**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* |
| 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* 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, Google*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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| --- | --- |
| **Company** | **Input** |
| Google | Support proposal 1.1. |
| OPPO | 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.**

|  |  |
| --- | --- |
| **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 |
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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 |  |
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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.  |
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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* |

**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 |
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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?  |
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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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| **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. |
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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

1. RP-222332 Revised WID on Further NR mobility enhancements MediaTek (Moderator)
2. R1-2208383 Latency Reduction and Target TA Determination for L1/L2 Mobility FUTUREWEI
3. [R1-2208407](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208407.zip) Timing advance management to reduce latency Huawei, HiSilicon
4. [R1-2208501](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208501.zip) Discussion on timing advance management for L1/L2-based inter-cell mobility Nokia, Nokia Shanghai Bell
5. R1-2208510 Enhancements on TA management to reduce latency ZTE
6. [R1-2208571](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208571.zip) Discussion on timing advance management to reduce latency Spreadtrum Communications
7. [R1-2208665](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208665.zip) Discussion on TA management for L1/L2 moblity vivo
8. [R1-2208748](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208748.zip) Timing advancement management for L1L2 mobility Lenovo
9. [R1-2208806](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208806.zip) Discussions on Timing Advance Management OPPO
10. [R1-2208885](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208885.zip) On TA management for NR mobility enhancement Google
11. [R1-2208959](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208959.zip) On timing advance management to reduce latency CATT
12. [R1-2209074](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209074.zip) On Timing Advance Management Intel Corporation
13. [R1-2209204](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209204.zip) Timing advance management to reduce latency InterDigital, Inc.
14. [R1-2209269](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209269.zip) Discussion on Timing advance management xiaomi
15. [R1-2209360](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209360.zip) Discussion on timing advance management to reduce latency CMCC
16. [R1-2209499](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209499.zip) UL Timing management to reduce handover latency MediaTek Inc.
17. [R1-2209542](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209542.zip) Timing advance management to reduce latency Ericsson
18. [R1-2209604](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209604.zip) Timing advance management to reduce mobility latency Apple
19. [R1-2209755](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209755.zip) Non-serving cell TA management for NR mobility enhancement Samsung
20. [R1-2209924](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209924.zip) Timing advance enhancement for inter-cell mobility NTT DOCOMO, INC
21. [R1-2210009](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210009.zip) TA management to reduce latency for L1/L2 based mobility Qualcomm Incorporated
22. [R1-2210200](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210200.zip) Timing advance alignment with low latency Rakuten Symphony