[100-e][329] NR_perf_enh2_Demod_Part3_NWM - Version 0.0.8
RAN4

3GPP TSG-RAN WG4 Meeting #100-e R4-2115801

Electronic Meeting, August. 16th – 27th, 2021

Agenda item: 9.12.3

Source: Moderator (Huawei, HiSilicon)

Title: Email discussion summary for [100-e][329] NR_perf_enh2_Demod_Part3_NWM

Document for: Information

1 Introduction

As per the discussion on BS PUSCH demodulation requirements for FR1 256QAM in last RAN4#99-e, still several open issues are left for further discussion as per the approved WF R4-2108667:

- *MCS*
  - *Option 1: MCS 22*
  - *Option 2: MCS 24*
  - *Option 3: MCS 20 or MCS 21 if there is testability issue for OTA test*
- *Tx EVM:*
  - *Option 1: Consider 3.5% Tx EVM modelling for alignment results*
  - *Option 2: Consider 3.5% Tx EVM impact in the impairment results*
    - *Option 2a: add a certain margin on top of the averaged impairment results*
    - *Option 2b: consider it in the impaired results submitted by companies*
  - *Option 3: Not consider 3.5% Tx EVM impact if the target SNR is 20dB or less*
- *SCS and bandwidth*
  - *15kHz SCS:*
    - *Option 1:5MHz and 10MHz*
    - *Option 2:5MHz, 10MHz and 20MHz.*
  - *30kHz SCS*
    - *Option 1:10MHz and 40MHz*
    - *Option 2: 10MHz, 20MHz, 40MHz and 100MHz.*

1st round discussion:

Collect companies' view on those left open issues and some new issues raised in this meeting, and try to reach consensus.

2nd round discussion:

Try to finalize all open issues so that companies can align the simulation results for next meeting.

2 Test parameters

2.1 Companies' contributions summary

Table 1: Companies' contributions summary

T-doc number	Company	Title	Proposals / Observations
R4-2111974	CATT	Discussion on PUSCH demodulation requirements for FR1 256QAM	Proposal 1: To adopt MCS 22 for 256QAM demodulation. Proposal 2: To adopt 15 kHz SCS: Option 2: 5MHz, 10MHz, 20MHz and 30 kHz SCS: Option 2:10MHz, 20MHz, 40MHz, 100MHz for 256QAM demodulation. Proposal 3: Adopt Option 2b: consider it in the impaired results submitted by companies.
R4-2111975	CATT	Simulation results for PUSCH 256QAM performance requirement	Simulation results

R4-2112035	Samsung	View on PUSCH demodulation requirement with FR1 256QAM	Proposal 1: Only define FR1 PUSCH 256QAM requirement with 5MHz and 10MHz for 15 KHz SCS, and 10MHz and 40MHz for 30 KHz SCS. Observation 1: large performance degradation can be observed with considering Tx EVM as 3.5% for MCS 24. Observation 2: Without considering Tx EVM impact, the targeting SNR with 70% TP for MCS 24 is larger than 20dB Observation 3: Even with considering Tx EVM impact, the targeting SNR with 70% TP for MCS 21 or MCS 20 is smaller than 20dB Proposal 2: Considering 3.5 Tx EVM impact on the impairment result, a certain margin on top of the averaged impairment results can be added. Proposal 3: MCS 21 or MCS 20 can be considered for PUSCH requirement with 256 QAM
R4-2112147	China Telecom	Initial simulation results and discussion on PUSCH FR1 256QAM demodulation requirements	Proposal 1: We are fine with MCS22 or MCS21 for PUSCH 256QAM requirement definition. Proposal 2: Not to consider 3.5% Tx EVM impact, or only consider the Tx EVM impact in the impairment results submitted by companies. Proposal 3: Reuse the same CBW configurations for Rel-15 PUSCH demodulation tests, i.e., option 2 for both 15kHz SCS and 30kHz SCS.

