposals

- Proposal 1 (Nokia): RAN4 not to define new BS demodulation requirements for multi-PUSCH scheduling in Rel-17

- Recommended WF

- Collect views in 1st round

Feedback Form 19: Issue 2-3-2: PUSCH performance requirements for multi-PUSCH scheduling

1 – Samsung Electronics Benelux BV

Samsung: We are ok with option 1, similar as Rel-15 and Rel-16, there is no multi-PUSCH scheduling requirement

2 – Intel Corporation (UK) Ltd

Support Proposal 1.

3 – HiSilicon Technologies Co. Ltd

Support Proposal 1.

4 – Ericsson LM

Ericsson: We support Proposal 1 that no algorithm difference is seen for multi-PUSCH scheduling.

Issue 2-3-3: PUSCH performance requirements with 32 UL HARQ processes

- Proposals

- Proposal 1 (Intel): Define PUSCH performance requirements to verify 32 UL HARQ processes feature

- Recommended WF

- Collect views in 1st round

Feedback Form 20: Issue 2-3-3: PUSCH performance requirements with 32 UL HARQ processes

1 – Nokia France

We do not support this proposal.

For FR2-1 and FR1 no such test was design for BS. We do not see a reason to define such a test for FR2-2 because 1) the workload is very high due to many test cases; 2) demodulation performance requirement is not used to verify memory problem of the BS.

2 – Samsung Electronics Benelux BV

Samsung: Similar as Rel-15/16, we donot think it is necessary to define test cases with large number of UL HARQ process

3 – HiSilicon Technologies Co. Ltd

We don't support this proposal. Similar views with Nokia

4 – Ericsson LM

Ericsson: We don't see much benefit to define requirement with 32 UL HARQ from demodulation perspective. As in Rel-15, no explicit HARQ process number is defined for the requirement because it is not relevant for BS demodulation.

5 – Intel Corporation (UK) Ltd

We are fine to not define PUSCH requirements with 32 UL HARQ processes considering received feedback from companies.

Issue 2-3-4: General PUSCH test setup

Moderator suggest discussing different aspects of simulation assumptions in one place since this is the first meeting. Companies, potentially, need more time on detailed work on simulation assumptions. Same time it is encouraged to converge on some general aspects.

- Proposals

- Proposal 1 (Ericsson): Start with MCS4/16/20 to see if it is feasible
- Proposal 2 (Ericsson): DM-RS/PT-RS configuration could start with Rel-15 assumptions. Further discussion is needed based on simulation results
- Proposal 3 (Huawei): Keep the number of transmission RBs open until there are corresponding agreements from RF team.
- Proposal 4 (Intel): Define FR2-2 PUSCH performance requirements assuming PTRS Tx
- Proposal 5 (Intel): Define FR2-2 PUSCH performance requirements only with 1+1 DMRS configuration

- Recommended WF

- Collect views in 1st round

Feedback Form 21: Issue 2-3-4: General PUSCH test setup

<p>1 – Nokia France</p> <p>We agree with the all the proposals. However, for the number of PRBs we suggest for the sake of advance of the work for the next meeting to agree on a temporary value. For example the maximum value that does not violate any CBW possible assuming a 5% or 10% guard band. We prose to discuss</p> <p>(SCS (kHz) CBW (MHz)) = (120 100) (120 400) (480 400) (480 800) (480 1600) (960 400) (960 800) (960 1600) (960 2000)</p> <p>proposed PRBs = (66) (264) (66) (132) (264) (32) (66) (132) (156)</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: we are ok with all proposals.</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>We support all these proposals and temporary values for PRB number suggested by Nokia.</p>
<p>4 – HiSilicon Technologies Co. Ltd</p> <p>OK with all proposals and temporary values for PRB number suggested by Nokia</p>
<p>5 – Ericsson LM</p> <p>We agree with the Proposals. We could discuss the details (parameters) when general (RF) issues are settled.</p>

Issue 2-3-5: Detailed PUSCH test setup

One company has submitted detailed set of simulation assumptions. Moderator suggests discussing it in the second round.

- Proposals

- Proposal 1 (Ericsson): Take simulation assumptions in Table 2-1 as the start point for PUSCH demodulation to check the phase noise impact and configuration feasibility. Down selection is needed based on simulation results

- Recommended WF

- Collect views in 2nd round

Feedback Form 22: Issue 2-3-5: Detailed PUSCH test setup

1 – Ericsson LM

Agree with recommended WF.

Issue 2-3-6: Rx processing assumptions

- Proposals
 - Proposal 1 (Huawei): Define PUSCH performance requirements by using ICI compensation.
- Recommended WF
 - Collect views in 2nd round

Feedback Form 23: Issue 2-3-6: Rx processing assumptions

1 – Samsung Electronics Benelux BV

Samsung: In general, whether to apply ICI compensation is up to BS implementation. we should evaluate the PN impact firstly

2 – Intel Corporation (UK) Ltd

At least for high MCS values ICI compensation is required. To evaluate phase noise impact we suggest considering two options: 1) Practical CPE compensation only; 2) Practical CPE + ICI compensation

3 – Ericsson LM

Agree with recommended WF.

Issue 2-3-7: Other

This set of proposals directly depends on the other issues or do not require urgent agreement. Can be deprioritized for the second-round discussion

- Proposals
 - Proposal 1 (Intel): Define FR2-2 PUSCH performance requirements with transform precoding enabled and UCI multiplexed on PUSCH only for the smallest CBWs for each SCS.
 - Proposal 2 (Intel): Define FR2-2 PUSCH performance requirements with transform precoding disabled at least for the following SCS/CBW combinations: 120/100, 120/400, 480/400, 960/400 kHz/MHz
 - Proposal 3 (Intel): As a baseline option consider application of FR2-1 applicability rules for FR2-2 as well.
- Recommended WF
 - Collect views in 2nd round

Feedback Form 24: Issue 2-3-7: Other

1 – Samsung Electronics Benelux BV

Samsung: we should focus on the test scope firstly, the detail test setup can be further discussion

2 – Ericsson LM

Agree with recommended WF.

Number of Tx antennas	Number of demodulation branches	Propagation conditions and correlation matrix	FRC
1	2	TDLA10-650	QPSK, Rank 1
		TDLA10-650	16QAM, Rank 1
TDLA10-200		64QAM Rank 1	
2		QPSK, Rank 2	
TDLA10-650		16QAM, Rank 2	

Number of Tx antennas	Number of demodulation branches	Propagation conditions and correlation matrix	FRC
1	2	TDLA10-650	QPSK, Rank 1

Number of Tx antennas	Number of demodulation branches	Propagation conditions and correlation matrix	UCI bits (CSI part 1, CSI part 2)
1	2	TDLA10-650	7 (5,2)
1	2	TDLA10-650	40 (20,20)

Number of Tx antennas	Number of demodulation branches	Propagation conditions and correlation matrix	UCI bits (CSI part 1, CSI part 2)
1	2	TDLA10-650	7 (5,2)
1	2	TDLA10-650	40 (20,20)

Figure 4: Proposal 5 (Intel): Scope of PUSCH performance requirements

Table 2.2-1: Simulation parameters for FR2-2 PUSCH demodulation

Parameter		Value
Transform precoding		Disabled
Default TDD UL-DL pattern (Note 1)		120kHz SCS: 3D1S1U, S=10D:2G:2U
HARQ	Maximum number of HARQ transmissions	4
	RV sequence	0, 2, 3, 1
DM-RS	DM-RS configuration type	1
	DM-RS duration	single-symbol DM-RS
	Additional DM-RS symbols	pos0, pos1
	Number of DM-RS CDM group(s) without data	2
	Ratio of PUSCH EPRE to DM-RS EPRE	-3 dB
	DM-RS port(s)	{0}, {0, 1}
DM-RS sequence generation		$N_{ID}=0, n_{SCID}=0$
Time domain resource	PUSCH mapping type	B
	Start symbol index	0
	Allocation length	10
Frequency domain resource	RB assignment	Full applicable test bandwidth (100MHz and 400MHz)
	Frequency hopping	Disabled
TPMI index for 2Tx two-layer spatial multiplexing transmission		0
Code block group based PUSCH transmission		Disabled
PT-RS configuration	Frequency density (K_{PT-RS})	2, Disabled
	Time density (L_{PT-RS})	1, Disabled
Test metric	Normalized throughput	70%
Antenna	Tx and Rx configuration	1Tx 2Rx
		2Tx 2Rx
Channel model		TDLA30-200/2000
		TDLA10-200/2000
		TDLA5-200/2000
MCS	64QAM MCS table index	4/16/20
Phase noise	Model sets in TR38.808	Set 1 (Note)

Note: Companies are suggested to deliver ideal simulation results with and without phase noise.

Figure 5: Proposal 1 (Ericsson): Detailed PUSCH test setup

2.2.4 Sub-topic 2-4: PUCCH performance requirements

Sub-topic description

Details of PUCCH performance requirements

Open issues and candidate options before e-meeting:

Issue 2-4-1: Scope of PUCCH performance requirements

- Proposals
 - Option 1 (Intel, Huawei, Ericsson): Define performance requirements for the enhanced PUCCH formats 0, 1, and 4. Define new requirements for PUCCH formats 2 and 3
 - Option 2 (Nokia): Define performance requirements for the enhanced PUCCH formats 0, 1, and 4
- Recommended WF
 - Collect views in 1st round

Feedback Form 25: Issue 2-4-1: Scope of PUCCH performance requirements

1 – Nokia France We agree with option 1. Not mentioning new requirements for PUCCH formats 2 and 3 in our proposal does not mean that we are saying no to them.
2 – Samsung Electronics Benelux BV Samsung: we are ok with option 2, we would like to check why we need to new format 2 and 3?
3 – Intel Corporation (UK) Ltd We support Option 1. PF 2 and 3 require new requirements due to another channel model (at least from RMS delay spread and max Doppler frequency perspective) in FR2-2 compared to FR2-1 and higher phase impact.
4 – HiSilicon Technologies Co. Ltd Support option 1
5 – Ericsson LM We support the definition of new requirements at least for normal PUCCH format 1/3, and also define requirements for enhanced PUCCH format 0/1/4.

Issue 2-4-2: Detailed PUCCH test setup

Moderator suggest focusing, at least, on baseline assumptions like test metrics and SCS. Second level details can be discussed in the second round.

- Proposals

- Proposal 1 (Ericsson): Take simulation assumptions in Table 2.3-1 and 2.3-2 as the start point for PUCCH demodulation to check the phase noise impact and configuration feasibility. Other PUCCH format could be lower priority.
- Proposal 2 (Ericsson): Define new requirements for FR2-2 multi-RB PUCCH performance. Take simulation assumptions in Table 2.3-3, 2.3-4 and 2.3-5 as the start point for PUCCH format 0/1/4 to check the phase noise impact and configuration feasibility.

- Proposal 3 (Huawei): Use following assumptions as start point to discuss for PUCCH requirements definition

- PF0:
 - 120 kHz, NRB=10, 1 OFDM symbol without hopping 1T2R, TDLA30-300 Low
 - 120 kHz, NRB=10, 2 OFDM symbol with hopping 1T2R, TDLA30-300 Low
 - 480 kHz, NRB=10, 1 OFDM symbol without hopping 1T2R□TDLA30-300 Low
 - 480 kHz, NRB=10, 2 OFDM symbol with hopping 1T2R□TDLA30-300 Low
 - 960 kHz NRB=10, 1 OFDM symbol without hopping 1T2R□TDLA30-300 Low
 - 960 kHz NRB=10, 2 OFDM symbol with hopping 1T2R□TDLA30-300 Low
- PF1:
 - 120 kHz, NRB=10, 14 OFDM symbol with hopping 1T2R□TDLA30-300 Low
 - 480 kHz, NRB=10, 14 OFDM symbol with hopping 1T2R, TDLA30-300 Low
 - 960 kHz NRB=10, 14 OFDM symbol with hopping 1T2R, TDLA30-300 Low
- PF2:
 - 480 kHz, NRB=9, 2 OFDM symbol, 1T2R□TDLA30-300 Low, UCI bits:22bit
 - 960 kHz NRB=9, 2 OFDM symbol , 1T2R□TDLA30-300 Low, UCI bits:22bit
- PF3
 - 480 kHz, NRB=3, 4 OFDM symbol, 1T2R□TDLA30-300 Low, UCI bits:16bit
 - 960 kHz NRB=3, 4 OFDM symbol , 1T2R□TDLA30-300 Low, UCI bits:16bit
- PF4:
 - 120 kHz, NRB=10, 14 OFDM symbol with hopping 1T2R□TDLA30-300 Low, UCI bits: 22 bits with polar coding/ Other UCI bits less than 11 with RM coding, OCC length=2.

