[102-e][209] NR_RF_FR1_enh_RRM_NWM - Version 0.0.2
RAN4

3GPP TSG-RAN WG4 Meeting # 102-e R4-2206752

Electronic Meeting, February 21 – March 3, 2022

Agenda item: 10.3.3, 10.3.4

Source: Moderator (Huawei, HiSilicon)

Title: Email discussion summary for [102-e][209] NR_RF_FR1_enh_RRM_NWM

Document for: Information

1 Introduction

This email thread discusses the RRM part of NR FR1 RF enhancement in Rel-17 [RP-202088] in agenda 10.3.3 and 10.3.4. This email discussion aims to discuss the RRM test cases due to R17 Tx switching.

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

- 1st round: Invite companies to provide comments in each sub-topic.
- 2nd round: work split

2 Topic #1: RRM core requirements for Tx switching enhancements

2.1 Companies' contributions summary

Table 1:

T-doc number	Company	Proposals / Observations
R4-2204887	Huawei	Formal big CR

2.2 Open issues summary

2.2.1 Open issues

No issues. All Core part issues for this WI were resolved.

2.2.2 CRs/TPs comments collection

A formal Big CR for agreement was proposed (this is a re-submission of endorsed Draft Big CR [R4-2120282]). Please provide comments on the big CR:

R4-2204887 (Huawei): Big CR: RRM requirements for Rel-17 NR FR1 RF

Feedback Form 1: Comments collection for Big CR R4-220488

1 – Intel We are fine with the changes. However, there are errors in affected clauses and affected specs on cover sheet. The affected clauses are new section 8.2.2.2.10A/B/C. The affected test spec is TS 38.533.
2 – China Telecommunications Minor editorial modification suggestion: - Remove the space between in the references to Table 8.2.2.2. 10A-1 and Table 8.2.2.2.10 -1 in sub-clauses 8.2.2.2.10A/B/C - Remove the [] on ”6.1.6 of TS 38.214”

2.3 Summary for 1st round

2.3.1 Open issues

2.3.2 CRs/TPs

2.4 Discussion on 2nd round (if applicable)

3 Topic #2: RRM test cases for Tx switching enhancements

3.1 Companies’ contributions summary

Table 2:

T-doc number	Company	Proposals / Observations
R4-2204888	Huawei	This contribution provided considerations on the test cases of DL interruptions due to R17 Tx switching enhancement.

3.2 Open issues summary

3.2.1 Open issues

Issue 2-1:Test cases need to be specified

Proposals

Option 1(Huawei): Six DL interruption test cases in SA need to be verified:

- DL Interruptions at UE switching between two uplink carriers with two transmit antenna connectorsfor UL inter-band CA
  - #1: NR UL **FDD** carrier 1 with 2Tx and NR UL **TDD** carrier 2 with 2Tx, and the two uplink carriers are in different bands;
  - #2: NR UL **TDD** carrier 1 with 2Tx and NR UL **TDD** carrier 2 with 2Tx, and the two uplink carriers are in different bands, and carrier 1 and carrier 2 have **different UL-DL pattern**.
- DL Interruptions at UE switching between one uplink band with one transmit antenna connector and one uplink band with two transmit antenna connectors for UL inter-band CA
  - #3: NR UL **FDD** carrier 1 in band A with 1TX, NR UL **TDD** carrier 2 and **TDD** carrier 3 in band B with 2Tx. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers;
  - #4: NR UL **TDD** carrier 1 in band A with 1TX, NR UL **TDD** carrier 2 and **TDD** carrier 3 in band B with 2Tx. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers and with the same TDD pattern. Carrier 1 and carrier 2 have **different UL-DL pattern**.
- DL Interruptions at UE switching between two uplink bands with two transmit antenna connectors for UL inter-band CA
  - #5: NR UL **FDD** carrier 1 in band A with 2TX, NR UL **TDD** carrier 2 and **TDD** carrier 3 in band B with 2Tx. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers;
  - #6: NR UL **TDD** carrier 1 in band A with 2TX, NR UL **TDD** carrier 2 and **TDD** carrier 3 in band B with 2Tx. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers and with the same TDD pattern. Carrier 1 and carrier 2 have **different UL-DL pattern**.