R4-2112212	CMCC	Discussion on BS demodulation requirements for FR1 256QAM	Proposal 1: Use MCS 24 for 256QAM FR1 conducted test cases. Proposal 2: Use MCS 21 for 256QAM conducted test cases. Proposal 3: For 15kHz SCS, define 5MHz, 10MHz and 20MHz bandwidth configuration test cases. Proposal 4: For 30kHz SCS, define 10MHz, 20MHz, 40MHz and 100MHz bandwidth configuration test cases.
R4-2112213	CMCC	Simulation results for PUSCH 256QAM performance	Simulation results Observation 1: The simulation results of MCS 24 is lower than 21dB. Observation 2: For 30kHz MCS 24, the SNR gap between 10MHz and 100MHz is about 1.5dB.
R4-2112326	ZTE Wistron Telecom AB	Link simulation results for PUSCH 256QAM demodulation requirements	Simulation results

R4-2112408	Ericsson	Discussion on NR FR1 PUSCH 256QAM demodulation	Proposal 1: A small set of bandwidths for each SCS, i.e. 5/10MHz for 15kHz SCS and 10/40MHz for 30kHz SCS, can be defined for the PUSCH demodulation performance requirements for 256QAM. Observation 1: If Tx EVM is considered, it should be considered on transmitter side and would increase the complexity of specification and testing. Observation 2: No Tx EVM impact is considered in previous LTE and NR PUSCH performance requirements. Proposal 2: For Tx EVM, Opt.3, i.e. not consider 3.5% Tx EVM impact if the target SNR is 20dB or less, is recommended. Proposal 3: For 256QAM, the PUSCH demodulation performance requirements is defined based on MCS#20.
R4-2112409	Ericsson	Simulation results for NR FR1 PUSCH 256QAM demodulation	Simulation results

R4-2112763	NTT DOCOMO, INC.	Views on the combination of SCS and CBW for FR1 PUSCH 256QAM	Observation 1: 15 kHz SCS for 20 MHz CBW and 30 kHz SCS for 100 MHz CBW are also typical cases. Observation 2: The difference of required SNR values among each CBWs is more remarkable in case 100 MHz and 40 MHz CBW for 30 kHz SCS and this is not negligible. Proposal 1: For FR1 PUSCH 256QAM performance tests, RAN4 should consider the following combinations of SCS and CBW (Option 2 for both 15 kHz SCS and 30 kHz SCS): • 15 kHz SCS: 5MHz, 10MHz, 20MHz CBW • 30 kHz SCS: 10MHz, 20MHz, 40MHz and 100MHz CBW

R4-2113122	Intel Corporation	Discussion on PUSCH requirements for FR1 256QAM	Proposal 1: Use MCS20 for FR1 PUSCH 256QAM requirements definition. Proposal 2: Further discuss whether to change channel model assumptions from TDL-A to TDL-D to resolve any potential OTA testability issues. Proposal 3: Consider 3.5% Tx EVM modelling for FR1 PUSCH 256QAM alignment simulation results (Option 1) or consider 3.5% Tx EVM impact in the impairment results submitted by companies (Option 2b). Proposal 4: Define FR1 PUSCH requirements with 256QAM modulation for CBWs 5MHz and 10MHz for 15 kHz SCS and for CBWs 10MHz and 40MHz for 30 kHz SCS.

R4-2113630	Nokia, Nokia Shanghai Bell	On PUSCH demodulation requirements for FR1 256QAM	Concerning MCS Using MCS24 the SNR requirements are >20dB, even for the rank1 only cases. RAN4 to use MCS22 in order to keep SNR requirements within reasonable levels. Concerning TxEVM A 3.5% EVM limits the max achievable SNR to approx. 29.1dB but has little performance impact below this threshold. Using UE TxEVM does not highlight performance differences between different implementation of BS receivers. RAN4 to not consider 3.5% Tx EVM impact.
R4-2113631	Nokia, Nokia Shanghai Bell	Simulation results for PUSCH demodulation requirements for FR1 256QAM	Simulation results

R4-2113784	Huawei, HiSilicon	Discussion on PUSCH demodulation requirements for FR1 256QAM	Proposal 1: Choose MCS 20 for 1T2R, MCS 22 for 1T4R and 1T8R for FR1 PUSCH 256QAM performance requirements definition. Proposal 2: Consider 3.5% Tx EVM impact in the impairment results, if Option 2a is selected, 1dB margin can be added on top of the averaged impairment results. Proposal 3: Define performance requirements for PUSCH 256QAM for bandwidth and SCS: - For 15kHz SCS: 5MHz and 10MHz - For 30kHz SCS: 10MHz and 40Mhz
R4-2113785	Huawei, HiSilicon	Simulation results for PUSCH demodulation requirements for FR1 256QAM	Simulation results
R4-2113786	Huawei, HiSilicon	Summary of simulation results for PUSCH requirements for FR1 256QAM	Summary of simulation results submitted by all interesting companies.

