After final round

Variant of [98e-14-R18-FR2-OTA] Version 0.0.3

RAN

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3GPP TSG RAN meeting #98-e RP-223454

Electronic Meeting, December 12-16, 2022

Agenda item: 9.2.11

Source: Qualcomm Incorporated

Title: Moderator's summary for discussion [98e-14-R18-FR2-OTA]

Document for: Information

1 Introduction

In RAN#97e, one checkpoint was assigned to RAN#98e in the SID on NR frequency range 2 (FR2) Over-the-Air (OTA) testing enhancements in RP-222652. This document provides the summary of the discussion for the email thread [98e-14-R18-FR2-OTA] regarding the checkpoint of whether to include transmitting simultaneously in the scope and revised SID during RAN#98e. The related documents are listed below:

- RP-223080, RP-223154, RP-223155

2 Topic#1: Discuss whether to include the case of transmitting simultaneously

Table 1: List of contributions

T-doc	Source	Observations and proposals

RP-223080	Xiaomi	Observation 1: The fixed AOA separation has been agreed for core requirement and the test method baseline has been agreed accordingly. Observation 2: It is feasible to discuss the multi-TX based on current agreed test method. Observation 3: To mostly reusing current test system to cover more tests is the basic consideration when enhancing the test method. Proposal: The multi-RX test method is prioritized in Rel-18 FR2 OTA test method SID and the multi-TX test method can be taken into account as 2nd priority.
RP-223154	Qualcomm Incorporated	Proposal 1: To remove the note regarding multi-Tx in the SID for study on FR2 OTA testing enhancements at this stage and revisit the scope when the discussion on the core requirements for multi-Tx will begin in RAN4. Proposal 2: It is encouraged that companies consider the forward compatibility for muti-Tx as much as possible when discussing the test methodology for multi-Rx in RAN4.

2.1 Initial round

2.1.1 Proposals and comments collection

Issue 1-1: Whether to include the case of transmitting simultaneously in the objective of this SID

- Option 1: Remove the note regarding multi-Tx in the SID and revisit the scope when the discussion on the core requirements for multi-Tx will begin in RAN4 (RP-223154)
- Option 2: Prioritize the multi-RX test method and take the multi-TX test method as the 2nd priority (RP-223080)

Feedback Form 1: Comments on Issue 1-1

1 – Qualcomm Incorporated

According to the WID and TU budget of MIMO Evolution for Downlink and Uplink in RP-213598, RAN4 will start to discuss the core requirements for MIMO Evolution in the February meeting (0.25TU for RF and 0.25TU for RRM in RAN4#106).

With that, we would prefer option 2. If we cannot get a consensus on option 2, we can accept option 1. But we need to capture the conclusion in the meeting reports that Multi-Tx should be included in the scope of this SI when RAN4 decides to specify the core requirements for multi-Tx.

2 – Guangdong OPPO Mobile Telecom.

Option 1 and 2 are ok, more prefer Option 2, considering Multi-Tx it is one of the enhancements in MIMO Rel-18 WI, and RAN4 is planned to define requirements for that.

3 – Beijing Xiaomi Mobile Software

We see the two options are not conflict. For the progress of option 2, we can wait and see the core requirement development to futher enhance the test method and to make the test system development more efficiency.

4 – ZTE Corporation

It is unclear when to start the 2nd priority work in the option 2. However, with the clarification from QC, we think it would be feasibe to combine both options, like:

Prioritize the multi-RX test method and take the multi-TX test method as the 2nd priority when the discussion on the core requirements for multi-Tx will begin in RAN4.

5 – MediaTek Inc.

Both Option 1 and 2 are fine to us.

6 – Verizon UK Ltd

As long as capturing the Multi-Tx in the scope of this SI for specifying the core requirements, we can prioritize Option 2 after Option 1 based on the TU budget of this work.

7 – CAICT

Both options are fine to us. ZTE's proposal could be a combined option.

8 – vivo Communication Technology

We prefer Option 2. As discussed in last RAN-P meeting, we believe multi-Tx as Rel-18 core requirement working scope should also be considered in this Rel-18 FR2 testability SI. Considering the workload and unclear progress of Rel-18 FeMIMO RF discussion in RAN4, we think it is reasonable to consider multi-Tx as 2nd priority.

