**3GPP TSG-SA5 Meeting #155 *S5-243267***

**Jeju, South Korea, 27 – 31 May 2024**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **28.552** | **CR** | **0569** | **rev** | **1** | **Current version:** | **18.6.0** |  |
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| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Rel-19 CR TS 28.552 New measurement on Distribution of time interval for L1/L2 Triggered Mobility |
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| ***Source to WG:*** | Nokia, Apple |
| ***Source to TSG:*** | S5 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** | 2024-05-16 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | LTM (L1/L2 Triggered Mobility) is a procedure in which a gNB receives L1 measurement report(s) from a UE, and on their basis the gNB changes UE’s serving cell by a cell switch command signaled via a MAC CE. The cell switch command indicates an LTM candidate cell configuration that the gNB previously prepared and provided to the UE through RRC signalling. Prior to sending the cell switch command it is possible to initiate UL TA acquisition procedure to one or multiple cells that are different from the current serving cell. For instance, the network may request the UE to perform early TA acquisition of a candidate cell before a cell switch. The early TA acquisition is triggered by PDCCH order as specified in clause 9.2.6 of the 3GPP 38.300. The obtained TA value may be then sent within the cell switch command which reduces mobility latency. Then the UE switches to the target cell according to the cell switch command. However, a LTM may be initiated even when TA acquisition has been triggered, but not yet completed. Typical reason may be when TA acquisition procedure was triggered too late. As another case a scenario when TA acquisition was successfully but TA value of the LTM candidate cell is evaluated as invalid. Typical reason may be when early TA acquisition is triggered too early.It is therefore recommended to define some new measurements related to distribution of time interval between initiation of Early TA acquisition and completion of the Early TA acquisition procedure/initiation of L1/L2 Triggered Mobility deo specific cases when TA is included or not within the Cell switch command message to identify too late and too early triggered TA acquisition procedure. |
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| ***Summary of change:*** | New measurement ““Distribution of time interval between initiation of Early TA acquisition and initiation of L1/L2 Triggered Mobility (successful scenario)”, “Distribution of time interval between initiation and successful completion of Early TA acquisition (successful scenario)”, “Distribution of time interval between initiation of Early TA acquisition and initiation L1/L2 Triggered Mobility (unsuccessful scenario 1)”, “Distribution of time interval between initiation and successful completion of Early TA acquisition (unsuccessful scenario 1)”, “Distribution of time interval between initiation of Early TA acquisition and initiation L1/L2 Triggered Mobility (unsuccessful scenario 2)”, and “Distribution of time interval between initiation of and successful completion of Early TA acquisition (unsuccessful scenario 2)”. |
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| ***Consequences if not approved:*** | Monitoring of the too late and too early triggered TA acquisition procedure for LTM is not possible. |
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| ***Clauses affected:*** | 5.1.1.6.x.1 (new), 5.1.1.6.x.2 (new), 5.1.1.6.x.3 (new), 5.1.1.6.x.4 (new), 5.1.1.6.x.5 (new), 5.1.1.6.x.6 (new), A.y (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ... |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | S5-243267 is a revision of S5-242671 |

***Start of first Change***

##### 5.1.1.6.x.1 Distribution of time interval between initiation of Early TA acquisition and initiation of L1/L2 Triggered Mobility (successful scenario)

a) This measurement provides distribution of the time interval between initiation of Early TA acquisition and initiation of L1/L2 Triggered Mobility (LTM) in successful scenario. The successful scenario reflects here to a scenario when early TA acquisition is successfully completed before the LTM is triggered. The measurement is provided per source and target candidate cell pair and optionally may be also provided per 5QI.

b) CC

c) Inter gNB-DU LTM:

Each sample is obtained as difference between the point in time when Cell switch command is send to UE from the source cell of source gNB-DU serving the UE in this point of time (step 18 in Figure 8.2.1.5-1 of TS 38.300 ) with TA value include for the candidate target cell of the candidate target gNB-DU for which UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which was successfully completed via reception of the TA value in the source cell of source gNB-DU within the CU-DU TA INFORMATION TRANSFER message from gNB-CU ((step 15 in Figure 8.2.1.5-1 of TS 38.300), and point in time when UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the clause 9.2.6 of TS 38.300 [49].

The source gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in source gNB-DU per source and target candidate cell pair.