2.2 Open issues summary

In this section, left open test parameters for PUSCH 256QAM demodulation performance requirements will be discussed.

2.2.1 MCS

The agreement in last RAN4#99-e as captured in the approved WF R4-2108667:

- *MCS*
  - *Option 1: MCS 22*
  - *Option 2: MCS 24*
  - *Option 3: MCS 20 or MCS 21 if there is testability issue for OTA test*

Issue 1: MCS

- Proposals
  - Option 1 MCS 20 (Samsung, Ericsson, Intel, Nokia, Huawei)
  - Option 2: MCS 21 (Samsung, CTC, CMCC for radiated test)
  - Option 3: MCS 22 (CATT, CTC, Nokia, Huawei for 1T4R)
  - Option 4: MCS 24 (CMCC for conducted test)
- Recommended WF: MCS 20 considering the OTA testability of 20dB and the issue of 3.5% Tx EVM

Feedback Form 1: Issue 1: MCS

1 – Samsung Electronics Benelux BV

Samsung:

Either option 1 or option 2 are fine for us. We are also fine with the recommended WF. Based on simulation results, even with considering Tx EVM impact, the target SNR with 70% TP for MCS 20 and MCS 21 is smaller than 20dB. Considering the OTA testability, we prefer to define MCS 20 or MCS 21 for 256QAM requirement.

Regarding to test different MCS for different antenna configuration, we are open to further discuss, considering large MCS can be available for large number antenna configuration due to antenna gain.

2 – Ericsson Inc.

Ericsson:

We are fine with option 1 or 2 since the SNR is much lower than 20dB, then 3.5% TxEVM would have neglectable impact on 70% NThp performance. We are also open for defining higher MCS for 4Rx and 8Rx considering much lower SNR.

3 – Intel Corporation SAS

Intel:

Support Option 1 as the lowest possible value.

We need to double check the results from all companies to make the conclusion on final SNR point. Potentially the SNR point, which will be captured in the conformance specification, will be slightly higher than 20 dB.

4 – CATT

Currently support option 3 for conducted test with TDL-A.

For OTA test, a general applicability rule for SNR limit is specified in TS 38.141-2 as “The tests requiring more than [20] dB SNR level are set to N/A in the test requirements”.

From the simulation result summary, only impairment SNR of MCS 20 can meet 20dB limit with TDL-A for 1T2R OTA test. However, the code rate of MCS 20 is lowest among 256QAM. Probably we can further discuss SNR together with channel model, e.g. SNR of MCS 22 in TDL-D.

5 – Nokia France Nokia, Nokia Shanghai Bell: We are fine with option 1, 2, or 3 in order to keep SNR requirements within reasonable levels. For these options 3.5% TxEVM would have neglectable impact on 70% Thp performance.
6 – Huawei Tech.(UK) Co.. Ltd To unify the test and consider the OTA testability limitation, we are also fine with MCS 20 for all antenna configurations.
7 – China Telecommunications Option 2 or option 3 is fine for us. We are also support the proposal from CMCC to set MCS 24 for conducted tests and MCS 21 for radiated test considering the testability issue.
8 – China Mobile Com. Corporation For 2Rx configuration, we are fine to compromise to Option 2. For 4Rx and 8Rx configuration, we prefer considering larger MCS configurations such as MCS24. We are open to have further discuss.
9 – Qualcomm CDMA Technologies We support option 1.
10 – ZTE Wistron Telecom AB Option 1 preferred, and also fine with Option 2 if justifying that there is no testability issue. As other companies' views, we are also open to discuss higher MCS values for 4R and 8R under the same consideration.

2.2.2 Channel model

Background: This is proposed by company for the first meeting, company can share view as per the submitted results and OTA testability.

Issue 2: Channel model

- Proposals
  - Option 1: Keep the previous TDL-A
  - Option 2: Change to TDL-D
- Recommended WF: TBD

Feedback Form 2: Issue 2: Channel model

1 – Samsung Electronics Benelux BV

Samsung:

This is the first meeting to discuss the channel model.

TDLA30-10, which is reused the assumption from DL 256QAM requirement. While for TDL_D channel, which was introduced for DL 256QAM targeting FR2, which has less number of path compared with FR1.

Since the UL 256 QAM requirement is defined for FR1, we prefer to keep previous agreement as TDLA30-10 channel.

2 – Ericsson Inc.

Ericsson:

We support option 1 and share the same view as Samsung. We don't see TDLA30-10 have much problems.

