**3GPP TSG RAN WG1 #110b-e R1-220XXXX**

**e-Meeting, October 10th – 19th, 2022**

**Agenda item:** 9.12.2

**Source:** Moderator (CATT)

**Title:** Moderator summary on Timing advance management: Round 1

**Document for:** Discussion and Decision

# Introduction

In RAN #94e, the Rel-18 WID of Further NR mobility enhancements are approved [1]. In the approved WID, Timing Advance management is a part of RAN1 objectives,

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| *To specify mechanism and procedures of L1/L2 based inter-cell mobility for mobility latency reduction:** *Configuration and maintenance for multiple candidate cells to allow fast application of configurations for candidate cells [RAN2, RAN3]*
* *Dynamic switch mechanism among candidate serving cells (including SpCell and SCell) for the potential applicable scenarios based on L1/L2 signalling [RAN2, RAN1]*
* *L1 enhancements for inter-cell beam management, including L1 measurement and reporting, and beam indication [RAN1, RAN2]*
	+ *Note 1: Early RAN2 involvement is necessary, including the possibility of further clarifying the interaction between this bullet with the previous bullet*
* *Timing Advance management [RAN1, RAN2]*
* *CU-DU interface signaling to support L1/L2 mobility, if needed [RAN3]*

*Note 2: FR2 specific enhancements are not precluded, if any.**Note 3: The procedure of L1/L2 based inter-cell mobility are applicable to the following scenarios:** + - *Standalone, CA and NR-DC case with serving cell change within one CG*
		- *Intra-DU case and intra-CU inter-DU case (applicable for Standalone and CA: no new RAN interfaces are expected)*
		- *Both intra-frequency and inter-frequency*
		- *Both FR1 and FR2*
		- *Source and target cells may be synchronized or non-synchronized*
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This summary includes the following:

* Summary of companies’ views on each of open issues raised by interested companies
* Observation and recommended proposal based on the summary of companies’ views

# Issue 1 – TA acquisition

Open issues on TA acquisition of the candidate target cell and company views are summarized below.

Table 1 Summary for Issue 1

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| **#** | **Issue** | **Companies’ views** |
| 1.1 | On whether TA acquisition of candidate target cell before handover should be supported in L1/L2 based mobility | Support*Huawei,vivo, MTK, CATT, OPPO, Futurewei, Apple, Spreadtrum, Interdigital, Google, QC(deactivated cell)* |
| 1.2 | Mechanism to obtain TA of candidate target cell  | Opt1: RACH based solution*Ericsson* Opt 1.1: PDCCH ordered RACH*Huawei, vivo, CATT, Samsung, NTT DoCoMo, OPPO, ZTE, CMCC, Google, Spreadtrum, Xiaomi, MTK, Google, QC* Opt 1.2: UE-triggered RACH*Samsung, NTT DoCoMo, CMCC ,Google, QC*Opt2: RACH-less solution Opt2.1: SRS based TA acquisition*Huawei, OPPO, Qualcomm, CMCC, Xiaomi, Futurewei(SRS based TA acquisition + DL reference timing difference)* Opt2.2: others*Qualcomm(UE reports Rx timing difference)**Xiaomi(measured by UE itself)* |
| 1.3 | Number of TA for candidate cells needs to be acquired | Opt1: One*Huawei, Google*Opt2: More than one*Huawei, Nokia, MTK*Depends on UE capability*Vivo, QC*FFS: detailed number*Spreadtrum* |
| 1.4  | Condition to trigger TA updating | Opt1: Expiration of TAT*ZTE*Opt2: others*Futurewei*(*timing offset of the received SRS over the serving node’s local time reference above a threshold)**Qualcomm**(SpCell/CG update command, or triggered/activated by gNB)* |

**Proposal 1.1:** Support TA acquisition of candidate target cell before handover in L1/L2 based mobility.

**Please share your views on issue 1.1 in the following table.**

|  |  |
| --- | --- |
| **Company** | **Input** |
| Google | Support proposal 1.1. |
| OPPO | Support |
| QC | Suggest to add “deactivated”, since if the target cell is an activated SCell, then no need any enhancementSupport TA acquisition of deactivated candidate target cell before handover in L1/L2 based mobility |
| Lenovo | Support  |
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**Proposal 1.2:** On mechanism to obtain TA of the non-serving cell, discuss and down-select among the following alternatives:

* Alt 1: RACH-based mechanisms

FFS: PDCCH ordered RACH/ UE-triggered RACH/ others

* Alt2: RACH-less solution

FFS: SRS based TA acquisition

**Please share your views on issue 1.2 in the following table.**

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| **Company** | **Input** |
| Google | Support in principle, but the wording can be changed a bit in the main-bullet as follows?**Proposal 1.2:** On mechanism for TA measurement ~~to obtain TA~~ of the non-serving cell, discuss and down-select among the following alternatives: |
| OPPO | Support and ok with the change suggested by Google |
| QC | Suggest the following wording, since candidate cell can also be configured serving cell, and the TA update is only needed to be enhanced for deactivated candidate cell. Also add Rx timing difference based into the FFS for down selection**Proposal 1.2:** On mechanism to obtain TA of the ~~non-serving~~ deactivated candidate cell, discuss and down-select among the following alternatives:* Alt 1: RACH-based mechanisms