 Intra gNB-DU LTM:

Each sample is obtained as difference between the point in time when Cell switch command is send to UE from the source cell of gNB-DU serving the UE in this point of time (step 13 in Figure 8.2.1.4-1 of TS 38.300 [49]) with TA value include for the candidate target cell of the gNB-DU for which UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which was successfully completed via reception of the TA value in the source cell from candidate target cell internally within the gNB-DU, and point in time when UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in gNB-DU per source and target candidate cell pair.

d) Each measurement is an integer.

e) The measurement name has the form MM.TAAckLTMSuccDist.Bin.5QI, where Bin indicates a delay range which is vendor specific.

f) NRCellDU;
NRCellRelation

g) Valid for packet switched traffic.

h) 5GS

##### 5.1.1.6.x.2 Distribution of time interval between initiation and successful completion of Early TA acquisition (successful scenario)

a) This measurement provides distribution of the time interval between initiation and successful completion of Early TA acquisition related to LTM in successful scenario. The successful scenario reflects here to a scenario when early TA acquisition is successfully completed before the LTM is consequently triggered. The measurement is provided per source and target candidate cell pair and optionally may be also provided per 5QI.

b) CC

c) Inter gNB-DU LTM:

Each sample is obtained as difference between the point in time when early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) for the candidate target cell of target gNB-DU was successfully completed via reception of the TA value in the source cell of source gNB-DU within the CU-DU TA INFORMATION TRANSFER message from gNB-CU ((step 15 in Figure 8.2.1.5-1 of TS 38.300 [49]) which was consequently followed with sending the Cell switch command to UE from the source cell of source gNB-DU serving the UE in this point of time (step 18 in Figure 8.2.1.5-1 of TS 38.300 [49]) with TA value include, and point in time when UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The source gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in source gNB-DU per source and target candidate cell pair.

 Intra gNB-DU LTM:

Each sample is obtained as difference between the point in time when TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) was successfully completed via reception of the TA value in the source cell from candidate target cell internally within the gNB-DU which was consequently followed with sending the Cell switch command to UE from the source cell of gNB-DU serving the UE in this point of time (step 13 in Figure 8.2.1.4-1 of TS 38.300 [49]) with TA value include, and point in time when UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in gNB-DU per source and target candidate cell pair.

d) Each measurement is an integer.

e) The measurement name has the form MM.TAAckSuccDist.Bin.5QI, where Bin indicates a delay range which is vendor specific.

f) NRCellDU;
NRCellRelation

g) Valid for packet switched traffic.

h) 5GS

##### 5.1.1.6.x.3 Distribution of time interval between initiation of Early TA acquisition and initiation of L1/L2 Triggered Mobility (unsuccessful scenario 1)

a) This measurement provides distribution of the time interval between initiation of Early TA acquisition and initiation of L1/L2 Triggered Mobility (LTM) in unsuccessful scenario 1. The unsuccessful scenario 1 reflects here to a scenario when early TA acquisition is successfully completed but the LTM was already triggered. The measurement is provided per source and target candidate cell pair and optionally may be also provided per 5QI.

b) CC

c) Inter gNB-DU LTM:

Each sample is obtained as difference between the point in time when Cell switch command is send to UE from the source cell of source gNB-DU serving the UE in this point of time (step 18 in Figure 8.2.1.5-1 of TS 38.300 [49]) with TA value not included for the candidate target cell of the candidate target gNB-DU for which UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which was successfully completed via reception of the TA value in the source cell of source gNB-DU within the CU-DU TA INFORMATION TRANSFER message from gNB-CU ((step 15 in Figure 8.2.1.5-1 of TS 38.300 [49]) but after sending the Cell switch command to UE (after the step 18 in Figure 8.2.1.5-1 of TS 38.300 [49]), and point in time when UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The source gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in source gNB-DU per source and target candidate cell pair.

 Intra gNB-DU LTM:

Each sample is obtained as difference between the point in time when Cell switch command is send to UE from the source cell of gNB-DU serving the UE in this point of time (step 13 in Figure 8.2.1.4-1 of TS 38.300 [49]) with TA value include for the candidate target cell of the gNB-DU for which UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which was successfully completed via reception of the TA value in the source cell from candidate target cell internally within the gNB-DU but after sending the Cell switch command to UE (after the step 13 in Figure 8.2.1.4-1 of TS 38.300 [49]), and point in time when UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in gNB-DU per source and target candidate cell pair.

d) Each measurement is an integer.

e) The measurement name has the form MM.TAAckLTMUnSucc1Dist.Bin.5QI, where Bin indicates a delay range which is vendor specific.