Besides, it should be noted that we do not prefer to further increase the TU of this SI based on Option 2.

9 – Samsung Electronics Co.

We support Option 1 given that the simultaneous transmission is not the feature for handheld devices in MIMO evolution WI yet. Based on that, since the RAN4 SID is focusing on the handheld devices, we don't even have to consider the order of the priority now between multi-Rx and multi-Tx as option 2.

10 – Intel Corporation (UK) Ltd

Option 1 and Option 2 are ok. We are also open to combine the options as ZTE suggested

11 – Qualcomm Incorporated

To Samsung:

We think whether to specify the simultaneous transmission for handheld UE should depend on the RAN4 discussion. Even in the end, the requirements are only defined for non-handheld UE such as FWA, we still need relevant test methods and test systems to verify the performance. Note that in the current SID, the other UE types have already been in the scope and should be discussed as 2nd priority which is in line with option 1.

See the objective below in the current SID:

"Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority"

12 – Qualcomm Incorporated

Corrected our comments above:

...

"Note that in the current SID, the other UE types have already been in the scope and should be discussed as 2nd priority which is in line with **option 2**."

13 – Huawei Technologies France

We support option 1. The consideration on measurement should be based on the core requirements, however multi-Tx as one aspect for Rel-18 MIMO enhancements, there is no much progress even in RAN1. Without discussion in RAN4 for the RF requirements for multi-Tx, it's not appropriate to discuss the measurement part in the test related SI.

Additionally, to Qualcomm, "Multi-Tx should be included in the scope of this SI…" doesn't seem necessary to be captured in this meeting, because it depends on related progress in RAN1 and RAN4. Even if necessary, we can discuss it for test part in the future.

14 – Nokia France

We have a slight preference for Option 2, as it retains the multi-tx clearly in the WI. In practice, putting multi-tx as 2nd priority will mean that it will not begin before the discussion on the core requirements for multi-Tx begins in RAN4, and this is fine.

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2.1.2 First round summary

12 companies added comments on this issue. 6 companies prefer option 2, i.e., take the Multi-Tx as the 2nd priority. 2 companies prefer option 1, i.e., remove the note and revisit the scope when the discussion for Multi-Tx core requirements starts in RAN4. 3 companies are fine with both options. 1 company suggested combining option 1 and option 2. The majority view is to take Multi-Tx as the 2nd priority.

In the intermediate round, from moderator's point of view, it is recommended to discuss the way forward below:

- Prioritize the multi-RX test method and take the multi-TX test method as the 2nd priority in the revised SID.
- Capture the note in the SID or in the meeting report: "The test method for the devices that can transmit simultaneously will not start before the discussion for core requirements begins in RAN4"
- The TU budget should not be changed.

2.2 Intermediate round

2.2.1 Proposals and comments collection

Issue 1-1: To discuss whether the way forward below is agreeable:

Way forward on whether to include the case of transmitting simultaneously:

- Prioritize the multi-RX test method and take the multi-TX test method as the 2nd priority in the SID
- Capture one note in the SID or in the meeting report: "The test method for the devices that can transmit simultaneously will not start before the discussion for core requirements begins in RAN4"
- The TU budget should not be changed.

Feedback Form 2: Comments on WF for Issue 1-1

1 – Nokia France We support the moderator's proposal. The note would be best captured in the SID. For clarity, it might be better to say "...discussion for **multi-Tx** core requirements...".
2 – MediaTek Inc. We are fine with Moderator's proposal.
3 – CAICT Ok with moderator's proposal.

4 – Qualcomm Incorporated

We believe the WF is a good compromise based on the initial round of discussion. Putting the test method for multi-Tx as the 2nd priority should have solved the concerns from Samsung on the UE type since the test method for other UE types has already been in the current SID as the 2nd priority. Meanwhile, capturing a note in SID saying the test method for mulit-Tx will not start before the multi-Tx core requirements begin in RAN4 is to solve Huawei's concern about the starting time in RAN4. In other words, even if RAN4 decides not to specify the multi-Tx requirements, the test method for multi-Tx will not start.

Therefore, we support moderator's proposal and we are OK with the suggestion by Nokia. Note that we don't use the term "multi-Tx" in the current SID, so we can say"...discussion for **corresponding** core requirements...".

