3GPP TSG-RAN WG2 Meeting #121-bis electronic draft R2-2304212

April 17-26, 2023

Source: Session Chair (CATT)

Title: Report from NR MIMO evolution session

## 7.20 NR MIMO evolution

(NR\_MIMO\_evo\_DL\_UL-Core; leading WG: RAN1; REL-18; WID: RP-223276)

Time budget: 0.5 TU

Tdoc Limitation: 2 tdoc

### 7.20.1 Organizational

Rapporteur input, incoming LS etc.

**Work plan**

R2-2302616 RAN2 work plan for MIMO evolution NTT DOCOMO, INC., Samsung, Huawei, HiSilicon Work Plan Rel-18

- ZTE asks about the plan to discuss TAG configuration for 2TA. DCM thinks we can start the discussions for now and if later there is detail understanding we can check.

- Ericsson thinks it is good RRC list is available in May, then can start stage 3 drafting, and think there are some questions that we may need to ask R1. Nokia also think we should try to figure out questions to ask.

* Noted

**LS in**

R2-2302455 LS to RAN2/4 on Agreements for Rel-18 MIMO (R1-2302226; contact: Samsung) RAN1 LS in Rel-18 NR\_MIMO\_evo\_DL\_UL To:RAN2, RAN4

- Samsung thinks we focus on 2TA first.

* Noted

### 7.20.2 Two TAs for multi-DCI multi-TRP

Includes discussion on whether to support per TRP UE-initiated RACH procedure, other RAN2 impacts of Two TAs for multi-DCI multi-TRP operation, etc.

**Per TRP UE-initiated RACH procedure**

R2-2302692 Discussion on multi-DCI multi-TRP with two TAs Intel Corporation discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1: CBRA procedure is supported for per TRP UE-initiated RACH procedure in intra-cell case, at least for TA recovery.*

*Proposal 2: CBRA procedure is not supported for per TRP UE-initiated RACH procedure in inter-cell case.*

R2-2303016 Considerations on multi-DCI multi-TRP operation with two TAs Fujitsu discussion Rel-18 NR\_MIMO\_evo\_DL\_UL R2-2301035

*Proposal 3: For multi-DCI based Multi-TRP operation with two TAs, RAN2 to discuss if per TRP UE-initiated RACH procedure is needed.*

*Proposal 3bis: If per TRP UE-initiated RACH procedure is not supported, RAN2 to further discuss which TA timer is restarted when TAC is received in RAR.*

R2-2302879 Two TAs for multi-DCI multi-TRP Huawei, HiSilicon discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1: In multi-DCI multi-TRP operation, for UL data arrival, the UE initiates CBRA on the serving PCI.*

*Proposal 2: In multi-DCI multi-TRP operation, parallel RACH on different TRPs is not supported.*

R2-2303560 Discussion on multi-DCI multi-TRP with two TAs Qualcomm Incorporated discussion NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 3: From RAN2 perspective, no need to enhance CBRA procedure to support per TRP UE-initiated RACH procedure.*

Discussions based on the 4 contributions above:

- DCM agree with QC that per TRP CBRA is not needed. Xiaomi thinks for Scell there is no need as in legacy, for Pcell there is per cell TA config, and thus agree as well. ZTE agree and think the discussion from Fujitsu make sense and agree to further discuss. LG also think this is not needed. Vivo, Nokia agree as well.

- OPPO think there are different cases.

- Nokia agree with the intention of QC P3, but want to improve the wording. OPPO think this is still not clear. Xiaomi think this is clear.

* From RAN2 perspective, per TRP UE-initiated RACH procedure is not supported.