3 – Intel Corporation SAS

Intel:

We are fine to keep TDL-A channel model in case it is fine for everyone to have requirements with SNR point slightly higher than 20 dB.

TDL-D is LOS channel model which is also feasible for FR1 operation. For FR2 DL 256QAM, TDL-D was selected to reduce SNR operating point and avoid any issue with OTA testing.

4 – Nokia France

Nokia, Nokia Shanghai Bell:

We support option 1 and we prefer to keep previous agreement of using TDLA30-10 channel model in the simulation.

5 – CATT

We are open to discuss potential channel model aiming at SNR reduction. More study for TDL-D is needed.

6 – Huawei Tech.(UK) Co.. Ltd

Considering TDL-A channel model is used for FR1 DL 256QAM, TDL-D is LOS channel and is more feasible for FR2, we prefer to keep the previous agreement to use TDLA30-10 channel model.

7 – China Telecommunications

We prefer to keep option 1. NLOS channel condition is the most popular condition should be considered for demod tests.

8 – China Mobile Com. Corporation

Share similar view with Samsung and Ericsson, TDL-A model is preferred.

9 – Qualcomm CDMA Technologies

We see no need to change the TDLA30-10 channel mode, so option 1 is ok with us

10 – ZTE Wistron Telecom AB

Option 1 as similar to FR1 DL 256QAM. We don't understand why we need to change to TDL-D.

11 – NTT DOCOMO INC.

We prefer to keep Option 1.

2.2.3 Tx EVM

The agreement in last RAN4#99-e as captured in the approved WF R4-2108667:

- *Tx EVM:*
  - *Option 1: Consider 3.5%Tx EVM modelling for alignment results*
  - *Option 2: Consider 3.5% Tx EVM impact in the impairment results*
    - *Option 2a: add a certain margin on top of the averaged impairment results*
    - *Option 2b: consider it in the impaired results submitted by companies*
  - *Option 3: Not consider 3.5% Tx EVM impact if the target SNR is 20dB or less*

Issue 3: Tx EVM

- Proposals
  - Option 1: Consider 3.5% Tx EVM modelling for alignment results (Intel)
  - Option 2: Consider 3.5% Tx EVM impact in the impairment results ()
    - Option 2a: add a certain margin on top of the averaged impairment results (Samsung, Huawei)
    - Option 2b: consider it in the impaired results submitted by companies (CATT, CTC, Intel, Huawei)
    - Option 3: Not consider 3.5% Tx EVM impact if the target SNR is 20dB or less (CTC?, Ericsson, Nokia)
- Recommended WF: TBD

Feedback Form 3: Issue 3: Tx EVM

1 – Samsung Electronics Benelux BV

Samsung:

Option 2 is preferred for us. In Rel-15 BS demodulation discussion, there is no Tx EVM considered in the alignment results. Considering the large performance degradation due to Tx EVM, especially for MCS 24, we think additional margin should be considered for 256 QAM performance derived.

Compared with phase noise modeling, the EVM model can be aligned well, a common margin can be considered on top of the averaged companies' impairment results. Based on our results, at least 1.5dB margin for MCS24 is needed. For MCS lower than 24, we are fine with 1dB additional margin. we are also ok with option 2b.

2 – Ericsson Inc.

Ericsson:

We think Option 3 is practical. If we consider Tx EVM into the requirement, it is straight forward to define an Tx EVM model in the conformance test, otherwise considering Tx EVM will only relax the requirement. But it is hard for TE vendors to adding such kind of EVM model. To avoid the complexity, we can consider lower MCS (i.e. 20 or 21) which would not be impacted by 3.5% Tx EVM. For 4Rx and 8Rx, the SNR would be lower than 20dB even for MCS24. In that case, it is no necessary to consider Tx EVM impact.

3 – Intel Corporation SAS

Intel:

TX EVM is always considered for DL requirements to take into account the potential TX generation imperfections at the test equipment side. Based on the past discussion with TE vendors, it is also rather to guaranty perfect signal generation during the testing.

Taking into account that high order modulation is rather sensitive to any imperfection, we suggest to take Tx EVM into account.

We support option 1 or 2b. We think that option 2b can be considered as compromised solution, because each company can decide the which impact from Tx EVM way want to include in the impairment results.