f) NRCellDU;
NRCellRelation

g) Valid for packet switched traffic.

h) 5GS

##### 5.1.1.6.x.4 Distribution of time interval between initiation and successful completion of Early TA acquisition (unsuccessful scenario 1)

a) This measurement provides distribution of the time interval between initiation and successful completion of Early TA acquisition related to LTM in unsuccessful scenario 1. The unsuccessful scenario 1 reflects here to a scenario when early TA acquisition is successfully completed but the LTM was already triggered. The measurement is provided per source and target candidate cell pair and optionally may be also provided per 5QI.

b) CC

c) Inter gNB-DU LTM:

Each sample is obtained as difference between the point in time when early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) for the candidate target cell of target gNB-DU was successfully completed via reception of the TA value in the source cell of source gNB-DU within the CU-DU TA INFORMATION TRANSFER message from gNB-CU ((step 15 in Figure 8.2.1.5-1 of TS 38.300 [49]) but after sending the Cell switch command to UE (after the step 18 in Figure 8.2.1.5-1 of TS 38.300 [49]), and point in time when UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The source gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in source gNB-DU per source and target candidate cell pair.

 Intra gNB-DU LTM:

Each sample is obtained as difference between the point in time when TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) was successfully completed via reception of the TA value in the source cell from candidate target cell internally within the gNB-DU but after sending the Cell switch command to UE (after the step 13 in Figure 8.2.1.4-1 of TS 38.300 [49]), and point in time when UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in gNB-DU per source and target candidate cell pair.

d) Each measurement is an integer.

e) The measurement name has the form MM.TAAckUnSucc1Dist.Bin.5QI, where Bin indicates a delay range which is vendor specific.

f) NRCellDU;
NRCellRelation

g) Valid for packet switched traffic.

h) 5GS

##### 5.1.1.6.x.5 Distribution of time interval between initiation of Early TA acquisition and initiation of L1/L2 Triggered Mobility (unsuccessful scenario 2)

a) This measurement provides distribution of the time interval between initiation of Early TA acquisition and initiation of L1/L2 Triggered Mobility (LTM) in unsuccessful scenario 2. The unsuccessful scenario 2 reflects here to a scenario when early TA acquisition is successfully completed before the LTM is triggered however source cell side evaluates the TA value as invalid at the point in time when LTM is triggered. The measurement is provided per source and target candidate cell pair and optionally may be also provided per 5QI.

b) CC

c) Inter gNB-DU LTM:

Each sample is obtained as difference between the point in time when Cell switch command is send to UE from the source cell of source gNB-DU serving the UE in this point of time (step 18 in Figure 8.2.1.5-1 of TS 38.300 [49] ) with TA value not included for the candidate target cell of the candidate target gNB-DU for which UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which was successfully completed via reception of the TA value in the source cell of source gNB-DU within the CU-DU TA INFORMATION TRANSFER message from gNB-CU ((step 15 in Figure 8.2.1.5-1 of TS 38.300 [49]) before sending the Cell switch command to UE (after the step 18 in Figure 8.2.1.5-1 of TS 38.300 [49]) but source of source gNB-DU evaluated the TA value as invalid, and point in time when UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The source gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in source gNB-DU per source and target candidate cell pair.

 Intra gNB-DU LTM:

Each sample is obtained as difference between the point in time when Cell switch command is send to UE from the source cell of gNB-DU serving the UE in this point of time (step 13 in Figure 8.2.1.4-1 of TS 38.300 [49]) with TA value include for the candidate target cell of the gNB-DU for which UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which was successfully completed via reception of the TA value in the source cell from candidate target cell internally within the gNB-DU before sending the Cell switch command to UE (after the step 13 in Figure 8.2.1.4-1 of TS 38.300 [49]) but the source cell of the gNB-DU evaluated the TA value as invalid, and point in time when UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in gNB-DU per source and target candidate cell pair.

d) Each measurement is an integer.

e) The measurement name has the form MM.TAAckLTMUnSucc2Dist.Bin.5QI, where Bin indicates a delay range which is vendor specific.

f) NRCellDU;
NRCellRelation

g) Valid for packet switched traffic.

h) 5GS

##### 5.1.1.6.x.6 Distribution of time interval between initiation of Early TA acquisition and successful completion of Early TA acquisition (unsuccessful scenario 2)