**Other RAN2 impacts of 2 TAs**

R2-2303769 Discussion on two TAs for multi-DCI multi-TRP Samsung Research America discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1: An additional TAG ID is configured for a serving cell.*

*Proposal 2: The maximum number of TAGs configured per MAC entity is increased to 8.*

*Proposal 3: Introduce a new TAC MAC CE if the maximum number of TAGs per MAC entity is increased.*

*Proposal 4: A MAC entity has up to 2 PTAGs with each PTAG using one TA for the SpCell.*

*Proposal 5: One TAT per TAG is configured and managed to support two TAs for mDCI mTRP.*

*Proposal 6: RAN2 to discuss UE behavior when only one TAT for a serving cell expires and when both TATs for a serving cell expire.*

*Proposal 7: For mDCI inter-cell mTRP, one separate RACH configuration is provided for each additional PCI for CFRA by PDCCH order.*

* Noted

R2-2303690 On multi-DCI multi-TRP with two TAs Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1: Utilize the existing TAG space (i.e., up to 4 TAGs) for multi-DCI multi-TRP purpose.*

*Proposal 2: Separate TATs are applied for the different TAGs for a serving cell (ie., same as legacy).*

*Proposal 3: Initial TA acquisition for the 2nd TAG is initiated by the network and performed through PDCCH order with CFRA procedure.*

*Proposal 4: Discuss how the RACH configuration to be used for TA acquisition for the 2nd TAG is pre-provisioned to the UE in inter-cell scenario.*

* Noted

Discussions based on the 2 contributions above:

- QC agree with Nokia on TAG space, no need to increase to 8. Apple agree, prefer to reuse current TA management framework. Xiaomi agree with all proposals from Nokia.

- Ericsson think we should understand the feature better before deciding on reuse legacy and thinks there is more impact to MAC procedure. Ericsson think the # of TAG depends on how serving cells are grouped and associated with TRP. OPPO think this is valid question and think we do not need full flexibility for TAG config.

- ZTE agree with P5 from Samsung contribution and think for TAG ID config there are options to consider. DCM agree with ZTE.

- Ericsson think we do not need to agree on TAG ID configuration and TAT per TAG at this stage and think we should first ask R1. CATT think this kind of high level assumption helps.

**Potential LS to R1**

R2-2303708 On 2TA operation Ericsson discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1 RAN2 to send LS to RAN1 from RAN2#121bis to ask further clarification questions on the possible groupings and related operation.*

*Proposal 2 RAN2 to ask RAN1 more details on the needed RACH configuration per additional PCI. Wht exactly needs to be different per additional PCI.*

*Proposal 3 RAN2 to use the draft LS in appendix as baseline to formulate questions to RAN1*

- HW agree to send LS and think we should discuss what to ask in detail. Xiaomi also agree to ask.

- Xiaomi, CATT suggest to inform our conclusion to R1.

- Intel want to ask for clarification on per TRP.

- OPPO want to understand why we ask 2nd question on RACH config.

* We will send LS to R1 asking questions. Offline drafting the LS, including the following aspects

**- the possible groupings and related operation for 2TAs**

**- other aspects based on offline comments/company contributions**

* [AT121bis-e][851][MIMOevo] LS on 2TA for multi-DCI multi-TRP (Ericsson)

Scope:

LS to RAN1 including the following aspects

* the possible groupings and related operation for 2TAs
* other aspects based on offline comments/company contributions

Intended outcome: draft LS to RAN1 in R2-2304341

Deadline: before WK2 CB

R2-2304341 DRAFT LS on 2TA operation for Rel-18 MIMO Ericsson LS out Rel-18 NR\_MIMO\_evo\_DL\_UL-Core To:RAN1

Discussions on the draft LS:

- HW think it is TAG not TAG group.

Q1a/1b:

*Q1a: For the TAG groups configured for the UE, are there configuration limitations involved? For example, whether one cell can or cannot belong to more than one group.*

*Q1b: Does RAN1 see a need to increase the number of TAGs?*

- DCM think we should be clear about A1, A2, etc.

- OPPO think for 1a we should ask explicitly.

- ZTE do not know the motivation of 1a, and think configuration is up to network (e.g., example 1)

- QC think we do not need examples in the LS and think the question can be just on high level. Apple agree. Nokia agree and think no need to ask config limitation, also think there is no need to ask 1b. LG E has similar view as QC and Nokia.

- Intel, Samsung agree with intention of 1a/1b, but suggest another wording for 1a, also suggest to make 1b clearer. Samsung think 1b is key point to ask.