- 480 kHz, NRB=10, 14 OFDM symbol with hopping 1T2R□TDLA30-300 Low, UCI bits: 22 bits with polar coding/ Other UCI bits less than 11 with RM coding, OCC length=2
 - 960 kHz, NRB=10, 14 OFDM symbol with hopping 1T2R□TDLA30-300 Low, UCI bits: 22 bits with polar coding/ Other UCI bits less than 11 with RM coding, OCC length=2
- Proposal 4 (Intel): Define the following set of requirements
- DTX to ACK probability requirements
 - Enhanced PUCCH format 0:
 - ACK missed detection requirements
 - 1 and 2 OFDM symbols
 - Enhanced PUCCH format 1
 - NACK to ACK probability requirements
 - ACK missed detection requirements
 - PUCCH format 2:
 - ACK missed detection requirements
 - UCI BLER performance requirements
 - 1 and 2 OFDM symbols
 - PUCCH format 3:
 - UCI BLER performance requirements
 - With and without additional DMRS
 - 4 and 14 OFDM symbols
 - Enhanced PUCCH format 4: With and without additional DMRS
 - UCI BLER performance requirements
- Recommended WF
- Collect views in 1st round

Feedback Form 26: Issue 2-4-2: Detailed PUCCH test setup

1 – Nokia France

We agree on these proposals after they capture the agreements that will be made in the general section.

2 – Samsung Electronics Benelux BV

Samsung: we support option 3, the detail number of RB, payload, channel model can be further discussed

3 – HiSilicon Technologies Co. Ltd

Support option 3

4 – Ericsson LM

Suggest to discuss this once the scope has been agreed.

Table 2.3-1: Simulation Parameters for FR2-2 PUCCH format 2

Parameter	Test
Number of information bits	2
Number of PRBs	1
Number of symbols	14
First PRB prior to frequency hopping	0
Intra-slot frequency hopping	enabled
First PRB after frequency hopping	The largest PRB index – (nrofPRBs – 1)
Group and sequence hopping	neither
Hopping ID	0
Initial cyclic shift	0
First symbol	0
Index of orthogonal cover code (<i>timeDomainOCC</i>)	0
SCS and bandwidth	120kHz SCS 100MHz/400MHz
Antenna configuration	1Tx 2Rx
Channel model	TDLA30-200/2000 TDLA10-200/2000 TDLA5-200/2000
Phase noise model	Set 1 in TR38.808
Test metric	SNR@NACK→ACK<0.1% SNR@ACK miss<1%
Simulation results: Ideal simulation results with/without phase noise.	

Table 2.3-2: Simulation Parameters for FR2-2 PUCCH format 3

Parameter	Test 1	Test 2
Modulation order	QPSK	
First PRB prior to frequency hopping	0	
Intra-slot frequency hopping	enabled	
First PRB after frequency hopping	The largest PRB index – (Number of PRBs - 1)	
Group and sequence hopping	neither	
Hopping ID	0	
Number of PRBs	1	3
Number of symbols	14	4
The number of UCI information bits	16	16
First symbol	0	0
SCS and bandwidth	120kHz SCS 100MHz/400MHz	
Antenna configuration	1Tx 2Rx	
Channel model	TDLA30-200/2000 TDLA10-200/2000 TDLA5-200/2000	
Phase noise model	Set 1 in TR38.808	
Test metric	SNR@BLER<1%	
Simulation results: Ideal simulation results with/without phase noise.		

Figure 6: Proposal 1 (Ericsson): Detailed PUCCH test setup

Table 2.3-3: Test Parameters for multi-RB PUCCH format 0

Parameter	Test
Number of UCI information bits	1
Number of PRBs	16
First PRB prior to frequency hopping	0
Intra-slot frequency hopping	N/A for 1 symbol
First PRB after frequency hopping	The largest PRB index – (Number of PRBs - 1)
Group and sequence hopping	neither
Hopping ID	0
Initial cyclic shift	0
First symbol	13 for 1 symbol
SCS and bandwidth	120kHz SCS 100MHz/400MHz
Channel model	TDLA30-200/2000 TDLA10-200/2000 TDLA5-200/2000
Test metric	SNR@DTX →ACK <1%

Table 2.3-4: Test Parameters for multi-RB PUCCH format 1

Parameter	Test
Number of information bits	2
Number of PRBs	16
Number of symbols	14
First PRB prior to frequency hopping	0
Intra-slot frequency hopping	enabled
First PRB after frequency hopping	The largest PRB index – (nrofPRBs – 1)
Group and sequence hopping	neither
Hopping ID	0
Initial cyclic shift	0
First symbol	0
Index of orthogonal cover code (timeDomainOCC)	0
SCS and bandwidth	120kHz SCS 100MHz/400MHz TDLA30-200/2000 TDLA10-200/2000 TDLA5-200/2000
Channel model	SNR@NACK →ACK <0.1%
Test metric	SNR@ACK miss <1%

Table 2.3-5: Test parameters for multi-RB PUCCH format 4

Parameter	Value
Modulation order	QPSK
First PRB prior to frequency hopping starting PRB	0
Number of PRBs	16
Intra-slot frequency hopping	enabled
First PRB after frequency hopping	The largest PRB index – (Number of PRBs – 1)
Group and sequence hopping	neither
Hopping ID	0
Number of symbols	14
The number of UCI information bits	22
First symbol	0
Length of the orthogonal cover code	n2
Index of the orthogonal cover code	n0
DM-RS position	Pos0, {pos0, pos1}
SCS and bandwidth	120kHz SCS 100MHz/400MHz

2.2.5 Sub-topic 2-5: PRACH performance requirements

Sub-topic description

Details of PRACH performance requirements

Open issues and candidate options before e-meeting:

Issue 2-5-1: Scope of PRACH requirements

- Proposals
 - Proposal 1 (Intel): For FR2-2 define the same set of PRACH performance requirements as in FR2-1:
 - False alarm probability requirements
 - PRACH miss detection requirements
- Recommended WF
 - Collect views in 1st round

Feedback Form 27: Issue 2-5-1: Scope of PRACH requirements

1 – Nokia France We agree with this proposal.
2 – Samsung Electronics Benelux BV Samsung: we are ok with option 1
3 – HiSilicon Technologies Co. Ltd We agree with this proposal.
4 – Ericsson LM We support Proposal 1.

Issue 2-5-2: SCS

- Proposals
 - Option 1 (Ericsson): Prioritize 120kHz SCS. Lower priority for 480kHz and 960kHz SCS
 - Option 2 (Nokia, Huawei, Intel): 120, 480 and 960 kHz
- Recommended WF
 - Collect views in 1st round

Feedback Form 28: Issue 2-5-2: SCS

<p>1 – Samsung Electronics Benelux BV</p> <p>Samsung: we support option 1, focus on 120KHz firstly</p>
<p>2 – Intel Corporation (UK) Ltd</p> <p>We support Option 2. Number of PRACH test cases is limited so requirements for all SCSs can be defined simultaneously.</p>
<p>3 – HiSilicon Technologies Co. Ltd</p> <p>We support option 2. Same views with Intel</p>
<p>4 – Ericsson LM</p> <p>To align with our proposal in General part, we prefer to prioritize 120kHz and 480kHz, but we are open for 960kHz SCS for PRACH.</p>

Issue 2-5-3: Sequence length

- Proposals

- Proposal 1 (Ericsson): L= 139, 571, 1151 for 120kHz
- Proposal 2 (Nokia): RAN4 to introduce performance requirements for the new combinations of L_RA and Δf_{RA} introduced for FR2-2.
- Proposal 3 (Huawei): Only max supported sequence length for each SCS
- Proposal 4 (Intel): Define performance requirements for PRACH with 1151 and 571 sequence length with 120 kHz; for PRACH with 571 sequence length with 480 kHz SCS; for PRACH with 139 sequence length with 960 kHz SCS

- Recommended WF

- Collect views in 1st round

Feedback Form 29: Issue 2-5-3: Sequence length

<p>1 – Samsung Electronics Benelux BV</p> <p>Samsung: we are ok with option 3</p>
<p>2 – Intel Corporation (UK) Ltd</p> <p>We support proposals 2 and 4 that are similar and in addition requirements definition for 139 sequence length for 120 kHz SCS. We expect that the supported sequence length will be up to BS declaration, hence it is required to cover all possible configurations.</p>
<p>3 – HiSilicon Technologies Co. Ltd</p> <p>We support proposal 3, but proposal 4 is also fine for us</p>

4 – Ericsson LM

Maybe simulations based on different sequence lengths with phase noise impact are needed. We suggest to start with 120kHz SCS using different sequence lengths. Other SCS could be tested if companies have resources.

Issue 2-5-4: PRACH formats

- Proposals
 - o Option 1 (Ericsson, Huawei): A2, B4, C2
 - o Option 2 (Intel): A1, A2, A3, B4, C0, C2
- Recommended WF
 - o Collect views in 1st round

Feedback Form 30: Issue 2-5-4: PRACH formats

<p>1 – Nokia France</p> <p>We agree with option 1.</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: we support option 1</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>We are fine to compromise to Option 1.</p>
<p>4 – HiSilicon Technologies Co. Ltd</p> <p>We agree with option 1.</p>
<p>5 – Ericsson LM</p> <p>We are open for discussion. Basically, all formats could be used for FR2-2, but A2/B4/C2 are typical formats for most of Rel-16 scenarios. Regarding small cell deployment in FR2-2, short duration format could also be considered.</p>

Issue 2-5-5: Channel model and Frequency offset

- Proposals
 - o Proposal 1 (Ericsson): Consider AWGN and multi-path fading channels, such as TDLA30-200/2000, TDLA10-200/2000 and TDLA5-200/2000
 - o Proposal 2 (Huawei): consider both AWGN and TDLA30-300

- Proposal 3 (Intel): Define FR2-2 PRACH performance requirements with AWGN channel model and with TDLA10-650 with frequency offset channel models

- Recommended WF

- Collect views in 1st round

Feedback Form 31: Issue 2-5-5: Channel model and Frequency offset

1 – Nokia France

We propose to double the doppler shifts and frequency shift in the test cases designed using previous use cases. regardless on the assumed UE speed and assumed frequency. For example for PRACH test cases for FR2-1

We propose to use 8000 Hz as Frequency offset and TDLAxx-600 as a propagation condition.

2 – Samsung Electronics Benelux BV

Samsung: we should discuss the channel model firstly

3 – Intel Corporation (UK) Ltd

We support proposal from Nokia to double max Doppler shift for PRACH requirements. Requirements with AWGN and fading propagation conditions should be defined. Fading conditions should be aligned among different physical channels

4 – HiSilicon Technologies Co. Ltd

We need more time to check the channel model firstly

5 – Ericsson LM

AWGN is necessary while for multi-path fading channel, we could follow the PUSCH and PUCCH channel models, while down selection could be possible as well.