#### a) This measurement provides distribution of the time interval between initiation of Early TA acquisition and completion of the TA acquisition in unsuccessful scenario 2. The unsuccessful scenario 3 reflects here to a scenario when early TA acquisition is successfully completed before the LTM is triggered however source cell side evaluates the TA value as invalid at the point in time when LTM is triggered. The measurement is provided per source and target candidate cell pair and optionally may be also provided per 5QI.

b) CC

c) Inter gNB-DU LTM:

Each sample is obtained as difference between the point in time when early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) for the candidate target cell of target gNB-DU was successfully completed via reception of the TA value in the source cell of source gNB-DU within the CU-DU TA INFORMATION TRANSFER message from gNB-CU ((step 15 in Figure 8.2.1.5-1 of TS 38.300 [49]) which was consequently followed with sending the Cell switch command to UE from the source cell of source gNB-DU serving the UE in this point of time (step 18 in Figure 8.2.1.5-1 of TS 38.300 [49] ) with TA value include, but source of source gNB-DU evaluated the TA value as invalid, and point in time when UE was previously instructed to start early TA acquisition procedure (step 13 in Figure 8.2.1.5-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The source gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in source gNB-DU per source and target candidate cell pair.

 Intra gNB-DU LTM:

Each sample is obtained as difference between the point in time when TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) was successfully completed via reception of the TA value in the source cell from candidate target cell internally within the gNB-DU which was consequently followed with sending the Cell switch command to UE from the source cell of gNB-DU serving the UE in this point of time (step 13 in Figure 8.2.1.4-1 of TS 38.300 [49]) with TA value include, and point in time when UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) but the source cell of the gNB-DU evaluated the TA value as invalid, and point in time when UE was previously instructed to start early TA acquisition procedure (step 11 in Figure 8.2.1.4-1 of TS 38.300 [49]) which is in details triggered on successful transmission of RA Preamble by the source gNB-DU to UE for Early TA acquisition procedure as defined in the chapter 9.2.6, 3GPP TS 38.300 [49].

The gNB-DU increments the corresponding bin with the delay range where the measured time interval falls into by 1 for the counters. The measurement is pegged in gNB-DU per source and target candidate cell pair.

d) Each measurement is an integer.

e) The measurement name has the form MM.TAAckLTMUnSucc3Dist.Bin.5QI, where Bin indicates a delay range which is vendor specific.

f) NRCellDU;
NRCellRelation

g) Valid for packet switched traffic.

h) 5GS

***Start of next Change***

# A.y Distribution of time interval for L1/L2 Triggered Mobility

LTM (L1/L2 Triggered Mobility) is a procedure in which a gNB receives L1 measurement report(s) from a UE, and on their basis the gNB changes UE’s serving cell by a cell switch command signaled via a MAC CE. The cell switch command indicates an LTM candidate cell configuration that the gNB previously prepared and provided to the UE through RRC signalling. Prior to sending the cell switch command it is possible to initiate UL TA acquisition procedure to one or multiple cells that are different from the current serving cell. For instance, the network may request the UE to perform early TA acquisition of a candidate cell before a cell switch. The early TA acquisition is triggered by PDCCH order as specified in clause 9.2.6 of the 3GPP 38.300. The obtained TA value may be then sent within the cell switch command which reduces mobility latency. Then the UE switches to the target cell according to the cell switch command.

However, a LTM may be initiated even when TA acquisition has been triggered, but not yet completed. Typical reason may be when TA acquisition procedure was triggered too late. As another case a scenario when TA acquisition was successfully but TA value of the LTM candidate cell is evaluated as invalid. Typical reason may be when early TA acquisition is triggered too early.

It is therefore recommended to provide monitoring with the following measurements: “Distribution of time interval between initiation of Early TA acquisition and initiation of L1/L2 Triggered Mobility (successful scenario)”, “Distribution of time interval between initiation and successful completion of Early TA acquisition (successful scenario)”, “Distribution of time interval between initiation of Early TA acquisition and initiation L1/L2 Triggered Mobility (unsuccessful scenario 1)”, “Distribution of time interval between initiation and successful completion of Early TA acquisition (unsuccessful scenario 1)”, “Distribution of time interval between initiation of Early TA acquisition and initiation L1/L2 Triggered Mobility (unsuccessful scenario 2)”, and “Distribution of time interval between initiation of and successful completion of Early TA acquisition (unsuccessful scenario 2) to identify proactively too late and too early triggered TA acquisition procedure and take preventive actions to avoid them.

***End of Changes***