FFS: PDCCH ordered RACH/ UE-triggered RACH/ others * Alt2: RACH-less solution

FFS: SRS based TA acquisition/Rx timing difference based |
| Lenovo | Support to study the two alternatives first, whether it needs to be down-selected is too early. |
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**Please share your views on issue 1.3 in the following table.**

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| **Company** | **Input** |
| Google | We think this is talking about number of TAGs? In our view, 1 TAG should be sufficient.  |
| OPPO |  |
| QC | This would depend on UE capability |
| Lenovo | Agree with QC that it depends on UE capability. |
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**Please share your views on issue 1.4 in the following table.**

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| **Company** | **Input** |
| Google | This seems to be a RAN2 issue? |
| OPPO | Is this to ask the UE maintain and track an TA of non-serving cell even before the UE switches to that cell? If so, we do not think this function is needed.  |
| QC | Updated our view, e.g. the update can be triggered/activated by gNB |
| Lenovo | Similar view with Google that it may be a RAN2 issue. In our opinion, it can triggered /activated by gNB or UE.  |
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# Issue 2 – TA indication

Open issues on TA indication and company views are summarized below.

Table 2 Summary for Issue 2

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| **#** | **Issue** | **Companies’ views** |
| 2.1 | Association between TA and candidate target cell | Alt1: Association between TA/TAG and candidate target cell implicitly (e.g. by TCI state indicating QCL source of candidate target cell index).*Samsung, CATT, MTK, Google*Alt2: Association between TA/TAG and candidate target cell ID explicitly.*NTT DoCoMo, ZTE, vivo, Qualcomm, OPPO* |
| 2.2 | When does the TA value of candidate target cell being indicated? | Alt1: before the UE handover to the target cell*, CATT*Alt2: in the handover command*vivo, Xiaomi, CATT, QC*Alt3: UE applying derived TA upon handover command*QC* |

**Proposal 2.1:** On association between TA and candidate target cell, discuss and down select from the following alternatives:

* Alt1: Associate TA/TAG and candidate target cell implicitly(e.g. by TCI state indicating QCL source of candidate target cell ID)
* Alt2: Associate TA/TAG and candidate target cell ID explicitly.

**Please share your views on issue 2.1 in the following table.**

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| **Company** | **Input** |
| Google | Support proposal 2.1 |
| QC | Fine to the proposal |
| Lenovo | Support the proposal. |
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**Proposal 2.2:** On the indication of the TA value of the target cell, discuss and down select from the following alternatives:

* Alt1: before the UE handover to the target cell
* Alt2: in the handover command

**Please share your views on issue 2.2 in the following table.**

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| --- | --- |
| **Company** | **Input** |
| Google | This may need more study, and we can make a decision after we see the general procedure for R18 mobility |
| OPPO | Indeed, the TA shall be indicated to the UE before the UE conduct the operation of switching from current cell to the target cell. So the TA value can be included in the handover command or be indicated to UE separately. However, the design of handover command and handover procedure is part of RAN2 discussion. So shall this be left to RAN2?  |
| QC | Suggest to add Alt3, which is based on Rx timing difference measured at UE, which further derives the TAAlt3: UE applying derived TA upon handover command |
| Lenovo | Similar view with Google. |
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# Issue 3 – Relationship between L1-L2 mobility and multi-DCI based multi-TRP transmission on TA management

Open issues on Relationship between L1-L2 mobility and multi-DCI based multi-TRP transmission on TA management and company views are summarized below.

Table 3 Summary for Issue 3

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| **#** | **Issue** | **Companies’ views** |
| 3.1 | Unified or independent design on TA management between L1-L2 mobility and multi-DCI based multi-TRP transmissionIt has been agreed to support two TAs in multi-DCI based multi-TRP transmission for Rel-18 FeMIMO. So, one open issue is whether to consider/extend the TA management mechanism of multi-DCI based multi-TRP in L1-L2 based inter-cell mobility.  | Alt1: Unified design on TA management and maintain as much commonalities as possible*Huawei, Ericsson, Apple, ZTE, Xiaomi*Alt2: Independent design for multi-DCI based m-TRP and L1-L2 mobilityQC |

**Proposal 3.1:** On the relationship between two TA mechanisms in Rel-18 multi-DCI based mTRP and L1/L2 based mobility, discuss and down select from the following alternatives:

* Alt1: Unified design on TA management and maintain as much commonalities as possible
* Alt2: Independent design for multi-DCI based m-TRP and L1-L2 mobility

**Please share your views on issue 3.1 in the following table.**

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| **Company** | **Input** |
| Google | We think these should be two independent features.  |
| OPPO | Two independent features. The method to measure the uplink timing for obtain TA can be used by both. But the design of TA indication would be totally independent features. |
| QC | They are independent. Any example how to unify the design? |
| Lenovo | There are two independent features therefore it is not neccessary to target for an unified design. |
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# Other potential issues

**Please share your views on other issues in the following table.**

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| **Company** | **Input** |
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# References

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