5 – vivo Communication Technology

We support moderator's good summary and proposed WF.

The updated wording for note from QC is also fine to us.

6 – Huawei Technologies France

We disagree with the moderator's proposal. The SI is targeted to multi-panel reception for FR2, which can be clearly seen from the justification part of the SI. And from the related Work Items and dependencies in the SID, actually the test method for multi-panel Rx is based on Rel-17 RAN1 MIMO WI. Similar case could be expected for the discussion in RAN4. Even there are RAN4 discussion next year for MIMO evolution WI, we don't know yet whether or what the RAN4 impact could be. It's not an appropriate time to make decision in RAN when we don't have any study in RAN4 and not sufficient study in RAN1 as well. We strongly object to make changes for the SID as proposed by moderator. And removing the note in current SID as originally proposed by Qualcomm is ok for us.

7 – Beijing Xiaomi Mobile Software

We are fine with Qualcomm's modification.

8 – ZTE Corporation

We are fine with the modification from QC.

9 – Samsung Electronics Co.

We would like to thank moderator to provide a compromise option. However, we still believe that it is too premature to leave the note in the SID because no one can confirm whether the new test method for multi-Tx is needed or not at this stage. Even though there is 'other UE type' in the SID, it is there for the multi-Rx only. We believe it is not the right time to capture it into the SID before the discussion, but can be considered once RAN4 starts the multi-Tx discussion. We may need to prepare but don't have to add it to the SID before it is clear.

10 – Intel Corporation (UK) Ltd

The way forward is agreeable, including the edit suggested by Qualcomm

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2.2.2 Intermediate round summary

In the intermediate round, 10 companies added the comments on the WF suggested by moderator.

8 companies including Nokia, MTK, CAICT, Qualcomm, vivo, Xiaomi, ZTE and Intel support the WF with minor edits. 2 companies including Huawei and Samsung are not OK to include multi-Tx test method in the SID at this stage since it is not clear whether and when RAN4 will specify the core requirements for multi-Tx. According to the TU budget of MIMO Evolution for Downlink and Uplink, RAN4 will discuss the core requirements of MIMO evolution from the next meeting in which multi-Tx is within the scope. From moderator's point of view, there is no harm to consider the multi-Tx test method as the 2nd priority for the forward compatibility of test system. To solve the concern about the connection between core requirements and test method, it is suggested to add the note "The test method for the devices that can transmit simultaneously will not start before the discussion for corresponding core requirements begins in RAN4" in the SID.

Based on the majority companies' view, the recommendation from moderator is:

- Take multi-Tx test method as 2nd priority in the SID
- Add one note in the SID: "The test method for the devices that can transmit simultaneously will not start before the discussion for corresponding core requirements begins in RAN4"
- TU should not be changed.

In the final round, it is recommended to discuss the revised SID based on the intermediate round summary.

2.3 Final round

2.3.1 Proposals and comments collection

Issue 1-1: Do you agree with the revised SID below? If not, please provide concrete changes. Note that TU budget for this SI should not be changed.

Table 2: WF on the revised SID

The objectives for FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer are as follows.

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive **and transmit** simultaneously from multiple Angle of Arrival (AoA)
    - The multiple AoA test setup should enable testing of up to 2 DL Layers with dual polarization for each angle
    - For RRM, the target should be to allow testing of 4 AoAs with 2 simultaneously active AoAs.
    - Define a test methodology for up to 4 DL MIMO layer demodulation testing
    - ~~Note: Revisit whether or not to include the case of transmitting simultaneously in RAN#98~~
    - **Note: The test method for devices that can receive simultaneously should be the first priority, and test method for devices that can transmit simultaneously is considered as 2nd priority.**
    - **Note: The test method for the devices that can transmit simultaneously will not start before the discussion for corresponding core requirements begins in RAN4.**
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority
- Develop the related preliminary uncertainty assessments for the test methodologies
- FR2 test methods defined in TR 38.810 and TR 38.884 should be used as the baseline.
- The tests shall take the test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level.

Feedback Form 3: Comments on the revised SID

1 – Nokia France

We support the moderator's proposal in principle.

We would like to suggest the following improvements to the structure:

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive **and transmit** simultaneously from multiple Angle of Arrival (AoA)
    - The multiple AoA test setup should enable testing of up to 2 DL Layers with dual polarization for each angle
    - For RRM, the target should be to allow testing of 4 AoAs with 2 simultaneously active AoAs.