Issue 2-5-6: Frequency offset

- Proposals

- Option 1 (Huawei): $0.1 * 71\text{GHz} = 7100\text{Hz}$
- Option 2 (Ericsson): Consider 0.1ppm (7000Hz) for FR2-2.

- Recommended WF

- Collect views in 1st round

Feedback Form 32: Issue 2-5-6: Frequency offset

<p>1 – Nokia France</p> <p>We propose to double the doppler shifts and frequency shift in the test cases designed using previous use cases. regardless on the assumed UE speed and assumed frequency. For example for PRACH test cases for FR2-1</p> <p>We propose to use 8000 Hz as Frequency offset and TDLA30-600 as a propagation condition.</p>
<p>2 – Samsung Electronics Benelux BV</p> <p>Samsung: either option 1 or option 2 are fine with us, since the target carrier frequency is up to 71GHz, option 1 can be considered</p>
<p>3 – Intel Corporation (UK) Ltd</p> <p>Option 1 is more preferable considering that requirements should be applicable up to 71 GHz. Also we are fine with proposal from Nokia on 8000 Hz</p>
<p>4 – HiSilicon Technologies Co. Ltd</p> <p>Prefer Option 1</p>
<p>5 – Ericsson LM</p> <p>We are fine with both options.</p>

Issue 2-5-7: Time error tolerance

- Proposals

- Proposal 1 (Huawei): Reuse test metric of Rel-15 and use assumptions in Table 2 as time error tolerance.

PRACH preamble A2, B4, C2	PRACH SCS (kHz)	Time error tolerance	
		AWGN	TDLA30-300
	120	0.07 us	0.22 us
	480	0.02 us	0.17 us
	960	0.01 us	0.16us

Figure 8: Proposal 1 (Huawei): time error tolerance

- Proposal 2 (Ericsson): 0.07us for AWGN. For multi-path fading channels, time error could be further discussed based on delay profile and timing error.

- Recommended WF

- Collect views in 2nd round

Feedback Form 33: Issue 2-5-7: Time error tolerance

1 – Samsung Electronics Benelux BV Samsung: ok with option 2, the time error pending the channel used
2 – HiSilicon Technologies Co. Ltd It depends on channel model
3 – Ericsson LM Agree with recommended WF

Issue 2-5-8: (Ncs, logical sequence index, v)

- Proposals

- Proposal 1 (Intel): Consider the following PRACH parameters as initial simulation assumptions:
Ncs = 69, logical sequence index = 0, v = 0.

- Recommended WF

- Collect views in 2nd round

Feedback Form 34: Issue 2-5-8: (Ncs, logical sequence index, v)

1 – Samsung Electronics Benelux BV Samsung: we can use option 1 as starting point, other options are not precluded
2 – HiSilicon Technologies Co. Ltd we can use option 1 as starting point, other options are not precluded
3 – Ericsson LM Agree with recommended WF

Issue 2-5-9: Detailed simulation assumptions

- Proposals

- Proposal 1 (Huawei): Define the requirements for PRACH operating in FR2-2 with following cases:
 - SCS: 120 kHz; Format: A2, B4 and C2; LRA: 1151; Propagation conditions: AWGN and TDLA30-30

- SCS: 480 kHz; Format: A2, B4 and C2, LRA: 571; Propagation conditions: AWGN and TDLA30-300
 - SCS: 960 kHz; Format: A2, B4 and C2, LRA: 139; Propagation conditions: AWGN and TDLA30-300.
- Proposal 2 (Ericsson): Define new requirements for FR2-2 PRACH. Take simulation assumptions in Table 2.4-1 as the start point to see the phase noise impact and configuration feasibility.

PRACH preamble	PRACH SCS (kHz)	Time error tolerance [u s]			Frequency offset		
		AWGN	TDLA30-200/2000	TDLA10-200/2000	TDLA5-200/2000	AWGN	Multi-path channel
A2, B4, C2 FFS on other preambles	120	0.07	FFS	FFS	FFS	0	7000

Figure 9: Proposal 2 (Ericsson): Detailed simulation assumptions

- Recommended WF

- Collect views in 2nd round

Feedback Form 35: Issue 2-5-9: Detailed simulation assumptions

<p>1 – Samsung Electronics Benelux BV</p> <p>Samsung: we can apply option 1 as starting piont , FFS on channel model, FFS on SCS</p>
<p>2 – Ericsson LM</p> <p>Agree with recommended WF</p>

2.3 Summary for 1st round

2.3.1 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

Table 2: First round summary for Topic #2

	Summary
Sub-topic 2-1: SCS/CBW combinations	<p>Issue 2-1-1: SCS for UL requirements definition Three companies support introduction of requirements for 120, 480 and 960 kHz SCS. One company suggested prioritizing 120 and 480 kHz. One company suggested prioritizing 120 kHz.</p> <p>Tentative agreement: Consider the following SCS for UL requirements definition:</p> <ul style="list-style-type: none"> - 120, 480 kHz - FFS 960 kHz <p>Candidate options: NA Recommendations for 2nd round: Continue discussion on necessity of requirements with 960 kHz SCS.</p>
	<p>Issue 2-1-2: CBW for UL requirements definition All companies agree to consider min and max CBW for each SCS. Several companies raised the possible testability issue for high CBWs.</p> <p>Tentative agreement:</p> <ul style="list-style-type: none"> - Consider minimum CBW for each SCS for UL requirements definition. - Consider maximum CBW for each SCS for UL requirements definition if no testability aspects are identified <ul style="list-style-type: none"> o Perform link budget analysis to study max achievable SNR during the test <p>Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement.</p>
Sub-topic 2-1: General issues	<p>Issue 2-2-1: FR2-1 requirements reuse All companies agreed with proposal one. One company suggest to clarify what "reuse" means.</p> <p>Tentative agreement: Do not apply FR2-1 performance requirements for FR2-2.</p> <p>Candidate options: NA Recommendations for 2nd round: NA</p>

	<p><u>Issue 2-2-2: General simulation assumptions</u></p> <p>All companies agreed to consider 1-2Tx/2Rx configuration. Four companies support considering normal CP length for all SCS. One company suggest discussing extended CP for 480 and 960 kHz SCS due to short slot length. Same time according to TS 38.211 extended CP length is not defined for 480 and 960 kHz SCSs.</p> <p>Tentative agreement: Define UL performance requirements with:</p> <ul style="list-style-type: none"> - Normal CP - With 1 and 2 Tx antennas - With 2 demodulation branches <p>Candidate options: NA</p> <p>Recommendations for 2nd round: Confirm tentative agreement</p>
	<p><u>Issue 2-2-3: Test SNR limit</u></p> <p>Four companies support this proposal and one company needs more time to check.</p> <p>Tentative agreement: Take [20] dB SNR limit FR2-2 at starting point. New test cases and method should be defined if it is finally approved that FR2-2 SNR limit is much lower than [20] dB.</p> <p>Candidate options: NA</p> <p>Recommendations for 2nd round: Confirm tentative agreement</p>

	<p><u>Issue 2-3-1: Scope of PUSCH performance requirements</u></p> <p>Diverse views on scope of PUSCH requirements</p> <p>Tentative agreement:</p> <p>Define the following PUSCH performance requirements:</p> <ul style="list-style-type: none"> - Performance requirements with transform precoding disabled with 70% throughput - FFS performance requirements with transform precoding disabled with 30% throughput - FFS performance requirements with transform precoding enabled - FFS performance requirements for PUSCH repetition type A <p>Do not define the following PUSCH performance requirements:</p> <ul style="list-style-type: none"> - Performance requirements for 2-step RA type - Performance requirements with mapping type B with non-slot transmission - Performance requirements with UCI multiplexed on PUSCH <p>Candidate options: NA</p> <p>Recommendations for 2nd round:</p> <p>Continue discussion on FFS aspect and try to converge on PUSCH scope.</p>
	<p><u>Issue 2-3-2: PUSCH performance requirements for multi-PUSCH scheduling</u></p> <p>All companies agreed with proposal 1.</p> <p>Tentative agreement:</p> <p>Do not define BS demodulation requirements for multi-PUSCH scheduling</p> <p>Candidate options: NA</p> <p>Recommendations for 2nd round: NA</p>

	<p><u>Issue 2-3-3: PUSCH performance requirements with 32 UL HARQ processes</u> Companies converged to not define requirements with 32 UL HARQ processes Tentative agreement: Do not define PUSCH performance requirements to verify 32 UL HARQ processes feature Candidate options: NA Recommendations for 2nd round: NA</p>
	<p><u>Issue 2-3-4: General PUSCH test setup</u> All companies agreed with proposed options and with suggestion on the temporary RB number for each CBW. PRB number will be updated once RF room reaches corresponding agreement. Tentative agreement: Consider the following simulation assumptions at starting point for PUSCH performance requirements:</p> <ul style="list-style-type: none"> - MCS 4, 16, 20 - DM-RS/PT-RS configuration Rel-15 assumptions - 1+1 DMRS configuration - PTRS Tx on - Temporary PRB number: <ul style="list-style-type: none"> o (66)(264)(66)(132)(264)(32)(66)(132)(156) for SCS (kHz CWB (MHz)) = (120 100)(120 400)(480 400) (480 800)(480 1600)(960 400)(960 800)(960 1600)(960 2000)
	<p><u>Issue 2-3-5: Detailed PUSCH test setup</u> No discussion in 1st round Recommendations for 2nd round: Collect views considering progress in other issues.</p>
	<p><u>Issue 2-3-6: Rx processing assumptions</u> Limited number of comments. Recommendations for 2nd round: Continue discussion</p>
	<p><u>Issue 2-3-7: Other</u> No discussion in 1st round Recommendations for 2nd round: Collect views considering progress in other issues.</p>

<p>Sub-topic 2-4: PUCCH performance requirements</p>	<p><u>Issue 2-4-1: Scope of PUCCH performance requirements</u> Four companies support Option 1 and one company supports Option 2. Considering majority view moderator suggest Option 1. Tentative agreement:</p> <ul style="list-style-type: none"> - Define performance requirements for the enhanced PUCCH formats 0, 1, and 4. - Define new requirements for PUCCH formats 2 and 3. <p>Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement</p>
	<p><u>Issue 2-4-2: Detailed PUCCH test setup</u> More discussion is needed considering progress of general issues. Moderator will update this issue for 2nd round discussion. Recommendations for 2nd round: Collect views considering progress in other issues.</p>
<p>Sub-topic 2-5: PRACH performance requirements</p>	<p><u>Issue 2-5-1: Scope of PRACH requirements</u> All companies agreed with proposal 1. Tentative agreement: Define the following PRACH performance requirements:</p> <ul style="list-style-type: none"> - False alarm probability requirements - PRACH miss detection requirements <p>Candidate options: NA Recommendations for 2nd round: NA</p>
	<p><u>Issue 2-5-2: SCS</u> Four companies support 120 kHz. Three companies support 480 kHz. Two companies support 960 kHz Tentative agreement: PRACH SCS:</p> <ul style="list-style-type: none"> - 120, 480 kHz - FFS 960 kHz <p>Candidate options: NA Recommendations for 2nd round: Discuss necessity of PRACH requirements with 960 kHz SCS.</p>

	<p><u>Issue 2-5-3: Sequence length</u> Three companies agree with proposal 4. One company prefers proposal 3. Tentative agreement: PRACH sequence length:</p> <ul style="list-style-type: none"> - 120 kHz: <ul style="list-style-type: none"> o 1151, 571 o FFS 139 - 480 kHz: <ul style="list-style-type: none"> o 571 o FFS on 139 - 960 kHz: <ul style="list-style-type: none"> o 139 <p>Candidate options: NA Recommendations for 2nd round: Discuss FFS options.</p>
	<p><u>Issue 2-5-4: PRACH formats</u> All companies agreed to consider Option 1. Tentative agreement: PRACH formats: A2, B4, C2</p>
	<p><u>Issue 2-5-5: Channel model and Frequency offset</u> More discussion is needed considering progress of Sub-topic 1-3. Tentative agreement: NA Recommendations for 2nd round: Focus on sub-topic 1-3 first.</p>

