3GPP TSG-RAN WG2 Meeting #122 R2-230xxxx

May 22-26, 2023

Source: Session Chair (CATT)

Title: Report from NR MIMO evolution session

## 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.

* [AT122][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

* [AT122][851][MIMOevo] Impacts on TAC MAC CE and/or RAR (Huawei)

Scope: Offline discussions based on P2 and P3 from R2-2305921, taking into account the comments online, try to align the understanding on the related procedure and the impact on absolute TA command MAC CE and/or RAR

Intended outcome: Offline report and updated proposals if possible in R2-2306631

Deadline: Before Friday CB 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.

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

RAN2 impacts of Two TAs for multi-DCI multi-TRP operation, aiming at progressing Stage-2 aspects as much as possible from RAN2 perspective.

Genreal aspects, RAN1 dependency, etc.

R2-2306433 Status of open issues on Two TAs for mDCI mTRP NTT DOCOMO INC. discussion Rel-19

*Observation 1. RAN1 agreed to support enhancements to indicate TAG ID via absolute TA command and left details up to RAN2.*

*Observation 2. Two possible solutions, explicit indication and implicit indication, were proposed in RAN1 discussion.*

*Proposal 1. RAN2 start discussion on enhancements on absolute TAC to indicate TAG ID. Potential solutions are:*

*- Explicit indication: Enhance absolute TAC MAC CE to indicate TAG ID.*

*- Implicit indication: No enhancement on MAC CE structure. Ensure that absolute TA command always updates TA with TAG ID = 0.*

*Proposal 2. Utilize reserved bits in Absolute Timing Advance Command MAC CE to indicate TAG ID. FFS on number of bits.*

*Observation 3. For introduction of two TA in intra-cell case,*

*- If one of two TAGs for PCell is regarded as PTAG while the other is regarded as STAG, RAN2 will have to change the definition of PTAG.*

*- If both of two TAGs for PCell are regarded as PTAG, RAN2 will have to change MAC procedures according to future functional agreements.*

*Proposal 3. RAN2 discuss the definition of relation between two TAGs for PCell. MAC spec impact might be a criterion.*

*Proposal 4. Configure one TAT per TAG to support two TAs for a serving cell.*

*Proposal 5. RAN2 can wait for RAN1 to associate TAG ID to TCI state. Making assumption or agreement is also ok.*

*Proposal 6. RAN2 wait for RAN1 reply before starting discussion on following open issues.*

*- Maximum number of TAGs per MAC entity*

*- MAC Behavior when one of two TAs for a serving cell expires*

*- MAC Behavior when both of two TAs for a serving cell expires*

- ZTE/vivo agree with P4 and think RAN1 is already discussing P5. DCM is OK to take P5 as working assumption. OPPO/vivo also think P5 can wait.

- Ericsson think this is ok but want to clarify.

- Xiaomi think we can progress on P5. OPPO think this relate to RRC configuration and this can be discussed together with other aspects.

* Configure one TAT per TAG to support two TAs for a serving cell, i.e., in this case 2 TAGs are configured for the serving cell.

Impact on the concept of PTAG/STAG

R2-2305799 Discussion on multi-DCI multi-TRP with two TAs Qualcomm Incorporated discussion NR\_MIMO\_evo\_DL\_UL-Core

*Observation 1: RAN1 has agreed that for two TA for multi-DCI multi-TRP, how to indicate the TAG ID via absolute TA command MAC CE is left up to RAN2.*

*Proposal 1: RAN2 to study how to define PTAG and STAG in the SpCell with 2TAGs and update the relevant UE behaviors when corresponding TAT timer of the associated TAG is expired.*

*Proposal 2: Except the term of PTAG and STAG, RAN2 will not introduce additional new terms of TAG in the case of multi-DCI multi-TRP with two TAs.*

*Proposal 3: In the multi-DCI multi-TRP with two TAs scenarios, a TAG containing the UL signals/channels associated with the CORESETPoolIndex #0 in the SpCell of a MAC entity is referred to as PTAG, whereas the STAG refers to other TAGs.*

*Proposal 4: In the multi-DCI multi-TRP with two TAs scenarios, when timeAlignmentTimer associated with PTAG expires, the UE should follow the legacy behavior.*

*Proposal 5: The initial TA update for the second TAG is initiated by network using PDCCH order triggered CFRA procedure.*

*Proposal 6: RAN2 to study the enhancement on the TA update to be applied for which TAG.*