4 – Nokia France

Nokia, Nokia Shanghai Bell:

Using UE TxEVM does not highlight performance differences between different implementation of BS receivers and the discussed MCS levels (20/21) do not show evident degradation due to TxEVM consideration. Thus, we propose not to consider 3.5% Tx EVM impact (option 3) or, at least, this TE RF impairment should be included in the impaired results.

5 – CATT

Support option 2b.

6 – China Telecommunications

Tx EVM should not have such big performance impact since we are defining SNR requirements lower than 20 dB.

Therefore, we prefer to use option 3 or option 2b which is aligned with the PUSCH for other modulation orders with similar SNR requirements.

7 – Huawei Tech.(UK) Co.. Ltd

As Intel said, the Tx EVM is always considered for the DL performance requirements, also as per our simulation results with and without Tx EVM, certain impact can be observed for different MCS, we generally agree with Option 2a, Option 2b is compromise way and leave up to company to decide the specific margin to add.

8 – ZTE Wistron Telecom AB

If the performance difference between the cases with or without Tx EVM is confirmed for PUSCH 256QAM, then Tx EVM should be accounted in some way. Either Option 2b with an aligned additional margin for this under a perfect signal generation, or companies submit simulation results under an imperfect signal generation with 3.5% Tx EVM.

2.2.4 SCS and bandwidth

The agreement in last RAN4#99-e as captured in the approved WF R4-2108667:

- *SCS and bandwidth*
  - *15kHz SCS:*
    - *Option 1:5MHz and 10MHz*
    - *Option 2: 5MHz, 10MHz and 20MHz.*
  - *30kHz SCS*
    - *Option 1:10MHz and 40MHz*
    - *Option 2:10MHz, 20MHz, 40MHz and 100MHz.*
- *Applicability rules for different SCS and CBW*

Reuse the existing applicability rules defined in sections 8.1.2.1.1 and 8.1.2.1.2 of TS 38.141-1

Issue 4: SCS and bandwidth

- Proposals
  - 15kHz SCS:
- Option 1: 5MHz and 10MHz (Samsung, Ericsson, Intel, Huawei)
- Option 2: 5MHz, 10MHz and 20MHz (CATT, CTC, CMCC, DCM)
    - 30kHz SCS:
- Option 1: 10MHz and 40MHz (Samsung, Ericsson, Intel, Huawei)
- Option 2: 10MHz, 20MHz, 40MHz and 100MHz (CATT, CTC, CMCC, DCM)
  - Recommended WF: TBD

Feedback Form 4: Issue 4: SCS and bandwidth

1 – Samsung Electronics Benelux BV

Samsung:

We still prefer option 1 for each MCS

From baseband processing perspective and simulation results provided by companies, the difference is very minor. Therefore, it is not necessary to duplicate the test cases defined in Rel-15. Based on the applicable

rule defined in Rel-15, we think only defining the minimum CBW requirement can fulfill the test purpose for 256QAM requirement verification. For test coverage purpose, the typical CBW configuration can be considered as 10MHz for 15 KHz SCS, and 40MHz for 30 KHz SCS.

Meanwhile, based on the agreement in the last meeting, the requirements with 2/4/8Rx need to be specified. If agreed with option 2 for each SCS, the total number of test case is about 42, which will result in much effort to align between companies.

To reduce the simulation and test effort, we prefer to only define FR1 PUSCH 256QAM requirement with 5MHz and 10MHz for 15 KHz SCS, and 10MHz and 40MHz for 30 KHz SCS

2 – Ericsson Inc.

Ericsson:

We also think Option 1 is feasible since there is applicability rule to cover all possible bandwidth. The simulation results from companies show no much difference between bandwidth for each SCS. It is no need to define requirements for all bandwidths.

3 – Intel Corporation SAS

Intel:

Support Option 1. Same comment as Samsung and Ericsson.

4 – CATT

Prefer Option 2 because it can maintain the same test bandwidth with other modulation. We are not against option 1. From the perspective of test and simulation burden, option 1 is also OK for us.

5 – China Telecommunications

First, there is no difference between 256QAM and other modulation orders whose test requirements have also covered 5MHz, 10MHz and 20MHz for 15k SCS and 10MHz, 20MHz, 40MHz and 100MHz for 30kHz SCS.

Second, it is observed from some companies' simulation results that around 1dB performance difference is shown between 40MHz and 100MHz.

Since we are not increasing the test case number with the agreed test applicability, we prefer to use option 2 for both 15kHz SCS and 30kHz SCS.