	<p><u>Issue 2-5-6: Frequency offset</u> All companies agreed to consider Option 1. One company proposed 8000 Hz that is double value of 4000Hz that is used for FR2-1.</p> <p>Tentative agreement: NA Candidate options:</p> <ul style="list-style-type: none"> - Option 1: 7100 Hz - Option 2: 8000 Hz <p>Recommendations for 2nd round: Discussed above options.</p>
	<p><u>Issue 2-5-7: Time error tolerance</u> 0.07us can be agreed for AWGN. More discussion is needed for multi-path fading conditions.</p> <p>Tentative agreement: Time error tolerance:</p> <ul style="list-style-type: none"> - 0.07us for AWGN - FFS for multi-path fading <p>Candidate options: NA Recommendations for 2nd round: Continue discussion considering progress of sub-topic 1-3.</p>
	<p><u>Issue 2-5-8: (Ncs, logical sequence index, v)</u> All companies support to consider proposal 1 as starting point.</p> <p>Tentative agreement: Consider the following PRACH parameters as starting point: Ncs = 69, logical sequence index = 0, v = 0.</p> <p>Candidate options: NA Recommendations for 2nd round: NA</p>
	<p><u>Issue 2-5-9: Detailed simulation assumptions</u> More discussion is needed considering progress of other issues</p> <p>Candidate options: NA Recommendations for 2nd round: Continue discussion in 2nd round considering progress of other issues.</p>

2.4 Discussion on 2nd round (if applicable)

TBA

3 Topic #3: UE performance requirements

3.1 Companies' contributions summary

T-doc number	Company	Proposals / Observations																																										
R4-2204584	Ericsson	<p>Proposal 1: RAN4 defines the UE demodulation and CSI reporting requirements with:</p> <ul style="list-style-type: none"> Number of receive antennas: 2Rx Modulation order: Up to 64QAM Both single carrier (FR2-2) and NR-DC FR1 + FR2-2 scenarios <p>Proposal 2: RAN4 defines the UE demodulation requirements with:</p> <ul style="list-style-type: none"> FR2-2 TDD: SCS = 120 kHz with min CBW = 100 MHz and Max CBW = 400 MHz FR2-2 TDD: SCS = 480 kHz with min CBW = 400 MHz and Max CBW = 1600 MHz <p>Observation 1: In Rel-17, NR operation in FR2-2 will only support Rel-15 patterns for CP-OFDM</p> <p>Proposal 3: Consider the parametrized phase noise model in [4] and use Rel-15 PTRS pattern for tests.</p> <p>Proposal 4: Define PDSCH demodulation requirements for UE with the following test setup.</p> <table border="1"> <thead> <tr> <th>Assumptions</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Carrier Frequency [GHz]</td> <td>70 GHz</td> </tr> <tr> <td>Subcarrier Spacing [KHz]</td> <td>120 KHz, 480 KHz</td> </tr> <tr> <td>Waveform</td> <td>CP-OFDM</td> </tr> <tr> <td>CP Type</td> <td>Normal CP</td> </tr> <tr> <td>Channel Model</td> <td>TDL model as defined in of TR38.901 Clause 7.7.2: - TDL-A (5ns, 10ns, 30 ns DS)</td> </tr> <tr> <td>Antenna configuration</td> <td>For TDL model: 2x2 ULA Low</td> </tr> <tr> <td>Velocity</td> <td>3 km/h, 30 km/h</td> </tr> <tr> <td>PA Model</td> <td>None</td> </tr> <tr> <td>gNB TRP PN Model</td> <td>TR38.803 example 2 BS PN profile and [3] Set 1</td> </tr> <tr> <td>UE PN Model</td> <td>TR38.803 example 2 UE PN profile and [3] Set 1</td> </tr> <tr> <td>Pre-loaded Tx EVM</td> <td>0%</td> </tr> <tr> <td>Additive Rx EVM</td> <td>0%</td> </tr> <tr> <td>I-Q Imbalance</td> <td>None</td> </tr> <tr> <td>Frequency Offset</td> <td>0 ppm</td> </tr> <tr> <td>Channel Estimation</td> <td>Realistic channel estimation</td> </tr> <tr> <td>Transmission Rank</td> <td>Rank 1 (Rank 2 is FFS)</td> </tr> <tr> <td>DMRS Configuration</td> <td>2 DMRS symbols at (2, 11) symbol index</td> </tr> <tr> <td>PTRS Configuration</td> <td>For CP-OFDM: (K = 2, L = 1)</td> </tr> <tr> <td>CSI-RS / TRS</td> <td>CSI-RS/TRS is assumed to be off (for RS overhead)</td> </tr> <tr> <td>MCS/TBS</td> <td>From MCS Table 1 (TS38.214): - MCS 7 (QPSK), - MCS 16 (16QAM), - [MCS 22] (64QAM). Note: It is assumed that $N_{oh}^{PRB} = 0$ for MCS calculations.</td> </tr> </tbody> </table> <p>FR2-2 TDD, SCS 120 KHz</p>	Assumptions	Value	Carrier Frequency [GHz]	70 GHz	Subcarrier Spacing [KHz]	120 KHz, 480 KHz	Waveform	CP-OFDM	CP Type	Normal CP	Channel Model	TDL model as defined in of TR38.901 Clause 7.7.2: - TDL-A (5ns, 10ns, 30 ns DS)	Antenna configuration	For TDL model: 2x2 ULA Low	Velocity	3 km/h, 30 km/h	PA Model	None	gNB TRP PN Model	TR38.803 example 2 BS PN profile and [3] Set 1	UE PN Model	TR38.803 example 2 UE PN profile and [3] Set 1	Pre-loaded Tx EVM	0%	Additive Rx EVM	0%	I-Q Imbalance	None	Frequency Offset	0 ppm	Channel Estimation	Realistic channel estimation	Transmission Rank	Rank 1 (Rank 2 is FFS)	DMRS Configuration	2 DMRS symbols at (2, 11) symbol index	PTRS Configuration	For CP-OFDM: (K = 2, L = 1)	CSI-RS / TRS	CSI-RS/TRS is assumed to be off (for RS overhead)	MCS/TBS	From MCS Table 1 (TS38.214): - MCS 7 (QPSK), - MCS 16 (16QAM), - [MCS 22] (64QAM). Note: It is assumed that $N_{oh}^{PRB} = 0$ for MCS calculations.
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Test number	CBW / SCS	MCS and rank	TDD UL/DL pattern	Propagation condition	Antenna configuration	Metric	Reference from TS38.101-4 7.2.2.2.1
1-1 (Note 1)	100MHz / 120kHz	QPSK 0.3 Rank 1	FR2.12 0-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-1
1-2 (Note 1)	100MHz / 120kHz	16QAM 0.48 Rank 1	FR2.12 0-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-3
1-3 (Note 1)	100MHz / 120kHz	64QAM 0.43 Rank 1	FR2.12 0-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-6
2-1 (Note 1)	400MHz / 120kHz	QPSK 0.3 Rank 1	FR2.12 0-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-1
2-2 (Note 1)	400MHz / 120kHz	16QAM 0.48 Rank 1	FR2.12 0-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-3
2-3 (Note 1)	400MHz / 120kHz	64QAM 0.43 Rank 1	FR2.12 0-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-6
3-1	TBD /	QPSK	FR2.12	TDL-A	2x2 ULA	70%	Test 2-1

3.2 Open issues summary

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

3.2.1 Sub-topic 3-1: SCS/CBW combinations

Sub-topic description:

New SCS and CBWs were introduced for FR2-2. RAN4 needs to discuss SCS/CBW combinations for requirements definition. Moderator suggest discussing separately SCS and CBW to converge on the required SCS/CBW combinations.

Open issues and candidate options before e-meeting:

Issue 3-1-1: SCS for DL requirements definition

- Proposals

- Option 1 (Nokia, Huawei, Intel): 120, 480 and 960 kHz
 - Huawei: 120, 480, 960 kHz for PDSCH and 480, 960 kHz for PDCCH/PBCH
- Option 2 (Ericsson): 120 and 480 kHz

- Recommended WF

- Collect views in 1st round on required SCS for DL test cases.
- Check whether it is agreeable to cover at least 120 and 480 kHz SCS
- Further discuss whether to cover 960 kHz SCS

Feedback Form 36: Issue 3-1-1: SCS for DL requirements

1 – Intel Corporation (UK) Ltd

We support Option 1. Propagation conditions and phase noise have different impact on each SCS, hence Rx algorithms can be adjusted for each SCS like channel estimation, phase noise ICI compensation etc.

2 – Nokia

We prefer Option 1.

Regarding Option 2, we have concerns down prioritizing 960 kHz with the tight schedule that we have. Since we have only two meetings, if we postpone the discussion on 960 kHz, we won't be able to finish these requirements in time.

3 – Apple GmbH

We support to only cover 120KHz SCS since that's mandatory. Since both 480KHz and 960KHz are optional, we prefer to de-prioritize them given limited time. But okay to consider at least 480KHz in addition to 120KHz. But definitely not all 3.

<p>4 – HiSilicon Technologies Co. Ltd</p> <p>Option 1</p>
<p>5 – Ericsson LM</p> <p>Ericsson supports Option 2. SCS 960 KHz is optional and we believe that could be deprioritized at this stage.</p>
<p>6 – Qualcomm Technologies Int</p> <p>We are also fine with considering 120 and 480kHz with higher priority. For 960kHz there is also a potential issue with the necessity of having a different SCS for SSB in the test</p>

Issue 3-1-2: CBW for DL requirements definition

Moderator recommends paying attention to the on-going discussion on FR2 enhanced OTA test methods [FR2_enhTestMethods] in which initial DL SNR assessment during the demod test is discussed for FR2-2.

- Proposals

- SCS 120 kHz
 - Option 1 (Nokia, Huawei): 400 MHz
 - Option 2 (Ericsson, Intel): 100 MHz and 400 MHz
- SCS 480 kHz
 - Option 1 (Nokia): 400 MHz, 800 MHz, and 1600 MHz
 - Option 2 (Ericsson): 400 MHz and 1600 MHz
 - Option 3 (Huawei): 1600 MHz
 - Option 4 (Intel): 400 MHz
- SCS 960 kHz
 - Option 1 (Nokia): 400 MHz, 800 MHz, 1600 MHz, and 2000 MHz
 - Option 2 (Huawei): 2000 MHz
 - Option 3 (Intel): 400 MHz

- Recommended WF

- Collect views in 1st round on required CBWs for DL test cases.

Feedback Form 37: Issue 3-1-2: CBW for DL requirements definition

1 – Intel Corporation (UK) Ltd

Main set of FR2-1 UE demodulation requirements is defined for one CBW and one SCS, and limited number of test cover other possible CBWs/SCS combinations. We suggest considering the same approach for FR2-2: Define requirements with 120 kHz and 100 MHz as a main set and limited number of test cases for 120 kHz 400 MHz and 480, 960 kHz + 400 MHz.

2 – Nokia

We understand the concerns of adding requirements for all CBW configurations and can compromise to requirements covering at least the lower and upper bands for each SCS:

SCS 120kHz: Option 2 (100MHz and 400MHz)

SCS 480kHz: Prefer option 1, but can compromise to Option 2 (400MHz and 1600MHz)

SCS 960kHz: Prefer option 1, but can compromise to Option 2+option3 (400MHz and 2000MHz)

3 – Apple GmbH

There is discussion in RF session on optionality of CBWs for FR2-2. We should wait for conclusion on that before we define requirements for all CBW. Also, just like in Rel-15 FR2, we don't need to define requirements for all CBW for SCS.

Based on the RF session the mandatory CBW are:

- 120KHz: 100MHz
- 480KHz: 400MHz
- 960 KHz: 400MHz

We propose that demod requirements are only defined for the above CBW first.

