**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* |
| 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* Opt 1.2: UE-triggered RACH*Samsung, NTT DoCoMo, CMCC ,Google*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*Opt2: More than one*Huawei, Nokia, MTK*Depends on UE capability*vivo*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)* |

**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.**

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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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**Please share your views on issue 1.3 in the following table.**

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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*Alt2: Association between TA/TAG and candidate target cell ID explicitly.*NTT DoCoMo, ZTE, vivo, Qualcomm* |
| 2.2 | When does the TA value of candidate target cell being indicated? | Alt1: before the UE handover to the target cell*OPPO, CATT*Alt2: in the handover command*vivo, Xiaomi, CATT* |

**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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**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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# 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 mobility |

**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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# Other potential issues

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

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