6 – Huawei Tech.(UK) Co.. Ltd

Support Option 1. considering minor performance difference among different channel bandwidth, it is not necessary to define test cases for so many different test cases, like UE demodulation requirements, only requirements for typical bandwidths are defined, also with the test applicability for different channel bandwidth and the minimum channel bandwidth, the test for different BS supporting different channel bandwidths can be covered. also the simulation workload should be considered.

7 – China Mobile Com. Corporation

We support Option 2 which is aligned with 64QAM. No extra test burden will be introduced. Only simulation effort should be considered, while we think it is not a big issue for companies since we had already do the similar simulation in R15.

8 – Qualcomm CDMA Technologies Support option 1.
9 – ZTE Wistron Telecom AB Option 1, similar view as Samsung and Ericsson and Huawei if considering the minor performance difference due to different channel bandwdith.
10 – NTT DOCOMO INC. We prefer Option 2 for both SCS. Regarding some companies' simulation results, the difference of performance is observed around 1-2 dB between 40MHz and 100MHz for 30kHz SCS. The applicable test case should be aligned among each modulation.

2.3 Summary for 1st round

2.3.1 Open issues

Table 2: Summary for 1st round

Sub-topic#	**Status summary**
MCS	Tentative agreements: MCS 20 Candidate options Option 1 MCS 20 (Samsung, Ericsson, Intel, Nokia, Huawei, Qualcomm, ZTE) Option 2: MCS 21 (Samsung, Ericsson, Nokia, CTC, CMCC for 2Rx) Option 3: MCS 22 (CATT for conducted test, Nokia, CTC) Option 4: MCS 24 () Recommendations for 2nd round: As per the submitted results, ideal SNR value is already higher than 20dB for MCS 24, few companies support it, moderator suggests to preclude MCS 24 As per the majority view and the 3.5% Tx EVM impact, to speed up the work, moderator suggests to select MCS 20?
Channel Mode	Tentative agreements: Keep to use the previous agreed TDLA30-10 Candidate options Option 1: Keep the previous TDLA30-10 (Samsung, Ericsson, Intel, Nokia, Huawei, CTC, CMCC, Qualcomm, ZTE, NTT DOCOMO) Option 2: Change to TDL-D Option 3: More study on TDLD (CATT) Recommendations for 2nd round: No need 2nd round discussion.

Tx EVM	Tentative agreements: Consider 3.5% Tx EVM impact in the impaired results submitted by companies. Candidate options Option 1: Consider 3.5%Tx EVM modelling for alignment results (Intel, ZTE?) Option 2: Consider 3.5% Tx EVM impact in the impairment results (Samsung) Option 2a: add a certain margin on top of the averaged impairment results (Samsung, Huawei, ZTE?) Option 2b: consider it in the impaired results submitted by companies (Samsung, Intel, Nokia, CATT, CTC, Huawei) Option 3: Not consider 3.5% Tx EVM impact if the target SNR is 20dB or less (Ericsson, Nokia, CTC) Recommendations for 2nd round: As per majority view, and it leaves freedom to company to decide whether to consider Tx EVM impact or how much impact should be considered, moderator suggest to go Option 2b.
CBW/SCS	Tentative agreements: Option 1 Candidate options 15kHz SCS: Option 1: 5MHz and 10MHz (Samsung, Ericsson, Intel, Huawei, CATT□Qualcomm, ZTE) Option 2: 5MHz, 10MHz and 20MHz (CATT, CTC, CMCC, DCM) 30kHz SCS: Option 1: 10MHz and 40MHz (Samsung, Ericsson, Intel, Huawei, CATT, Qualcomm, ZTE) Option 2: 10MHz, 20MHz, 40MHz and 100MHz (CATT, CTC, CMCC, DCM) Recommendations for 2nd round: As per the discussion in the 1st round, supporting of different options is: 7:4 for the Option 1 v.s. Option 2. Considering the simulation efforts and alignment among companies, is it possible that we go Option 1?

2.4 Discussion on 2nd round

Focus on discussion on the way forward and confirm the following tentative agreements made after the 1st round discussion if company still has strong concerns.