4 – HiSilicon Technologies Co. Ltd

Need more time to check the discussions on supported CBWs from RF session

5 – Ericsson LM

Ericsson supports

Option 2 [NP1] [KT2] for SCS 120 KHz,

Option 2 for SCS 480 KHz, and disagree with Option 3 since the min CBW is mandatory, so it should be considered for performance requirements.

For SCS 960 KHz, Ericsson deprioritizes this SCS, however, if we will go for it, Ericsson will support Option 1 but without including all intermediate CBW.

3.2.2 Sub-topic 3-2: General issues

Sub-topic description

General aspects regardless of DL Physical channel

Open issues and candidate options before e-meeting:

Issue 3-2-1: FR2-1 requirements reuse for 120 kHz SCS

- Proposals

- Proposal 1 (Intel): Do not reuse FR2-1 performance requirements for FR2-2.
- Proposal 2 (Nokia): Study if new UE demodulation and CSI reporting performance requirements for SCS 120 kHz with 100 MHz channel bandwidth are needed for the operation in FR2-2
- Proposal 3: (Nokia): Analyse the impact of the FR2-2 frequency range on the existing UE demodulation and CSI reporting performance requirements for SCS of 120kHz. If needed, add new performance requirements for PDSCH, PDCCH and PBCH with FR2-2 using 120kHz SCS.
- Proposal 4: (Nokia): In case new UE demodulation and CSI reporting requirements are needed for 120kHz SCS in FR2-2, update the existing requirements to be valid for FR2-1 only and create separate requirements for FR2-2

- Recommended WF

- Collect views in 1st round.

Feedback Form 38: Issue 3-2-1: FR2-1 requirements reuse for 120 kHz SCS

<p>1 – Intel Corporation (UK) Ltd</p> <p>Our evaluations show that current PDSCH requirements are not applied for FR2-2 due to higher phase noise impact. In addition, we think that another channel model should be considered for FR2-2 with smaller RMS delay spread and higher max Doppler frequency. Therefore, we proposed to not reuse FR2-1 requirements.</p>
<p>2 – Nokia</p> <p>Based on the simulation results provided by Intel, we agree with Proposal 1.</p>
<p>3 – Apple GmbH</p> <p>The requirements from FR2-1 for 120KHz cannot be reused for FR2-2 as the phase noise has different impact depending on carrier frequency.</p>
<p>4 – HiSilicon Technologies Co. Ltd</p> <p>We agree with Proposal 1 since channel model and phase noise model is different</p>
<p>5 – Ericsson LM</p> <p>Ericsson supports Proposal 1 due to PN effects</p>
<p>6 – Qualcomm Technologies Int</p> <p>We think it's best to evaluate applicability of the requirements once we have results and check effective PN impact. For PDSCH this might be of less importance if the channel models or BW combinations change</p>

Issue 3-2-2: General simulation assumptions

- Proposals

- Proposal 1 (Ericsson): RAN4 defines the UE demodulation and CSI reporting requirements with:
 - Number of receive antennas: 2RxModulation order:
 - Up to 64QAM
- Proposal 2 (Intel): Define FR2-2 performance requirements with normal CP only, with 2 Rx antennas, and with 1 and 2 Tx antennas that is selected case by case.
- Proposal 3 (Huawei): Use 2 receiving antennas
- Proposal 4 (Huawei): Keep the number of transmission RBs open until there are corresponding agreements from RF team

- Recommended WF

- Collect views in 1st round

Feedback Form 39: Issue 3-2-2: General simulation assumptions

1 – Intel Corporation (UK) Ltd

We are fine with all proposals, and suggestion from Nokia on number of RBs for BS (issue 2-3-4) can be considered for UE as well.

2 – Nokia

All proposals seems agreeable to us. For proposal 4 results are not expected from RAN1 any time soon, so we need to start simulation on a temporary alignment.

Similar to our comment for BS (issue 2-3-4):

For the number of PRBs we suggest for the sake of advance of the work for the next meeting to agree on a temporary value. For example, the maximum value that does not violate any CBW possible assuming a 5% or 10% guard band. We propose to discuss

(SCS (kHz) CBW (MHz)) = (120 100) (120 400) (480 400) (480 800) (480 1600) (960 400) (960 800) (960 1600) (960 2000)

proposed PRBs = (66) (264) (66) (132) (264) (32) (66) (132) (156)

3 – Apple GmbH

Proposals 1-3 are fine.

For proposal 4, we need to use some assumption to bring simulation results. We propose to wait until end of this meeting and use the numbers agreed in RF session. Another alternative is to use numbers based on current proposals as proposed by Nokia above.

Again we propose to define requirements with combinations below:

120KHz: 100MHz - 66PRB

480KHz: 400MHz - 66PRB

960 KHz: 400MHz - 32 PRB

4 – HiSilicon Technologies Co. Ltd

We are fine with all proposals and suggestion from Nokia on number of RBs are fine for us

5 – Ericsson LM

Ericsson supports Proposal 1, and agrees on Proposals 2, 3 and 4 as well.

Issue 3-2-3: Other

- Proposals
 - o Proposal 1 (Nokia): Increase the FLD_high max frequency to cover FR2-2 frequency bands, i.e. “FDL_high may not exceed 71000 MHz” and reconsider existing requirements if needed:
- Recommended WF
 - o Collect views in 1st round

Feedback Form 40: Issue 3-2-3: Other

1 – Intel Corporation (UK) Ltd

Support proposal 1.

2 – Nokia

Support Proposal 1

3 – HiSilicon Technologies Co. Ltd

Need more time to check

4 – Ericsson LM

Ericsson supports Proposal 1.

3.2.3 Sub-topic 3-3: PDSCH performance requirements

Sub-topic description

Details of PDSCH performance requirements

Open issues and candidate options before e-meeting:

Issue 3-3-1: Detailed scope of PDSCH requirements

Current issue is based on the exact proposed summary tables for PDSCH requirements. Companies may either comment directly to this issue or use issues [3-3-2 – 3-3-8] created in a classical way.

- Proposals

- Proposal 1 (Ericsson):

- Proposal 2 (Intel): Define FR2-2 PDSCH performance requirements according to Tables 2-6

- Recommended WF

- Collect views in 1st round

Feedback Form 41: Issue 3-3-1: Detailed scope of PDSCH requirements

<p>1 – Nokia</p> <p>We prefer to discuss these topics, e.g. propagation conditions etc. separately and not as finished tables.</p>
<p>2 – Apple GmbH</p> <p>We should define requirements for mandatory features first. Later discuss requirements with other optional features.</p>
<p>3 – HiSilicon Technologies Co. Ltd</p> <p>Same views with Apple and Nokia. Especially, we propose to only focus on basic requirements and de-prioritized optional features such as PDSCH requirements with type B mapping, enhanced receiver type A and 32 DL HARQ processes</p>
<p>4 – Ericsson LM</p> <p>Ericsson supports Proposal 1. We believe that for SCS 120 KHz, max CW = 400 MHz should be examined, and performance requirements should be defined accordingly. For SCS 480 KHz, we can accept to start with min CBW = 400 MHz, which is mandatory, and keep the max CBW = 1600 MHz for later.</p>
<p>5 – Qualcomm Technologies Int</p> <p>We share also other companies' views that we should focus on a limited set of basic requirements at this stage to make it within the work plan constraints. Additional requirements can be included after we have this baseline set</p>

Issue 3-3-2: PDSCH performance requirements for multi-PDSCH scheduling

- Proposals

- Proposal 1 (Nokia): RAN4 to not include new UE demodulation performance requirements for the feature of Multi-PDSCH scheduled by a single DCI

- Proposal 2 (Huawei): Define the PDSCH performance requirements with following assumptions:
 - 120 kHz SCS: Single TB scheduling
 - 480 kHz SCS: 4-TB scheduling
 - 960 kHz SCS: 8-TB scheduling
- Proposal 3 (Intel): Define PDSCH performance requirements with 480 and 960 kHz SCS with multi-slot scheduling by single DCI.

- Recommended WF

- Collect views in 1st round

Feedback Form 42: Issue 3-3-2: PDSCH performance requirements for multi-PDSCH scheduling

<p>1 – Nokia</p> <p>We do not have a strong preference for proposal 1. We are fine to also have separate requirements for multi-PDSCH scheduled by single DCI, if time remains. However, we see it as lower importance compared to the other topics.</p> <p>We see different reasons from contributions for proposal 2 (use Multi-PDSCH to speed up test) and proposal 3 (add Multi-PDSCH requirements to test the newly added feature), hence we feel proposal 2 should be discussed separately.</p> <p>We also see that the decision on multi-PDSCH is not yet finalized for 480kHz/960kHz SCS in RAN1.</p>
<p>2 – Apple GmbH</p> <p>Focus on mandatory features first for FR2-2 requirements, given the limited time to define performance requirements in Rel-17.</p>
<p>3 – HiSilicon Technologies Co. Ltd</p> <p>We support proposal 2. As discussed in our paper, PDCCH can't be scheduled in every slot for 480kHz/960kHz SCS. Therefore, multi-TB scheduling may help speed up the test.</p>
<p>4 – Ericsson LM</p> <p>Ericsson is open for discussion</p>
<p>5 – Intel Corporation (UK) Ltd</p> <p>According to our understanding of RAN1 UE feature list, support of 480 and 960 kHz SCS assumes support of multi-slot scheduling feature. Therefore, we support proposal 2 and 3.</p>
<p>6 – Qualcomm Technologies Int</p> <p>The impact of this choice on demodulation performance needs to be checked, we can further discuss it</p>

Issue 3-3-3: PDSCH performance requirements with 32 DL HARQ processes

- Proposals

- Proposal 1 (Intel): Define PDSCH performance requirements for 32 DL HARQ processes with the test metric 30% of maximum throughput
- Proposal 2 (Nokia): RAN4 to not have explicit new demod requirements for increased number of HARQ processes. However, RAN4 to take care to specify sufficient HARQ processes for other PDSCH requirements.

- Recommended WF

- Collect views in 1st round

Feedback Form 43: Issue 3-3-3: PDSCH performance requirements with 32 DL HARQ processes

<p>1 – Nokia</p> <p>We do not have a strong opinion here. Can also accept Proposal 1.</p> <p>However use of 32 HARQ process should be limited to certain test scenarios, since it is defined as optional UE feature in R1-2200780.</p>
<p>2 – Apple GmbH</p> <p>Focus on mandatory features first for FR2-2 requirements, given the limited time to define performance requirements in Rel-17.</p>
<p>3 – HiSilicon Technologies Co. Ltd</p> <p>Agree with Apple</p>
<p>4 – Ericsson LM</p> <p>Agree with Apple and Huawei, but open for discussion if needed.</p>
<p>5 – Intel Corporation (UK) Ltd</p> <p>Support of 32 HARQ processes impacts soft buffer implementation. It cannot be an issue for BS, but for UE it really important to verify that UE stores all soft bits and makes soft combining. Just one test case is enough for this feature. Support proposal 1.</p>

Issue 3-3-4: Mapping type

- Proposals

- Proposal 1 (Intel): A and B

- Recommended WF

- Collect views in 1st round

Feedback Form 44: Issue 3-3-4: Mapping type

1 – Nokia Agree to proposal 1 (to follow legacy)
2 – Apple GmbH Define requirements with Mapping Type A alone.
3 – HiSilicon Technologies Co. Ltd Agree with Apple
4 – Ericsson LM Open for discussions
5 – Intel Corporation (UK) Ltd We suggest using approach from FR2-1 and define most of the requirements with mapping type A and one test with mapping type B.