Recommended WF

Further discussion

Feedback Form 2: Comments collection for Issue 2-1

1 – China Telecommunications Ok with option 1.
2 – Huawei Technologies France support option 1

Issue 2-2: Test configurations and UE antenna configurations, if test case #1 and #2 listed in issue 2-1 are agreeable

Proposals

- Option 1(Huawei): For test case #1 and #2, the test configurations and UE antenna configurations are listed as below,

Table 3:

Test case index	**Description**
#1	NR carrier 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode;
#2	NR carrier 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note: TDD CA combination configuration with different UL/DL patterns

Table 4:

Cells	UE antenna configuration
PCell	2x2
SCell	2x2

Recommended WF

Further discussion

Feedback Form 3: Comments collection for Issue 2-2

1 – China Telecommunications ok with option 1.
2 – Huawei Technologies France support option 1.

Issue 2-3: Test configurations and UE antenna configurations, if test case #3 and #4 listed in issue 2-1 are agreeable

Proposals

- Option 1(Huawei): For test case #3 and #4, the test configurations and UE antenna configurations are listed as below,

Table 5:

Test case	**Description**
#3	NR carrier 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note1: Carrier 2 and carrier 3 with same UL/DL patterns.
#4	NR carrier 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note1: Carrier 2 and carrier 3 with same UL/DL patterns. Note2: Carrier 1 and carrier 2 with different UL/DL patterns

Table 6:

Cells	UE antenna configuration

PCell	1x2
SCell 1	1x2
SCell 2	1x2

Recommended WF

Further discussion

Feedback Form 4: Comments collection for Issue 2-3

1 – China Telecommunications ok with option 1.
2 – Huawei Technologies France support option 1.
3 – Huawei Technologies France We found a typo for SCell 1 and SCell 2: they shall have 2 TX.

Issue 2-4: Test configurations and UE antenna configurations, if test case #5 and #6 listed in issue 2-1 are agreeable

- Proposals
  - Option 1(Huawei): For test case #5 and #6, the test configurations and UE antenna configurations are listed as below,

Table 7:

Test case	**Description**
#5	NR carrier 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note1: Carrier 2 and carrier 3 with same UL/DL patterns.

#6	NR carrier 1 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 2 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note1: Carrier 2 and carrier 3 with same UL/DL patterns. Note2: Carrier 1 and carrier 2 with different UL/DL patterns.

Table 8:

Cells	UE antenna configuration
PCell	2x2
SCell 1	1x2
SCell 2	1x2

Recommended WF

Further discussion

Feedback Form 5: Comments collection for Issue 2-4

1 – China Telecommunications For test case 5 and 6 (for 2Tx-2Tx switching between 3 CCs within 2 bands)□in our understanding, the UE antenna configuration should also be 2x2 for SCell 1 and Scell 2.
2 – Huawei Technologies France Agree with Chian Telecomm, SCell 1 and SCell2 shall have 2 TX

3.2.2 CRs/TPs comments collection

3.3 Summary for 1st round

3.3.1 Open issues

Issue 2-1:Test cases need to be specified

Tentative agreements:

Six DL interruption test cases in SA need to be verified:

- DL Interruptions at UE switching between two uplink carriers with two transmit antenna connectorsfor UL inter-band CA
  - #1: NR UL **FDD** carrier 1 with 2Tx and NR UL **TDD** carrier 2 with 2Tx, and the two uplink carriers are in different bands;
  - #2: NR UL **TDD** carrier 1 with 2Tx and NR UL **TDD** carrier 2 with 2Tx, and the two uplink carriers are in different bands, and carrier 1 and carrier 2 have **different UL-DL pattern**.
- DL Interruptions at UE switching between one uplink band with one transmit antenna connector and one uplink band with two transmit antenna connectors for UL inter-band CA
  - #3: NR UL **FDD** carrier 1 in band A with 1TX, NR UL **TDD** carrier 2 and **TDD** carrier 3 in band B with 2Tx. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers;
  - #4: NR UL **TDD** carrier 1 in band A with 1TX, NR UL **TDD** carrier 2 and **TDD** carrier 3 in band B with 2Tx. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers and with the same TDD pattern. Carrier 1 and carrier 2 have **different UL-DL pattern**.
- DL Interruptions at UE switching between two uplink bands with two transmit antenna connectors for UL inter-band CA
  - #5: NR UL **FDD** carrier 1 in band A with 2TX, NR UL **TDD** carrier 2 and **TDD** carrier 3 in band B with 2Tx. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers;

- #6: NR UL **TDD** carrier 1 in band A with 2TX, NR UL **TDD** carrier 2 and **TDD** carrier 3 in band B with 2Tx. NR UL carrier 2 and carrier 3 are two contiguous aggregated carriers and with the same TDD pattern. Carrier 1 and carrier 2 have **different UL-DL pattern**.

Recommendations for 2nd round: No further discussion.

Issue 2-2: Test configurations and UE antenna configurations, if test case #1 and #2 listed in issue 2-1 are agreeable

Tentative agreements:

For test case #1 and #2, the test configurations and UE antenna configurations are listed as below,

Table 9:

Test case	**Description**
#1	NR carrier 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode;
#2	NR carrier 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note: TDD CA combination configuration with different UL/DL patterns

Table 10:

Cells	UE antenna configuration
PCell	with 2 TX
SCell	with 2TX

Recommendations for 2nd round: No further discussion.

Issue 2-3: Test configurations and UE antenna configurations, if test case #3 and #4 listed in issue 2-1 are agreeable

Tentative agreements:

For test case #3 and #4, the test configurations and UE antenna configurations are listed as below,

Table 11:

Test case	**Description**
#3	NR carrier 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note1: Carrier 2 and carrier 3 with same UL/DL patterns.
#4	NR carrier 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note1: Carrier 2 and carrier 3 with same UL/DL patterns. Note2: Carrier 1 and carrier 2 with different UL/DL patterns.

Table 12:

Cells	**UE antenna configuration**
PCell	with 1TX
SCell 1	with 2TX
SCell 2	With 2TX

Recommendations for 2nd round: No further discussion.

Issue 2-4: Test configurations and UE antenna configurations, if test case #5 and #6 listed in issue 2-1 are agreeable

Tentative agreements:

For test case #5 and #6, the test configurations and UE antenna configurations are listed as below,

Table 13:

Test case	**Description**
#5	NR carrier 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; NR carrier 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note1: Carrier 2 and carrier 3 with same UL/DL patterns.
#6	NR carrier 1 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 2 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; NR carrier 3: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; Note1: Carrier 2 and carrier 3 with same UL/DL patterns. Note2: Carrier 1 and carrier 2 with different UL/DL patterns.

Table 14:

Cells	**UE antenna configuration**
PCell	with 2TX
SCell 1	with 2TX
SCell 2	with 2TX

Recommendations for 2nd round: No further discussion.

3.3.2 CRs/TPs

3.4 Discussion on 2nd round (if applicable)

4 Recommendations for Tdocs

4.1 1st round

New tdocs

Table 15:

Title	Source	Comments
WF on R17 NR FR1 RF enhancement RRM	Huawei, HiSilicon	

Existing tdocs

Table 16:

Tdoc number	Title	Source	Recommendation
R4-2204887	Big CR: RRM requirements for Rel-17 NR FR1 RF	Huawei, HiSilicon	Revised

4.2 2nd round