2.4.1 MCS

MCS: MCS 20

Feedback Form 5: MCS

1 – Ericsson Inc. Ericsson: We are fine with MCS20.
2 – Samsung Electronics Benelux BV Samsung: We are fine with MCS20
3 – Huawei Tech.(UK) Co.. Ltd We are fine with MCS 20 considering the testability issue for OTA testing
4 – Intel Corporation SAS We are fine with MCS 20
5 – CATT We are fine with MCS 20
6 – China Telecommunications We proposed to use MCS 21 or MCS 22 to use higher data rate for the testing and considering the OTA testability. However, since there are companies concern on the simulation workload, we would like to give our compromise to use MCS20, to try to finalize this issue and to avoid simulation work for each candidate MCS index for each CHBW. **At the same time, we would like to do encourage companies to re-consider our proposal on CBW requirements in 2.4.3, because the simulation workload have been 1/4 compared with that of the last meeting.**
7 – Nokia France Nokia, Nokia Shanghai Bell: : We are fine with MCS20.
8 – China Mobile Com. Corporation Share same view with China Telecom. To move forward, we can compromise to use MCS 20, hope it can address companies' concerns about simulation workload. **Meanwhile, we also hope companies can re-consider operator's proposal about CBW configuration**, since similar work has been done for other modulation schemes, we think it is reasonable and feasible to keep the CBW configuration align with other modulation schemes.
9 – ZTE Wistron Telecom AB We are fine with MCS 20.

2.4.2 Tx EVM

No explicit Tx EVM modelling in the alignment results, consider 3.5% Tx EVM impact in the impairment results submitted by companies.

Feedback Form 6: Tx EVM

1 – Ericsson Inc. Ericsson: We agree with no explicit Tx EVM modeling in the alignment results. Basically, we don't think it is necessary to consider 3.5% EVM impact if MCS with low target SNR is selected, but we are open for further discussion.
2 – Samsung Electronics Benelux BV Samsung: we are fine with recommended WF
3 – Huawei Tech.(UK) Co.. Ltd We are fine with the recommended WF. no explicit Tx EVM modelling in the alignment results, but it is up to company for the impact.
4 – Intel Corporation SAS We are fine with recommended WF. Each company can decide whether to include additional impairment in their results due to imperfections in the TE vendor TX side or not.
5 – China Telecommunications we are fine with recommended WF
6 – CATT We are fine with the recommended WF.
7 – Nokia France Nokia, Nokia Shanghai Bell: We are fine with the recommended WF (no explicit Tx EVM modelling in the alignment results).
8 – Nokia France Nokia, Nokia Shanghai Bell: Concerning the issue highlighted by Ericsson, we agree that 3.5% EVM does not impact the performance requirements at the selected low target SNR. However, this leads us to a different conclusion, i.e., that we do not mind taking them into account for the impairment results even if their impact is negligible. Hence, we are fine with both options including the WF one. Thank you.
9 – ZTE Wistron Telecom AB We are fine with the recommended WF.

2.4.3 SCS and bandwidth combination

–15kHz SCS: 5MHz and 10MHz

–30kHz SCS: 10MHz and 40MHz

Feedback Form 7: SCS and bandwidth combination

1 – China Mobile Com. Corporation We still support Option 2: *15kHz SCS: 5MHz, 10MHz and 20MHz* *30kHz SCS: 10MHz, 20MHz, 40MHz and 100MHz.* As mention by us and other companies, Option 2 can maintain the same test bandwidths with other modulation, and there is no difference between 256QAM and other modulation schemes. Test burden will not increased, the simulation effort is similar with R15, we think it is not a big issue for companies. 100MHz for 30KHz SCS is also a common case in our network, it is better to include it in test CBWs.
2 – Ericsson Inc. Ericsson: We agree with WF to only consider minimum and general bandwidth.
3 – Samsung Electronics Benelux BV Samsung: we are fine with WF, the test purpose can be verified by proposed CBWs with limited test effort
4 – Huawei Tech.(UK) Co.. Ltd We agree with the WF considering the heavy simulation load and the test coverage can be ensure by the minimum channel bandwidth
5 – Intel Corporation SAS We support recommended WF
6 – CATT We are fine with the recommended WF.
7 – China Telecommunications We still support option 2. We share same view with CMCC. In addition. since we are very close to finalize the MCS index issue, we do not think there will be so much simulation workload since we still have enough time for simulation.
8 – Nokia France Nokia, Nokia Shanghai Bell: We agree with the WF.

9 – NTT DOCOMO INC. We still slightly prefer option 2. We share same view with CMCC and China Telecom. The fact that the test conditions are not consistent between 256QAM and the other modulations seems a bit strange for us, even if this tests are not a test to evaluate the performance under actual operational conditions.
10 – ZTE Wistron Telecom AB We are fine with the recommended WF.