Issue 3-3-5: Requirements with 30% throughput

- Proposals
 - Proposal 1 (Intel): Define
- Recommended WF
 - Collect views in 1st round

Feedback Form 45: Issue 3-3-5: Requirements with 30% throughput

1 – Nokia Agree to proposal 1 (to follow legacy)
2 – Apple GmbH Only define requirements for 70% max TP.
3 – HiSilicon Technologies Co. Ltd Agree with Apple
4 – Ericsson LM For DL, we do believe that 70% peak throughput is more relevant. 30% case could be considered in UL

5 – Intel Corporation (UK) Ltd

Soft buffer implementation is an important aspect for UE architecture hence we proposed to define one test case with 30% throughput test metric. This test should be considered as a part of minimum performance requirements for FR2-2 similar to FR2-1. This issue was discussed in RAN1 and finally RAN1 asked RAN4 to define suitable test cases (R1-1801139).

Issue 3-3-6: Requirements for enhanced receiver type 1

- Proposals
 - o Proposal 1 (Intel): Define
- Recommended WF
 - o Collect views in 1st round.

Feedback Form 46: Issue 3-3-6: Requirements for enhanced receiver type 1

<p>1 – Nokia</p> <p>Agree to proposal 1 (to follow legacy)</p>
<p>2 – Apple GmbH</p> <p>Dont define requirements for enhancements receiver Type 1. We need not repeat all requirements for FR2-2. Just choose a small set of requirements to cover mandatory features.</p>
<p>3 – HiSilicon Technologies Co. Ltd</p> <p>Agree with Apple</p>
<p>4 – Ericsson LM</p> <p>Agree with Apple and Huawei, but open for discussion if needed.</p>
<p>5 – Intel Corporation (UK) Ltd</p> <p>We are fine to deprioritize requirements for enhanced receiver type 1 considering limited time on performance part.</p>

Issue 3-3-7: MCS, modulation order for PDSCH requirements

- Proposals
 - o Proposal 1 (Ericsson): QPSK 0.3, 16QAM, 0.48, 64QAM, 0.43
 - o Proposal 2 (Intel): QPSK 0.3, 16QAM, 0.48, 64QAM, 0.46

- Recommended WF
 - Collect views in 2nd round

Feedback Form 47: Issue 3-3-7: MCS, modulation order for PDSCH requirements

<p>1 – Intel Corporation (UK) Ltd</p> <p>We propose to consider the same MCS values for FR2-2 as used in FR2-1 as starting point: MCS 4, MCS 13, MCS 22.</p>
<p>2 – Apple GmbH</p> <p>Proposal 2 to use existing MCS as baseline is fine for us.</p>
<p>3 – HiSilicon Technologies Co. Ltd</p> <p>Proposal 2 is fine for us</p>
<p>4 – Ericsson LM</p> <p>We support both proposals and we would like to maintain MCS moderate, [MCS 22].</p>

Issue 3-3-8: Rank

- Proposals
 - Proposal 1 (Ericsson): Rank 1 (Rank 2 FFS)
 - Proposal 2 (Huawei): Define the PDSCH performance requirements for both rank 1 and rank 2:
 - Rank 1: DMRS port 1000 is used and configure the RRC signalling indicating UE to assume FDD-OCC is not applied to all the antenna ports for DMRS which is applicable should be configured
 - Rank 2: DMRS port 1000 and 1002 are used
 - Proposal 3 (Intel): Rank 1 and 2
- Recommended WF
 - Collect views in 2nd round

Feedback Form 48: Issue 3-3-8: Rank

<p>1 – Intel Corporation (UK) Ltd</p> <p>We support to consider both Rank 1 and Rank 2. As for FD-OCC for Rank 1, we suggest to evaluate both options to understand performance impact because for 120 kHz and 960 kHz observations might be quite different.</p>
--

2 – Ericsson LM

Ericsson supports Proposal 1. We do believe that Rank 2 should be FFS, since we prioritize SCS 120 KHz and 480 KHz, and would not go for high MCS.

Issue 3-3-9: PTRS configuration

- Proposals

- Proposal 1 (Ericsson): Use Rel-15 PTRS pattern for tests
- Proposal 2 (Nokia): Rederive performance requirements with the maximally dense PTRS configurations for FR2-2 below:

- Recommended WF

- Collect views in 2nd round

Feedback Form 49: Issue 3-3-9: PTRS configuration

1 – Ericsson LM

We support Proposal 1 which encloses Proposal 2, since Rel-15 provides $K = 2, L = 1$

Issue 3-3-10: Detailed PDSCH configuration

- Proposals

- Proposal 1 (Ericsson): Define PDSCH demodulation requirements for UE with the following test setup:

- Recommended WF

- Collect views in 2nd round pending on progress of issues above

Feedback Form 50: Issue 3-3-10: Detailed PDSCH configuration

Issue 3-3-11: Transmission burst model

- Proposals

- Proposal 1 (Huawei): Use transmission burst model defined in LAA as start point to be discussed and set the gap between two transmission bursts at least to 4/8/16 OFDM symbols for 120/480/960 kHz SCS. Further discuss following test setup:

- COT duration
- LBT failure probability
- HARQ feedback
- Start symbol and end symbol within the slot

- Recommended WF

- Collect views in 2nd round

Feedback Form 51: Issue 3-3-11: Transmission burst mode

<p>1 – Apple GmbH</p> <p>Dont consider transmission burst model as we propose not to define requirements with LBT failure.</p>
<p>2 – HiSilicon Technologies Co. Ltd</p> <p>We can compromise to not consider LBT failure</p>
<p>3 – Ericsson LM</p> <p>We do not support LBT for FR2-2, but we are open for discussion.</p>
<p>4 – Qualcomm Technologies Int</p> <p>If we introduce LBT, our view is that we can reuse NR-U transmission model used in Rel.16, with updated configuration parameters and we don't need to introduce a complete new model in NR, also in the interest of time</p>

Issue 3-3-12: Rx processing assumptions

- Proposals

- Proposal 1 (Huawei): Define PDSCH performance requirements by using ICI compensation.

- Recommended WF

- Collect views in 2nd round

Feedback Form 52: Issue 3-3-12: Rx processing assumptions

<p>1 – Intel Corporation (UK) Ltd</p> <p>At least for high MCS values ICI compensation is required. To evaluate phase noise impact we suggest considering two options: 1) Practical CPE compensation only; 2) Practical CPE + ICI compensation</p>

2 – Ericsson LM

We agree that CPE only is not enough for FR2-2, and ICI compensation is needed.

3 – Qualcomm Technologies Int

This assumption should be further discussed

FR2-2 TDD, SCS 120 KHz

Test number	CBW / SCS	MCS and rank	TDD UL/DL pattern	Propagation condition	Antenna configuration	Metric	Reference from TS38.101-4 7.2.2.2.1
1-1 (Note 1)	100MHz / 120kHz	QPSK 0.3 Rank 1	FR2.120-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-1
1-2 (Note 1)	100MHz / 120kHz	16QAM 0.48 Rank 1	FR2.120-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-3
1-3 Note 1)	100MHz / 120kHz	64QAM 0.43 Rank 1	FR2.120-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-6
2-1 (Note 1)	400MHz / 120kHz	QPSK 0.3 Rank 1	FR2.120-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-1
2-2 (Note 1)	400MHz / 120kHz	16QAM 0.48 Rank 1	FR2.120-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-3
2-3 (Note 1)	400MHz / 120kHz	64QAM 0.43 Rank 1	FR2.120-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-6
3-1	TBD / 120kHz	QPSK 0.3 Rank 2	FR2.120-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-1
3-2	TBD / 120kHz	16QAM 0.48 Rank 2	FR2.120-2	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	Test 2-3

Note 1 Tests (1,2)-1, (1,2)-2, and (1,2)-3 will consider Rank 1 instead of Rank 2 as stated in TS 38.101-4 Section 7.2.2.2.1.

FR2-2 TDD, SCS 480 KHz

Test number	CBW / SCS	MCS and rank	TDD UL/DL pattern	Propagation condition	Antenna configuration	Metric	Reference from TS38.101-4
1-1	400MHz / 480kHz	QPSK 0.3 Rank 1	TBD	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	New
1-2	400MHz / 480kHz	16QAM 0.48 Rank 1	TBD	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	New
1-3	400MHz / 480kHz	64QAM 0.43 Rank 1	TBD	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	New
2-1	1600MHz / 480kHz	QPSK 0.3 Rank 1	TBD	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	New
2-2	1600MHz / 480kHz	16QAM 0.48 Rank 1	TBD	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	New
2-3	1600MHz / 480kHz	64QAM 0.43 Rank 1	TBD	TDL-A (5, 10, 30) ns	2x2 ULA Low	70% of peak rate	New

Figure 11: Proposal 1 (Ericsson): detailed scope of PDSCH requirements

Table 2. Requirements for Rank 1 with mapping type A

CBW (MHz)/SCS (kHz)	Modulation and code rate	Propagation conditions	Correlation matrix and antenna configuration	Fraction of maximum throughput
100/120	QPSK, 0.30	TDLA10-650	2x2 ULA Low	70
100/120	16QAM, 0.48	TDLA10-650	2x2 ULA Low	30
100/120	64QAM, 0.46	TDLA10-650	2x2 XPL Medium	70
400/480	QPSK, 0.30	TDLA10-650	2x2 ULA Low	70
400/960	QPSK, 0.30	TDLA10-650	2x2 ULA Low	70

Table 3. Requirements for Rank 2 with mapping type A

CBW (MHz)/SCS (kHz)	Modulation and code rate	Propagation conditions	Correlation matrix and antenna configuration	Fraction of maximum throughput
100/120	QPSK, 0.30	TDLA10-200	2x2 ULA Low	70
100/120	16QAM, 0.48	TDLA10-650	2x2 ULA Low	70

Table 4. Requirements for Rank 2 for enhanced receiver type 1

CBW (MHz)/SCS (kHz)	Modulation and code rate	Propagation conditions	Correlation matrix and antenna configuration	Fraction of maximum throughput
100/120	16QAM, 0.48	TDLA10-200	2x2 ULA Medium	70

Table 5. Requirements for Rank 1 with mapping type B

CBW (MHz)/SCS (kHz)	Modulation and code rate	Propagation conditions	Correlation matrix and antenna configuration	Fraction of maximum throughput
100/120	QPSK, 0.30	TDLA10-200	2x2 ULA Low	70

Table 6. Requirements for 32 DL HARQ processes

CBW (MHz)/SCS (kHz)	Modulation and code rate	Propagation conditions	Correlation matrix and antenna configuration	Fraction of maximum throughput
100/120	QPSK, 0.30	TDLA10-200	2x2 ULA Low	30

PTRS configuration	Frequency density (K_{PTRS})		2
	Time density (L_{PTRS})		1
	Resource Element Offset		2

Figure 13: Proposal 2 (Nokia): PTRS configuration

Assumptions	Value
Carrier Frequency [GHz]	70 GHz
Subcarrier Spacing [KHz]	120 KHz, 480 KHz
Waveform CP Type	CP-OFDM Normal CP
Channel Model	TDL model as defined in of TR38.901 Clause 7.7.2: - TDL-A (5ns, 10ns, 30 ns DS)
Antenna configuration Velocity	For TDL model: 2x2 ULA Low 3 km/h, 30 km/h
PA Model	None
gNB TRP PN Model	TR38.803 example 2 BS PN profile and [3] Set 1
UE PN Model	TR38.803 example 2 UE PN profile and [3] Set 1
Pre-loaded Tx EVM Additive Rx EVM	0% 0%
I-Q Imbalance Frequency Offset	None 0 ppm
Channel Estimation	Realistic channel estimation
Transmission Rank	Rank 1 (Rank 2 is FFS)
DMRS Configuration	2 DMRS symbols at (2,11) symbol index
PTRS Configuration CSI-RS / TRS	For CP-OFDM: ($K = 2, L = 1$) CSI-RS/TRS is assumed to be off (for RS overhead)
MCS/TBS	From MCS Table 1 (TS38.214): - MCS 7 (QPSK), - MCS 16 (16QAM), - [MCS 22] (64QAM). Note: It is assumed that $N_{ch}^{PRB} = 0$ for MCS calculations.