- Ericssion think a bit more discussion on 1a/1b formulation is useful.

- Nokia think there is some concern.

* Intention of 1a/1b is agreeable, short email discussion to fine tune the wording for Q1a/1b.

*Q2a: When the timer associated with one of the TRPs of a serving cell expires, is it according to RAN1 view that UL towards that TRP (e.g. SRS resources sets associated to that TRP) are impacted but UL towards the another TRP (e.g. SRS resources sets associated to that TRP) can remain in operation?*

 *Q2b: Is there a need from RAN1’s perspective to have two PTAGs in case of two TAGs belongs to a PCell?*

- LG E think we do not ask R1 for TAG design, since it is pure R2 topic. Intel, OPPO agrees.

- CATT think 2a is already assuming TAT per TAG and think we should make it clear before using this in the question in R2. ZTE think this comment is valid and think 2b is not needed.

- Huawei think 1a is OK and the assumption can be added if needed, and think 2b is not clear.

- Xiaomi think 1a should be OK and for 2b we need to first discuss in R2. QC agree that 2b is not needed, Nokia, vivo agree. Nokia think with R1 agreement it 2a is already clear.

- vivo think 2b is useful and think we can discuss in R2 but still ask R1 at the same time.

- Samsung thinks both 2a/2b are R2 discussions, but OK to ask 2a. Samsung think we should first understand the high level impact with 2TA/2TAGs.

- Ericsson think we need to ask 2a, and for 2b we could skip. Ericsson think we should check R1 agreement and discuss more. IDT agree from high level.

* We focus on 2a, but we further discuss the wording.

*Q3a: Is there a difference in the RACH configuration between the additional PCIs configured for the UE?*

*Q3b: Is there a difference in the RACH configuration between the original serving cell (TRP/PCI) and the additional PCIs configured for the UE?*

- Ericsson suggest to check companies’ view.

- OPPO not sure about 3a. Ericsson think this impact ASN1 design e.g., the configuration flexibility of RACH resources.

- Apple want to understand aPCI is for serving cell or other cells. Ericsson clarify that this is for serving cell.

- Xiaomi want to wait for more input from R1 and think for each PCI we need RACH config.

- CATT understand the intention and think this is stage 3 so not very urgent. CATT think we might anyway ask more question in e.g., May. Intel agree.

- Nokia think we need to check the wording, e.g., the intention is to check with R1 can we have separate RACH config for aPCI.

- ZTE, DCM think this is not very urgent.

* We remove Q3.
* [Post121bis-e][852][MIMOevo] LS on 2TA for multi-DCI multi-TRP (Ericsson)

Scope: LS to RAN1 on 2TA for multi-DCI multi-TRP operation, based on the agreements, also fine tune the wording for the questions based on comments collected.

Intended outcome: Agreeable LS to RAN1 in R2-2304342

Deadline: April 28th 1000 UTC

R2-2302568 Discussion on multiple TAG OPPO discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2302939 Discussion on Multi-TRP with two TAs SHARP Corporation discussion NR\_MIMO\_evo\_DL\_UL-Core

R2-2302975 Discussion on two TAs for multi-TRP NEC Corporation discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2303022 Discussions on Two TAs for multi-DCI multi-TRP CATT discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2303248 Discussion on the impacts of Two TAs for multi-DCI multi-TRP operation Lenovo discussion Rel-18

R2-2303249 Discussion on the UE-initiated RACH procedure in multi-TRP operation Lenovo discussion Rel-18

R2-2303422 Support of Two TAs for multi-DCI multi-TRP Apple discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2303691 RA procedure while SpCell is configured with 2 TAGs Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2303732 UL time alignment in multi-DCI based multi-TRP with two TAs InterDigital discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2303757 Discussion on TA maintenance in two TAs for multi-TRP LG Electronics Inc. discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2304042 Discussion on two TAs for multi-TRP Xiaomi discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2304131 Intial Discussion On 2TA for unified TCI state based mPDCCH mTRP ZTE Corporation,Sanechips discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2304132 Considerations on the PDCCH order RACH for acquiring the TRP sepcific TA ZTE Corporation,Sanechips discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

### 7.20.3 Other

Other RAN2 impacts than those discussed in 7.20.1 and 7.20.2.