  - Define a test methodology for up to 4 DL MIMO layer demodulation testing
  - ~~Note: Revisit whether or not to include the case of transmitting simultaneously in RAN#98~~

- **With second priority, define a test methodology for RF/RRM requirements testing for devices that can transmit simultaneously to multiple Angles of Departure (AoD)**
  - **Note: The test methodology for devices that can transmit simultaneously will not start before discussion of the corresponding core requirements begins in RAN4.**
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority
- Develop the related preliminary uncertainty assessments for the test methodologies
- FR2 test methods defined in TR 38.810 and TR 38.884 should be used as the baseline.
- The tests shall take the test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level.

2 – Verizon UK Ltd

We support the moderator's proposal and agree with the Nokia comments above!

3 – Qualcomm Incorporated

We support the moderator's proposal and the modifications from Nokia. One minor update is to remove the "and transmit" in the first bullet since we will have a separate bullet for multi-Tx part as suggested by Nokia.

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive ~~**and transmit**~~ simultaneously from multiple Angle of Arrival (AoA)
  - The multiple AoA test setup should enable testing of up to 2 DL Layers with dual polarization for each angle
  - For RRM, the target should be to allow testing of 4 AoAs with 2 simultaneously active AoAs.
  - Define a test methodology for up to 4 DL MIMO layer demodulation testing
  - ~~Note: Revisit whether or not to include the case of transmitting simultaneously in RAN#98~~

- **With second priority, define a test methodology for RF/RRM requirements testing for devices that can transmit simultaneously to multiple Angles of Departure (AoD)**
  - **Note: The test methodology for devices that can transmit simultaneously will not start before discussion of the corresponding core requirements begins in RAN4.**
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority

- Develop the related preliminary uncertainty assessments for the test methodologies
- FR2 test methods defined in TR 38.810 and TR 38.884 should be used as the baseline.
- The tests shall take the test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level.

4 – Huawei Technologies France

We disagree with the moderator proposal. We don't know yet whether there could be RAN4 spec impact for the RAN1 related feature in Rel-18. It's premature to consider test method for multi-Tx as second priority. We would suggest the SID change as:

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive **and transmit** simultaneously from multiple Angle of Arrival (AoA)
  - The multiple AoA test setup should enable testing of up to 2 DL Layers with dual polarization for each angle
  - For RRM, the target should be to allow testing of 4 AoAs with 2 simultaneously active AoAs.
  - Define a test methodology for up to 4 DL MIMO layer demodulation testing
  - ~~Note: Revisit whether or not to include the case of transmitting simultaneously in RAN#98~~
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority
- Develop the related preliminary uncertainty assessments for the test methodologies
- FR2 test methods defined in TR 38.810 and TR 38.884 should be used as the baseline.
- The tests shall take the test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level.

5 – MediaTek Inc.

We support QC's revised version.

6 – Samsung Electronics Co.

Thanks moderator for the hard work. But, again for multi-Rx, when starting OTA test SI, there is RAN4 multi-RX chain DL WI already in which there is clear core impact (at least spherical coverage as noted in the WID). We still believe that the same rule and procedure shall apply to multi-Tx discussion for SID if necessary. The multi-Tx is not even started yet in RAN4, and there is nothing we can take whether there would be RAN4 impact for the SID . We still prefer QC's original proposal (RP-223155) but can live with coming back to the next meeting after RAN4 starts the discussion.

7 – Beijing Xiaomi Mobile Software

We are fine with Qualcomm's revised version. We would also like to add a note as:

Note: The test method defined for multi-RX should be reused as much as possible.

Since this is the original purpose as to simplify the test method for both multi-RX and multi-TX.

8 – Huawei Technologies France

For clarification, there is a copy & paste error in our above comments. The change should be based on the existing SID, i.e.

The objectives for FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer are as follows.