*Proposal 7: For the RACH initiated in the case of multi-DCI multi-TRP with two TAs, the reserve bit in RAR is enhanced to indicate which TAG (the first TAG or the second TAG) the TA in RAR is applied.*

*Proposal 8: One reserve bit in absolute TA command MAC CE is used to indicate which TAG the absolute TA command is applied.*

R2-2306140 Discussion on TA maintenance in two TAs for multi-TRP LG Electronics Inc. discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1. In mTRP operation, a MAC entity has only one PTAG, same as legacy.*

*Proposal 2. In mTRP operation, one of TRPs in SpCell is defined as SpTRP, and PTAG is defined as a TAG containing the SpTRP of a MAC entity. The other TRPs in SpCell belongs to STAG and TRPs in SCell belongs to PTAG or STAG depending on its own TA.*

*Proposal 3. The TRP of SpCell which is associated with Type 1 CSS is defined as SpTRP.*

*Proposal 4. If TAT of PTAG is not running, uplink transmission of all TRPs is not allowed except RA procedure.*

*Proposal 5. If TAT of STAG is not running, uplink transmission of all TRPs belonging to the corresponding STAG is not allowed except RA procedure.*

*Proposal 6. For PTAG, if TAT is not running and there is any uplink transmission, CBRA is initiated for SpTRP.*

*Proposal 7. If PDCCH order indicates a TRP, CFRA is initiated for the corresponding TRP.*

R2-2304766 Discussion on multiple TAG OPPO discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

Observation 1: For “multi-DCI based multi-TRP operation with two TAs”, one serving cell can belong to two TAGs.

*Proposal 1: No configuration restriction is introduced for additional TAGs except that maximum number of TAGs per cell group is 4.*

*Observation 2: MAC procedure per serving cell could be impacted due to introduction of two TAG per serving cell*

*Proposal 2: when one TAG of one serving cell is out of synchronization, UE should only release radio resource specific to concerned TRP i.e. shared radio resource between TRPs of the same serving cell is not released.*

*Proposal 3: If both TAGs are out of synchronization, legacy procedure applies*

*Proposal 4: When another TAG is introduced for the PSCell, this TAG is taken as another PTAG (called secondary PTAG).*

*Proposal 4a: The new TAG except for secondary PTAG is STAG regardless whether the concerned serving cell is in PTAG or STAG.*

*Proposal 5: The legacy procedure relevant to PTAG applies only when both PTAG and secondary PTAG are out of synchronization, otherwise only proposal 2 applies.*

*Proposal 6: per TRP UE-initiated CBRA RACH is not supported when*

*1, Only PTAG or secondary PTAG is out of synchronization, but not both*

*2, Any STAG is out of synchronization*

*Proposal 7: CBRA is only support when both PTAG and secondary PTAG are out of uplink synchronization.*

*Proposal 8: For CFRA triggered for inter-cell case, nothing new in RAR need be introduced*

*Proposal 9: To check with RAN1 that one PRACH source associated with additionalPCI is sufficient for one serving cell*

*Proposal 10: For CFRA triggered for intra-cell case, RAN2 wait for RAN1’s further progress*

*Proposal 11: For CBRA, UE chooses PRACH resource associated with serving TRP to trigger RACH procedure.*

*Proposal 12: the TAG Id space is not extended.*

*Proposal 13: the TAG Id of secondary PTAG is 1.*

- OPPO ask why the pTAG is related to coresetpoolindex #0. QC think it is configured at first and it is used for single TRP case.

- APPLE agree with QC proposal and think the proposals from QC are simple. LG E has different understanding as QC in terms of how PTAG is defined and think the index is not so important.

- HW think the main issue is the two TAGs used for SpCell and think this is functional discussions. Samsung/ZTE/vivo agree with HW. Ericsson also think we need to discuss procedure before modelling. DCM agree.

- vivo think we can start with baseline such as only one TAG. LG think the first step is what if the TAT of PTAG expires. Nokia also think RAN2 can discuss on this.

- Xiaomi wonders how 2 TAGs are configured.

- OPPO suggest to wait for R1 reply. ZTE agrees.

- DCM think R1 may reply for pcell and scell cases and think we can wait.