Note: This agenda item is with lower priority, i.e., it is treated only if time allows.

**Extension of uTCI framework**

R2-2303023 Discussion on Unified TCI Framework Extension for Multi-TRP CATT discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Unified TCI framework extension for M-DCI based MTRP*

*Proposal 1: One reserved bit in R17 Unified TCI States Activation/Deactivation MAC CE is used for the CORSET Pool ID.*

*Unified TCI framework extension for S-DCI based MTRP*

*Proposal 2: MAC CE enhancement is needed for S-DCI based MTRP using unified TCI framework.*

*Proposal 3: For the MAC CE enhancement, it is supported that each TCI codepoint corresponds to one or both TRP(s).*

*Proposal 4: For the MAC CE enhancement, it is supported that each corresponding TRP maps to:*

*- one joint TCI state, or*

*- a DL TCI state, an UL TCI state, or a pair of DL and UL TCI states*

R2-2303064 MAC impacts on the enhancements of the unified TCI state framework Samsung discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1: Revise the legacy unified TCI state activation/deactivation MAC CE by adding a “CORESET Pool ID” field to support mDCI based mTRP operation.*

*Proposal 2: sDCI based mTRP operation using unified TCI state framework considers the intra-cell and inter-cell.*

*Proposal 3: For sDCI based mTRP operation using unified TCI state framework, introduce the new MAC CE containing TCI state information of mTRPs.*

*- If the signaling type of the unified TCI state configuration is configured by RRC (i.e. either joint DL/UL TCI state or separate DL/UL TCI state), it applies to both TRPs.*

*- Introduce the new field indicating if the unified TCI state of the second TRP is present or not.*

Initial discussions based on the above two contributions:

- Samsung think P1 is the same for these two contributions. Samsung there are new agreements from R1, but think we at least discuss these proposals.

- Ericsson/DCM think we focus on P1 at this stage. ZTE agree.

- DCM think we can progress with P1.

- Nokia think in the next meeting we discuss how to progress the MAC CE design based on R1 agreements.

- Xiaomi has concern and think we should wait. LG think it is a bit early to agree anything on MAC CE.

- vivo think wording can be improved.

Chair: there is some support for the following, but some companies think it is too early and we should wait.

**Working assumption:**

* Revise the legacy unified TCI state activation/deactivation MAC CE by adding a “CORESET Pool ID” field to support mDCI based mTRP operation.

R2-2302880 Extension of unified TCI framework for mTRP Huawei, HiSilicon discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

**Others**

R2-2303725 On incoming LSs on Rel-18 MIMO Ericsson discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2303758 Discussion on power control for multi-TRP LG Electronics Inc. discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2303939 Intra-UE prioritization for simultaneous multi-panel transmission ASUSTeK discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

## Status of At-Meeting Email Discussions

This subclause is not an Agenda Item. It contains a running summary of the email discussions assigned to take place during the meeting weeks.

* [AT121bis-e][850] Organizational - MIMO evo (CATT)

Scope:

* Share plans for the meeting and list of ongoing email discussions
* Share meetings notes and agreements for review and endorsement

Intended outcome: General information sharing about the sessions

Deadline: EOM

* [AT121bis-e][851][MIMOevo] LS on 2TA for multi-DCI multi-TRP (Ericsson)

Scope:

LS to RAN1 including the following aspects

* the possible groupings and related operation for 2TAs
* other aspects based on offline comments/company contributions

Intended outcome: draft LS to RAN1 in R2-2304341

Deadline: before WK2 CB

Closed.

## List of post meeting email discussions

* [Post121bis-e][852][MIMOevo] LS on 2TA for multi-DCI multi-TRP (Ericsson)

Scope: LS to RAN1 on 2TA for multi-DCI multi-TRP operation, based on the agreements made, also fine tune the wording for the questions based on comments collected.

Intended outcome: Agreeable LS to RAN1 in R2-2304342

Deadline: April 28th 1000 UTC