Figure 14: Proposal 1 (Ericsson): detailed PDSCH configuration

3.2.4 Sub-topic 3-4: PDCCH performance requirements

Sub-topic description

Details of PDCCH performance requirements

Open issues and candidate options before e-meeting:

Issue 3-4-1: Performance requirements for multi-slot PDCCH monitoring

- Proposals
 - Proposal 1 (Intel): Define performance requirements for multi-slot PDCCH monitoring for 480 and 960 kHz SCS:
- Recommended WF
 - Collect views in 1st round

Feedback Form 53: Issue 3-4-1: Performance requirements for multi-slot PDCCH monitoring

1 – Apple GmbH Focus on mandatory features first for FR2-2 requirements, given the limited time to define performance requirements in Rel-17.
2 – HiSilicon Technologies Co. Ltd Need more time to check
3 – Ericsson LM Open for discussion

Issue 3-4-2: PDCCH simulation assumptions

- Proposals
 - Proposal 1 (Intel): For FR2-2 120 kHz SCS define the same set of PDCCH performance requirements as in FR2-1 but with the updated channel model.
 - Proposal 2 (Huawei): Use following assumptions for PDCCH performance test.
 - SCS: 480 kHz and 960 kHz
 - Antenna configuration: 1T2R and 1T4R
 - Aggregation level: 2 and 4 for 1T2R; 8 and 16 for 2T2R

- PDCCH transmissions: PDCCH is transmitted in the first slot of every four slots for 480 kHz and in the first slot of every eight slots for 960 kHz
- Proposal 3 (Ericsson): Define PDCCH demodulation requirements for UE in FR2-2 with the following test setup

FR2-2 TDD, SCS 120 KHz								
Test number	CB W (MHz)	CORESET RB	CORESET duration	Aggregation level	Propagation condition	Antenna config	Metric (Pm-dsg)	Reference from TS38.101-4 7.3.2.2
1-1	100	60	1	2	TDL-A (5, 10, 30) ns	1x2 low	1%	1Tx Test 1
1-2	100	60	1	4	TDL-A (5, 10, 30) ns	1x2 low	1%	1Tx Test 2
1-3	100	60	1	8	TDL-A (5, 10, 30) ns	2x2 low	1%	2Tx Test 1
1-4	100	60	2	16	TDL-A (5, 10, 30) ns	2x2 low	1%	2Tx Test 2
2-1	400	TBD	TBD	TBD	TDL-A (5, 10, 30) ns	1x2 low	1%	New
2-2	400	TBD	TBD	TBD	TDL-A (5, 10, 30) ns	2x2 low	1%	New

FR2-2 TDD, SCS 480 KHz								
Test number	CB W (MHz)	CORESET RB	CORESET duration	Aggregation level	Propagation condition	Antenna config	Metric (Pm-dsg)	Reference from TS38.101-4 7.3.2.2
1-1	400	TBD	TBD	TBD	TDL-A (5, 10, 30) ns	1x2 Low	1%	New
1-2	400	TBD	TBD	TBD	TDL-A (5, 10, 30) ns	2x2 Low	1%	New
2-1	1600	TBD	TBD	TBD	TDL-A (5, 10, 30) ns	1x2 Low	1%	New
2-2	1600	TBD	TBD	TBD	TDL-A (5, 10, 30) ns	2x2 Low	1%	New

Figure 15: Proposal 3 (Ericsson): PDCCH simulation assumptions

- Recommended WF

- Collect views in 2nd round

Feedback Form 54: Issue 3-4-2: PDCCH simulation assumptions

1 – Ericsson LM

Ericsson supports Proposal 3. About Proposal 2, Ericsson asks Huawei more details on the needed 1T4R for FR2-2.

3.2.5 Sub-topic 3-5: PBCH performance requirements

Sub-topic description

Details of PBCH performance requirements.

Open issues and candidate options before e-meeting:

Issue 3-5-1: PBCH simulation assumptions (if introduced pending on outcome of issues Issue 1-2-2)

- Proposals

- Proposal 1 (Huawei): Use following assumptions for PBCH performance test:
 - SCS: 480 kHz and 960 kHz
 - Antenna configuration: 1T2R
 - SSB index: Known and set it to index 0
 - Propagation conditions: TDLA30-75
 - TDD:
- Proposal 2 (Ericsson): Define PBCH demodulation requirements with the following test setup

Test number	BW/ SSB SCS	Propagation condition	Antenna configuration	Metric (Pm-bch)	Reference from TS38.101-4 SS/PBCH block index A : not known B : known
1-1	100 MHz / 120 KHz	TDL-A (5, 10, 30) ns	1x2 Low	1%	A
1-2	400 MHz / 120 KHz	TDL-A (5, 10, 30) ns	1x2 Low	1%	B
2-1 (Note 1)	400 MHz / 480 KHz	TDL-A (5, 10, 30) ns	1x2 Low	1%	A
2-2 (Note 1)	1600 MHz / 480 KHz	TDL-A (5, 10, 30) ns	1x2 Low	1%	B

Note 1: SSB SCS 480 KHz is new.

Figure 16: Proposal 2 (Ericsson): PBCH simulation assumptions

- Recommended WF

- Collect views in 2nd round

Feedback Form 55: Issue 3-5-1: PBCH simulation assumptions

1 – Ericsson LM

Ericsson supports Proposal 2 where we consider both known and unknown SSB block index. Furthermore, the channel model should be different of FR2-1

3.2.6 Sub-topic 3-6: SDR performance requirements

Sub-topic description

Details of SDR performance requirements

Open issues and candidate options before e-meeting:

Issue 3-6-1: SDR performance requirements (if introduced pending on outcome of issues Issue 1-2-2)

Introduction of SDR requirements is discussed in Sub-topic 1-2

- Proposals

- Proposal 1 (Intel): Study SNR values applicability in Table 7.5A.1-4: “SNR required to achieve 85% of peak throughput under AWGN conditions” for FR2-2
- Proposal 2(Ericsson): Define SDR test for UE in FR2-2 ;considering 2 Rx UE

MCS indexes for indicated UE capabilities applicable for FR2-2.

Received antenna	Maximum number of PD SCH MIMO layers	Maximum modulation format	Scaling factor	MCS
2Rx UE	1	6	0.75	[22]
	1	6	0.4	14
	1	4	1	16
	1	4	0.8	16
	1	4	0.75	16
	1	4	0.4	10
	1	2	1	9
	1	2	0.8	9
	1	2	0.75	9
	1	2	0.4	4

Figure 17: Proposal 2 (Ericsson): MCS indexes for indicated UE capabilities applicable for FR2-2

- Recommended WF

- Collect views in 1st round

Feedback Form 56: Issue 3-6-1: SDR performance requirements

<p>1 – Intel Corporation (UK) Ltd</p> <p>Table 7.5A.1-4 in TS 38.101-4 specified baseband SNR required to achieve 85% in AWGN conditions. Since phase noise has higher impact in FR2-2, analysis on these SNR values applicability for FR2-2 is needed.</p>
<p>2 – Apple GmbH</p> <p>We need to further study and revise the MCS config For SDR requirements.</p>
<p>3 – HiSilicon Technologies Co. Ltd</p> <p>We support to not define SDR test</p>
<p>4 – Ericsson LM</p> <p>We can agree with Apple, that further studies are needed.</p>

3.2.7 Sub-topic 3-7: CSI reporting requirements

Sub-topic description

Details of CSI reporting requirements

Open issues and candidate options before e-meeting:

Issue 3-7-1: Scope of CSI reporting requirements

- Proposals
 - Proposal 1 (Ericsson): Only CQI, PMI is FFS
 - Proposal 2 (Intel): CQI, PMI and RI
- Recommended WF
 - Collect views in 1st round

Feedback Form 57: Issue 3-7-1: Scope of CSI reporting requirements

<p>1 – Intel Corporation (UK) Ltd</p> <p>We suggest having the same test coverage for FR2-2 as in FR2-1 because there can be a dedicated UEs defined for FR2-2 operation. We understand that RAN4 has limited time to define all requirements, but still the minimum functionality should be verified.</p>

2 – Apple GmbH

We slightly prefer to de-prioritize CSI reporting for FR2-2 given the time. We need to revisit the feedback delay and doppler for FR2-2 to ensure that the parameters give reasonable results. If we must define requirements, only define CQI reporting in AWGN first. Requirements in fading channel need additional work.

3 – HiSilicon Technologies Co. Ltd

We propose to postpone the CSI test in next release considering the workload and timeline

4 – Ericsson LM

Ericsson supports Proposal 1 but can agree with Apple and Huawei to postpone this task.

Issue 3-7-2: CQI reporting requirements under static propagation conditions

- Proposals

- Proposal 1 (Ericsson): Define the CQI reporting definition test for 2Rx UE with CQI table 1 (64QAM) by reusing the existing test setup and metrics
- Proposal 21 (Intel): Study reuse of FR2-1 CQI reporting requirements in Static propagation conditions for FR2-2

- Recommended WF

- Collect views in 1st round

Feedback Form 58: Issue 3-7-2: CQI reporting requirements under static propagation conditions**1 – Intel Corporation (UK) Ltd**

In our understanding current FR2-1 CQI reporting requirements under static propagation conditions can be also applied for FR2-2. We suggest analyzing this for the next meeting.

2 – Apple GmbH

Reusing CQI reporting requirements from FR2 for 120KHz for FR2-2 might work. Suggest that as a starting point.

3 – HiSilicon Technologies Co. Ltd

We propose to postpone it in next release

4 – Ericsson LM

Ericsson supports Proposal 1 (both proposals can converge). However, we are fine to postpone this as suggested by Huawei.

Issue 3-7-3: CQI reporting requirements under fading propagation conditions

- Proposals

- Proposal 1 (Intel): Define FR2-2 CQI reporting requirements in Fading propagation conditions for FR2-2 with the typical channel model for FR2-2
- Proposal 2 (Nokia): RAN4 to discuss how changes to the channel models would impact the CSI reporting requirements
- Proposal 3 (Ericsson): Define the wideband CQI reporting under fading condition for 2Rx UE with CQI table 1 (64QAM) by reusing the existing test setup and metrics

- Recommended WF

- Collect views in 1st round

Feedback Form 59: Issue 3-7-3: CQI reporting requirements under fading propagation conditions

1 – Intel Corporation (UK) Ltd Support proposal 3. Also, channel model should be changed to more typical configuration as mentioned in Proposals 1 and 2.
2 – Apple GmbH Dont define requirements in fading channels.
3 – HiSilicon Technologies Co. Ltd We propose to postponing it in next release
4 – Ericsson LM [Option 1] Ericsson supports Proposal 3 while all proposals can converge. [Option 2] We can postpone this task as suggested by Huawei

Issue 3-7-4: Simulation assumptions for CQI reporting requirements

- Proposals

- Proposal 1 (Ericsson): 2Rx UE with CQI table 1 (64QAM) by reusing the existing test setup and metrics
- Proposal 2 (Intel): Define CQI reporting requirements only for wideband CQI reporting granularity

- Recommended WF

- Collect views in 2nd round

Feedback Form 60: Issue 3-7-4: Simulation assumptions for CQI reporting requirements

1 – Ericsson LM

Ericsson supports Proposal 1.

Issue 3-7-5: Simulation assumptions for PMI reporting requirements

- Proposals
 - Proposal 1 (Intel): Define FR2-2 PMI reporting requirements with type 1 single panel codebook, rank 1, and wideband PMI reporting granularity
- Recommended WF
 - Collect views in 2nd round

Feedback Form 61: Issue 3-7-5: Simulation assumptions for PMI reporting requirements

Issue 3-7-6: Simulation assumptions for RI reporting requirements

- Proposals
 - Proposal 1 (Intel): Define FR2-2 RI reporting requirements with rank 1 and rank 2, and with low and high antenna correlations
- Recommended WF
 - Collect views in 2nd round

Feedback Form 62: Issue 3-7-6: Simulation assumptions for RI reporting requirements

3.3 Summary for 1st round

3.3.1 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.