- Define a test methodology for RF/RRM/Demodulation requirements testing for devices that can receive simultaneously from multiple Angle of Arrival (AoA)
    - The multiple AoA test setup should enable testing of up to 2 DL Layers with dual polarization for each angle
    - For RRM, the target should be to allow testing of 4 AoAs with 2 simultaneously active AoAs.
    - Define a test methodology for up to 4 DL MIMO layer demodulation testing
    - ~~Note: Revisit whether or not to include the case of transmitting simultaneously in RAN#98~~
- Smartphone form factor should be the first priority, other UE types should also be discussed as 2nd priority
- Develop the related preliminary uncertainty assessments for the test methodologies
- FR2 test methods defined in TR 38.810 and TR 38.884 should be used as the baseline.
- The tests shall take the test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level.

This is the original proposal by Qualcomm in RP-223155. Considering the RAN4 work does not start, it's not clear whether there could be RAN4 spec impact in Rel-18. It is known that for multi-panel Rx, even we have discussion in RAN4 in Rel-17, but no requirements were identified at that time. The test aspect should be based on the core requirements. Thus we think it's too early to make decision now. Tend to agree with Samsung, we can come back later to see if SID needs to be updated if we have a clear view in RAN4 based on detailed technical discussion.

9 – vivo Communication Technology

We are fine with Qualcomm updated version. However, considering the multi-Tx requirement work is not started in RAN4, the more reasonable way to moveforward would be postponing the check point to RAN#99 meeting, and further discuss whether it is proper to add multi-Tx as 2nd priority.

10 – Qualcomm Incorporated

We would clarify our proposal in RP-223155 in which the note was removed but as commented in the initial round, we would like to capture the meeting notes that multi-Tx should be considered once RAN4 starts to discuss the core requirements for multi-Tx . That is actually also in line with option 2. We believe that taking the multi-Tx test method into account is very important from the test system forward compatibility PoV regardless RAN4 will specify the multi-Tx requirements in Rel-18 or Rel-19. Considering companies still have different views on when to include multi-Tx in the scope, we can live with vivo's suggestion of postponing the checkpoint to RAN#99.

11 – Guangdong OPPO Mobile Telecom.

It seems there is no much difference among companies comments, we are ok to include the multi-Tx in this SI as long as the requirements are specified. Before that probably postpone is more safe way, but no strong view on this.

3 Topic#2: Revised SID

Table 3: List of contributions

T-doc	Source	Observations and proposals
RP-223155	Qualcomm Incorporated	Remove the note below: Note: Revisit whether or not to include the case of transmitting simultaneously in RAN#98

3.1 Initial round

3.1.1 Proposals and comments collection

Issue 2-1: Provide the comments on the revised SID in RP-223155.

Feedback Form 4: Comments on Issue 2-1

1 – Qualcomm Incorporated

Depends on the outcome of Issue 1-1.

2 – Beijing Xiaomi Mobile Software

Agree to further discuss the multi-TX method.

3 – vivo Communication Technology

SID can be updated based on issue 1-1 outcome.

4 – Samsung Electronics Co. We support the revision as commented to Issue 1-1.
5 – Intel Corporation (UK) Ltd Prefer to discuss after Issue 1-1 has been addressed
6 – Huawei Technologies France We support to remove the note in the SID.
7 – Nokia France I don't understand why this question is here. The WID should be updated to reflect the outcome of issue 1-1.

3.1.2 First round summary

From moderator's point of view, it is recommended to focus on the discussion on Issue 1-1 in the intermediate round. The SID will be revised based on the outcome of Issue 1-1 in the final round.

3.2 Intermediate round

No need to discuss Issue 2-1 in the intermediate round. Please provide your comments on Issue 1-1.

3.3 Final round

No need to discuss Issue 2-1 in the final round. Please provide your comments on Issue 1-1.

4 Conclusion

After rounds of discussion, there is no consensus on whether and when to include multi-Tx test method in the scope of this SI. Considering RAN4 will start to discuss the core requirements for Rel-18 MIMO Evolution next meeting, the Moderator's recommendation is to come back next plenary meeting to revisit this issue base on the RAN4 progress.

With that, the Moderator's recommendations for thread [98e-14-R18-FR2-OTA] are:

Recommendation of WF

- To postpone the checkpoint on revisiting whether or not to include the case of transmitting simultaneously to RAN#99.

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Recommendation of related T-docs

RP-223155 -> To be revised to RP-223536 to postpone the checkpoint on revisiting whether or not to include the case of transmitting simultaneously to RAN#99.

RP-223080 -> To be noted

RP-223154 -> To be noted