2.5 Summary for 2nd round

2.5.1 Open issues

Table 3: Summary for 2nd round

Sub-topic#	**Status summary**
MCS	Discussion summary: All interesting companies are OK with MCS 20. Tentative agreements: MCS 20
Tx EVM	Discussion summary: Still one company does not think that it is necessary to consider 3.5% Tx EVM impact if MCS with low target SNR is selected, but it is open for further discussion; one company is ok with both options. All other companies are fine with the recommended WF. Tentative agreements: Consider 3.5% Tx EVM impact in the impaired results submitted by companies. Candidate options Option 1: consider it in the impaired results submitted by companies (Samsung, Intel, Nokia, CATT, CTC, Huawei, ZTE) Option 2: Not consider 3.5% Tx EVM impact if the target SNR is 20dB or less (Ericsson, Nokia) Recommendations for 2nd round: As per Thursday's GTW on Aug 26 agreement, Option 1 is agreed.

CBW/SCS	Discussion summary: 3 companies still prefer Option 2 for the CBW/SCS combination selection. All other companies are OK with Option 1. Tentative agreements: None Candidate options 15kHz SCS: Option 1: 5MHz and 10MHz (Samsung, Ericsson, Intel, Huawei, CATT□Nokia, ZTE) Option 2: 5MHz, 10MHz and 20MHz (CTC, CMCC, DCM) 30kHz SCS: Option 1: 10MHz and 40MHz (Samsung, Ericsson, Intel, Huawei, CATT, Nokia, ZTE) Option 2: 10MHz, 20MHz, 40MHz and 100MHz (CTC, CMCC, DCM) Recommendations for 2nd round: As per Thursday's GTW on Aug 26 agreement, the following compromise is agreed: 15kHz SCS: 5MHz and 10MHz 30kHz SCS: 10MHz, 40MHz and 100MHz

3 Recommendations for Tdocs

3.1 1st round

New Tdocs

Table 4: Recommendation for new Tdocs

Title	Source	Comments
Way forward on FR1 PUSCH 256QAM performance requirements	Huawei, HiSilicon	

Existing tdocs:

Table 5: Recommendation for the existing tdocs

Tdoc number	Title	Source	Recommendation	Comments
R4-2111974	Discussion on PUSCH demodulation requirements for FR1 256QAM	CATT	Noted	

R4-2111975	Simulation results for PUSCH 256QAM performance requirement	CATT	Noted	
R4-2112035	View on PUSCH demodulation requirement with FR1 256QAM	Samsung	Noted	
R4-2112147	Initial simulation results and discussion on PUSCH FR1 256QAM demodulation requirements	China Telecom	Noted	
R4-2112212	Discussion on BS demodulation requirements for FR1 256QAM	CMCC	Noted	
R4-2112213	Simulation results for PUSCH 256QAM performance	CMCC	Noted	
R4-2112326	Link simulation results for PUSCH 256QAM demodulation requirements	ZTE Wistron Telecom AB	Noted	
R4-2112408	Discussion on NR FR1 PUSCH 256QAM demodulation	Ericsson	Noted	
R4-2112409	Simulation results for NR FR1 PUSCH 256QAM demodulation	Ericsson	Noted	
R4-2112763	Views on the combination of SCS and CBW for FR1 PUSCH 256QAM	NTT DOCOMO, INC.	Noted	
R4-2113122	Discussion on PUSCH requirements for FR1 256QAM	Intel Corporation	Noted	

R4-2113630	On PUSCH demodulation requirements for FR1 256QAM	Nokia, Nokia Shanghai Bell	Noted	
R4-2113631	Simulation results for PUSCH demodulation requirements for FR1 256QAM	Nokia, Nokia Shanghai Bell	Noted	
R4-2113784	Discussion on PUSCH demodulation requirements for FR1 256QAM	Huawei,HiSilicon	Noted	
R4-2113785	Simulation results for PUSCH demodulation requirements for FR1 256QAM	Huawei,HiSilicon	Noted	
R4-2113786	Summary of simulation results for PUSCH requirements for FR1 256QAM	Huawei,HiSilicon	Noted	

3.2 2nd round

Table 6: Recommendation for 2nd round tdocs

Tdoc number	**Title**	**Source**	**Recommendation**	**Comments**
R4-2115748	WF on FR1 PUSCH demodulation requirements for FR1 256QAM	Huawei	Agreeable	