Table 3: First round summary for Topic #3

	Summary
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<p>Sub-topic 3-1: SCS/CBW combinations</p>	<p><u>Issue 3-1-1: SCS for DL requirements definition</u> All companies support 120 kHz and 480 kHz. More discussion is needed on 960 kHz Tentative agreement: Consider the following SCS for DL requirements definition:</p> <ul style="list-style-type: none"> - 120, 480 kHz - FFS 960 kHz <p>Candidate options: NA Recommendations for 2nd round: Continue discussion on necessity of requirements with 960 kHz SCS.</p>
	<p><u>Issue 3-1-2: CBW for DL requirements definition</u> Diverse views on the required CBW. For 120 kHz SCS four companies support 100 MHz and 3 companies 400 MHz also. For 480 kHz four companies support 400 MHz and 2 companies 1600 MHz also. For 960 kHz SCS four companies support 400 MHz and 2 companies 2000 MHz also. Further discussion is needed. Tentative agreement:</p> <ul style="list-style-type: none"> - 120 kHz: <ul style="list-style-type: none"> o 100, 400 MHz - 480 MHz: <ul style="list-style-type: none"> o 400 MHz o FFS on 1600 MHz - 960 kHz: <ul style="list-style-type: none"> o 400 MHz o FFS on 2000 MHz <p>Candidate options: NA Recommendations for 2nd round: Discuss FFS options.</p>

<p>Sub-topic 3-2: General issues</p>	<p><u>Issue 3-2-1: FR2-1 requirements reuse for 120 kHz SCS</u> Five companies support proposal 1. Tentative agreement: Do not apply FR2-1 performance requirements for FR2-2. Candidate options: NA Recommendations for 2nd round: NA</p>
	<p><u>Issue 3-2-2: General simulation assumptions</u> All companies agreed with proposed options and with suggestion on the temporary PRB number for each CBW. PRB number will be updated once RF room reaches corresponding agreement. Tentative agreement: Consider the following simulation assumptions at starting point for PDSCH performance requirements:</p> <ul style="list-style-type: none"> - Normal CP - 1 and 2 Tx antennas and 2 Rx antennas - Up to 64QAM modulation order - Temporary PRB number: <ul style="list-style-type: none"> o (66)(264)(66)(132)(264)(32)(66)(132)(156) for SCS (kHz CWB (MHz)) = (120 100)(120 400)(480 400) (480 800)(480 1600)(960 400)(960 800)(960 1600)(960 2000) <p>Candidate options: NA Recommendations for 2nd round: NA</p>
	<p><u>Issue 3-2-3: Other</u> Three companies support proposal 1. One company prefer more time to check. Tentative agreement: Increase the FLD_high max frequency to cover FR2-2 frequency bands, i.e. “FDL_high may not exceed 71000 MHz” and reconsider existing. Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement.</p>

<p>Sub-topic 3-3: PDSCH performance requirements</p>	<p><u>Issue 3-3-1: Detailed scope of PDSCH requirements</u> No need to reach agreement on this issue. Tentative agreement: NA Candidate options: NA Recommendations for 2nd round: NA</p>
	<p><u>Issue 3-3-2: PDSCH performance requirements for multi-PDSCH scheduling</u> Different views were received on this issue. More discussion is needed. Tentative agreement: NA Candidate options:</p> <ul style="list-style-type: none"> - Option 1: Define PDSCH performance requirements with the following assumptions: <ul style="list-style-type: none"> o 120 kHz SCS: Single TB scheduling o 480 kHz SCS: 4-TB scheduling o 960 kHz SCS: 8-TB scheduling - Option 2: Do not define PDSCH performance requirements with multi-TB scheduling <p>Recommendations for 2nd round: Continue discussion based on the candidate options</p>
	<p><u>Issue 3-3-3: PDSCH performance requirements with 32 DL HARQ processes</u> Different views were received on this issue. More discussion is needed. Tentative agreement: NA Candidate options:</p> <ul style="list-style-type: none"> - Option 1: Define one test case to verify PDSCH performance with 32 DL HARQ processes with the test metric 30% of maximum throughput. - Option 2: Do not define requirements for PDSCH with 32 DL HARQ processes. <p>Recommendations for 2nd round: Continue discussion based on the candidate options</p>

	<p><u>Issue 3-3-4: Mapping type</u> All companies agreed to consider at least mapping type A. More discussion is needed on mapping type B.</p> <p>Tentative agreement:</p> <ul style="list-style-type: none"> - Define PDSCH requirements with mapping type A - FFS define PDSCH test case to verify mapping type B processing. <p>Candidate options: NA Recommendations for 2nd round: Discuss necessity of requirement for mapping type B.</p>
	<p><u>Issue 3-3-5: Requirements with 30% throughput</u> Different views were received on this issue. More discussion is needed.</p> <p>Tentative agreement: NA Candidate options:</p> <ul style="list-style-type: none"> - Option 1: Define PDSCH requirement with 30% throughput. - Option 2: Do not define PDSCH requirement with 30% throughput. <p>Recommendations for 2nd round: Continue discussion considering above options.</p>
	<p><u>Issue 3-3-6: Requirements for enhanced receiver type 1</u> Companies are converged to not defined requirements for enhanced receiver type 1.</p> <p>Tentative agreement: Do not define PDSCH requirements with enhanced receiver type 1.</p> <p>Candidate options: NA Recommendations for 2nd round: NA</p>

	<p><u>Issue 3-3-7: MCS, modulation order for PDSCH requirements</u> MCS 4 and 13 can be agreed. More discussion is needed on MCS with 64QAM Tentative agreement: Define PDSCH requirements with MCS 4, MCS 13, and MCS [22] Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement and discuss MCS value to cover 64QAM</p>
	<p><u>Issue 3-3-8: Rank</u> More discussion is needed on Rank 2 and FD-OCC dispreading Tentative agreement: Define PDSCH requirements with:</p> <ul style="list-style-type: none"> - Rank 1 <ul style="list-style-type: none"> o FFS FD-OCC is not applied to all the antenna ports for DMRS - FFS Rank 2 <p>Candidate options: NA Recommendations for 2nd round: Discussed FFS aspects. More details on FD-OCC issue is encouraged to be provided.</p>
	<p><u>Issue 3-3-9: PTRS configuration</u> More discussion is needed. Same time proposal 1 and 2 are same and can be collapse to one option. Tentative agreement: Consider PTRS configuration as K=2, L=1 Candidate options: NA Recommendations for 2nd round: Confirm tentative agreement.</p>
	<p><u>Issue 3-3-10: Detailed PDSCH configuration</u> Proposal 1 should be rederived considering progress of other issues Tentative agreement: NA Candidate options: NA Recommendations for 2nd round: Continue discussion in 2nd round considering progress of other issues.</p>

	<p><u>Issue 3-3-11: Transmission burst model</u> Two options are on table after first round discussion. Tentative agreement: NA Candidate options:</p> <ul style="list-style-type: none"> - Option 1: Use transmission burst model defined in LAA as start point to be discussed and set the gap between two transmission bursts at least to 4/8/16 OFDM symbols for 120/480/960 kHz SCS. - Option 2: Use Rel-16 NR-U Transmission burst model <p>Recommendations for 2nd round Continue discussion in 2nd round considering progress of issue 1-2-4.</p>
	<p><u>Issue 3-3-12: Rx processing assumptions</u> Limited number of comments. Tentative agreement: NA Candidate options: NA Recommendations for 2nd round Continue discussion</p>
<p>Sub-topic 3-4: PDCCH performance requirements</p>	<p><u>Issue 3-4-1: Performance requirements for multi-slot PDCCH monitoring</u> More discussion is needed. Tentative agreement: NA Candidate options:</p> <ul style="list-style-type: none"> - Option 1: Define performance requirements for multi-slot PDCCH monitoring for 480 and 960 kHz SCS - Option 2: Do not define performance requirements for multi-slot PDCCH monitoring for 480 and 960 kHz SCS <p>Recommendations for 2nd round Continue discussion based on the candidate options</p>
	<p><u>Issue 3-4-2: PDCCH simulation assumptions</u> Limited number of comments. One question was raised regarding the purpose of introduction requirements with 4Rx. Tentative agreement: NA Candidate options: NA Recommendations for 2nd round Continue discussion. Provide feedback on the raised question.</p>

<p>Sub-topic 3-5: PBCH performance requirements</p>	<p><u>PBCH simulation assumptions (if introduced pending on outcome of issues Issue 1-2-2)</u> Limited number of comments. Tentative agreement: NA Candidate options: NA Recommendations for 2nd round Continue discussion considering proposal in issue 1-2-2 to define PBCH requirements only with unknown index.</p>
<p>Sub-topic 3-6: SDR performance requirements</p>	<p><u>Issue 3-6-1: SDR performance requirements (if introduced pending on outcome of issues Issue 1-2-2)</u> Companies suggest to have more study if requirements will be introduced. Tentative agreement: If requirements will be introduced, study MCS configuration applicability for FR2-2 from FR2-1 and SNR values to achieve 85% throughput. Candidate options: NA Recommendations for 2nd round: NA</p>
<p>Sub-topic 3-7: CSI reporting requirements</p>	<p><u>Issue 3-7-1: Scope of CSI reporting requirements</u> Three companies prefer to deprioritize CQI reporting requirements at least with fading conditions, PMI and RI reporting requirements introduction. Tentative agreement:</p> <ul style="list-style-type: none"> - Define CQI reporting requirements under static propagation conditions. <ul style="list-style-type: none"> o FFS CQI reporting requirement under multi-path fading conditions - FFS PMI reporting requirements introduction - FFS RI reporting requirements introduction <p>Candidate options: NA Recommendations for 2nd round: Discuss FFS aspects</p>

	<p><u>Issue 3-7-2: CQI reporting requirements under static propagation conditions</u> All companies agreed on proposal 1 and 2 as baseline assumption if such requirement will be introduced Tentative agreement: Define the CQI reporting definition test for 2Rx UE with CQI table 1 (64QAM) by reusing the existing test setup and metrics Candidate options: NA Recommendations for 2nd round: NA</p>
	<p><u>Issue 3-7-3: CQI reporting requirements under fading propagation conditions</u> All companies agreed on proposal 1, 2, and 3 if such requirement will be introduced Tentative agreement: Define the wideband CQI reporting under fading condition for 2Rx UE with CQI table 1 (64QAM) by reusing the existing test setup and metrics Candidate options: NA Recommendations for 2nd round: Confirm or remove tentative agreement considering progress of issue 3-7-1.</p>
	<p><u>Issue 3-7-4: Simulation assumptions for CQI reporting requirements</u> Limited number of comments. Tentative agreement: NA Candidate options: NA Recommendations for 2nd round Continue discussion considering progress of other issues</p>
	<p><u>Issue 3-7-5: Simulation assumptions for PMI reporting requirements</u> No comments Tentative agreement: NA Candidate options: NA Recommendations for 2nd round Continue discussion considering progress of issue 3-7-1</p>
	<p><u>Issue 3-7-6: Simulation assumptions for RI reporting requirement</u> No comments Tentative agreement: NA Candidate options: NA Recommendations for 2nd round Continue discussion considering progress of issue 3-7-1</p>

3.4 Discussion on 2nd round (if applicable)

TBA

4 Recommendations for Tdocs

4.1 1st round

Table 4:

Title	Source	Comment
WF on demodulation performance requirements definition for 52.6 - 71 GHz.	Intel Corporation	WF to cover general aspects, scope of performance requirements and initial simulation assumptions