Impacts on TAC MAC CE and/or RAR

R2-2305921 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, parallel RACH on different TRPs is not supported.*

*Proposal 2: Use one R bit of absolute TA command MAC CE to indicate the TAG which the TA command applies to. “0” means the first TAG configured for SpCell and “1” means the second TAG configured for SpCell.*

*Proposal 3: Wait for RAN1 to decide whether to modify the RAR format for both 2-step RACH and 4-step RACH defined in MAC spec.*

*Proposal 4: RAN2 assumes that a serving cell can be associated with two TAGs and each UL/joint TCI state of the serving cell belongs to either TAG associated with the serving cell.*

*Proposal 5: In Rel-18, the maximum number of TAGs is the same like in Rel-17, including when multi-DCI multi-TRP operation is used.*

*Proposal 6: HARQ buffers are not flushed on a serving cell until both associated TATs expire. If this is PCell for mTRP, HARQ buffers are flushed for all serving cells if both associated TATs expire.*

P2:

- DCM/ZTE agree with P2 and think this is same as R1 agreement. LG think this relate to whether we have one PTAG or two. Nokia think P2 and P3 do not align and think 2 step and 4 step should be discussed together.

- Nokia/Ericsson has concern to agree P2 as working assumption.

- vivo agree with P2 in general but think wording can be improved.

??

Working assumption (which aligns with R1 agreement): For intra-cell case, for 2-step RACH, we will revise absolute TA command MAC CE to indicate the TAG which the TA command applies to. FFS how.

FFS for 4-step case.

Offline discussions on P2 and P3, taking into account the comments online.

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R2-2304938 Further issues for Multi-TRP with two TAs support SHARP Corporation discussion NR\_MIMO\_evo\_DL\_UL-Core

R2-2305318 Discussions on Two TAs for Multi-DCI Multi-TRP CATT discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2305588 Discussion on Two TAs for Multi-TRP NEC Corporation discussion NR\_MIMO\_evo\_DL\_UL-Core

R2-2305719 Discussion on the impacts of Two TAs for multi-DCI multi-TRP operation Lenovo discussion Rel-18

R2-2305720 Discussion on the UE-initiated RACH procedure in multi-TRP operation Lenovo discussion Rel-18

R2-2305752 RA procedure while SpCell is configured with 2 TAGs Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2305848 On 2TA operation Ericsson discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core Withdrawn

R2-2306036 On 2TA operation Ericsson discussion Rel-18

R2-2306161 Support of Two TAs for multi-DCI multi-TRP Apple discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2306327 Discussion on two TAs for multi-DCI multi-TRP Samsung Research America discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2306421 Further Considerations On UE initiated RACH for acquiring 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, including:

unified TCI extension to mTRP operation, including the cases for sDCI and mDCT, and other topics if identified

Unified TCI extension to mTRP operation

R2-2306225 Remaining issues on unified TCI extension to mTRP operation Samsung discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1: RAN2 confirm the following working assumption as an agreement.*

* 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 i.e. the activated unified TCI state(s) for the first TRP can be associated with the serving cell PCI and the activated unified TCI state(s) for the second TRP can be associated with a PCI other than the serving cell PCI.*

*Proposal 3: For sDCI based mTRP operation using unified TCI state framework, introduce the new MAC CE containing following 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(s) indicating:*

* whether TCI state(s) for TRP(s) uses the joint DL/UL TCI mode or the separate TCI mode*

* if the unified TCI state of the second TRP is present or not,*

* if the indicated TCI codepoint is consist of one TCI state, whether the indicated TCI state(s) is for the first or second TRP(s)*

R2-2306532 Considerations on unified TCI state extension for s-DCI based mTRP ZTE Corporation,Sanechips discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

*Proposal 1. Design a new unified TCI state activation/deactivation MAC CE (e.g. enhanced unified TCI state activation/deactivation MAC CE) for the case of s-DCI based mTRP.*

*Proposal 2. The enhancement unified TCI state MAC CE can be studied based on the below structure.*

R2-2304767 Discussion on MAC CE design for mTRP OPPO discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2304876 RAN2 impacts of multi-TRP with unified TCI states Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2305319 Discussion on Unified TCI Framework Extension for Multi-TRP CATT discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2305800 Discussion on unified TCI framework extension for mTRP operation Qualcomm Incorporated discussion NR\_MIMO\_evo\_DL\_UL-Core

R2-2305851 On unified TCI for mTRP Ericsson discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2305922 Extension of unified TCI framework for mTRP Huawei, HiSilicon discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2306129 Intra-UE prioritization for Simultaneous multi-panel transmission ASUSTeK discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core R2-2303939

R2-2306144 Discussion on impact of multi-TRP on MAC CE LG Electronics Inc. discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

R2-2306420 Considerations on unified TCI state extension for s-DCI based mTRP ZTE Corporation,Sanechips discussion Rel-18 NR\_MIMO\_evo\_DL\_UL-Core

=> Revised in R2-2306532