3GPP TSG-RAN WG3 #115-e R3-222418

21 Feb - 3 Mar 2022

Online

Agenda Item: 10.2.1.4

Source: ZTE (moderator)

Title: Summary of Offline Discussion on CB: # SONMDT2\_UEHistoryInfor

Document for: Approval

# Introduction

**CB: # SONMDT2\_UEHistoryInfor**

**- Turn WAs to agreements? Continue the discussion on the open issues from last meeting**

**- Time information for SN UHI: Time spent without SCG and/or Time stamp?**

**- Capture agreements and update the TPs if agreeable**

(ZTE - moderator)

Summary of offline disc R3-222418

It is proposed to divide the discussion into two phases:

**- Phase 1: Identify the issues to be discussed in RAN3**

 Deadline: Please provide your views by 4:00am UTC Friday February 25th

**- Phase 2: Further discussion to capture agreements and open issues**

 Deadline: TBD pending on the outcome of Phase 1

# For the Chairman’s Notes

[TBD]

# Phase 1 discussion

## Whether to include Time spent without SCG and/or Time stamp?

In the last meeting, it is still FFS whether MN can correlate MN and SN UHI only based on time stay in PSCell. According to the contributions, majority companies acknowledge that a correlation issue may occur when the time stay parameter exceeds its limit. But companies have diverging views on how to solve this issue. [1] believes that both Time spent without SCG and Time stamp can be included. [2] proposes to extend the max value of the time stayed in one cell or specify that the stay time is continued in a successive entry once exceeded. [3] proposes to use the duration between two messages to calculate the accurate PSCell stay time, but the Time stamp solution is also acceptable. [6][9] believes that Time stamp is vital to achieve accurate correlation. [6] also proposes the following scenario when 2 consecutive PSCells exceed the time stay limit, it is not possible to achieve accurate correlation without Time stamp even Time spent without SCG is added. It seems that introducing Time stamp is acceptable for majority companies to help MN to correlate MN and SN UHI.



In the last meeting, it is also still FFS whether to include Time spent without SCG and/or Time stamp. The reasons for each camp are listed as follows.

Time stamp:

* Time spent without SCG will cause accumulating inaccuracy issue over the duration of DC operation which is not good for the correlation. Times tamp helps avoid this issue [9].
* Only including Time stamp is enough since time spent without SCG can be calculated based on the time stamp and time stay parameters [9].

Time spent without SCG:

* If Time stamp is used, the MN needs to extract time duration information for UE without SCG, which is more complex compared with Time spent without SCG [1]
* Using Time stamp will increase the overhead of inter-node message and require time synchronization [2]
* Time stamp is a point in time while the time without SN is a period of time. It is not possible to indicate the time duration without SN via a time stamp [3].
* This information can be used to enhance understanding of previous UE choices in terms of DC [6].

We have already discussed this issue in several meetings and it seems that both camps stay the same position. Moderator would suggest a hybrid scheme including both two parameters as a compromise. An example is given in the following figure to illustrate how to achieve the correlation based on the hybrid scheme. We can design the time stamp as the absolute time when a PSCell is added, thus the MN is aware of the starting time t1, t3, and t5 for each PSCell. Since we have agreed to include time UE stayed in the cell in SN UHI, MN can derive the corresponding leaving time t2, t4, and t6 for each PSCell according to the time stay parameters T1, T2, and T3 for each PSCell. But if the *time UE stayed in the cell* IE exceeds its limit, e.g. the limit is 4095 but T2 > 4095, then T2 will be set to 4095 and the calculated leaving time t’4 is wrong (PSCell 2 will only be correlated to PCell 1 instead of both PCell 1 and PCell 2 with this wrong information). When the the *time UE stayed in the cell* IE exceeds its limit, we can use time spent without SCG to calculate the correct leaving time of this PSCell, e.g. using the time spent without PSCell 2 T4 with t5 to derive the correct t4.



**Question 1: Companies are kindly asked which option below is preferred.**

1. **Time stamp**
2. **Time spent without SCG**
3. **Hybrid solution including both Time stamp and Time spent without SCG**

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| Company | Option | Comment |
| ZTE | 1) or 3) | UHI does not require strict synchronization, and the time differences among different base stations are very small. Thus the synchronization issue pointed out by the opponents is not critical. A correlation error will be caused if we only use 2) to achieve the correlation as analyzed in [9]. We think only including time stamp is enough since time spent without SCG can be calculated based on the time stamp and time stay parameters, but we can accept 3) as a compromise.  |
| Nokia | 1 | Time spent without PSCell is very questionable metric. First, it has to be measured at the MN, which means the MN has to be involved in the generating of SCG UHI – something that was agreed to be avoided. Then, its use is also doubtful – once DC is released, shall the MN keep counting “time without PSCell”? If not, then there will be hardly any “time without PScell”, because as long as DC is configured, there is always some PSCell. |
| Lenovo | 1) | The issue due to synchronization among gNBs/eNBs is negligible, and Option1 is preferred for MN to achieve the correlation. Option 3 is acceptable for the case that the time UE stayed in the cell IE exceeds the limit. |
| Qualcomm | Probably 1 | Does Option 1 include both the Timestamp of PSCell addition and Timestamp of PSCell release, or just the addition timestamp?If accurate correlation is not possible with just the Time spent without SCG, perhaps Option 1 is simple instead of using both the metrics in Option 3. |
| Samsung | None or the solution in [2] | For correlation purpose, time stay in PSCell from SN is enough. Because the MN also knows time spent without SCG and the time stay in PCell. Based on time stay in PCell, time stay in PSCell and time spent without SCG, the MN can make the correlation. The only thing needs to be considered is when the time UE stayed in a cell exceeds its limit, e.g. the limit is 4095. To solve this, extend the limit of time stay in PSCell is enough. Time stay in PScell is new added in Rel-17. There is no any issue to define a bigger limit. Or alternatively, to add a second entry once the timer is exceeded as proposed in [2]. To introduce an absolute time stamp for solving the not popular case is too much. The proponents of time stamp have emphasized the accuracy issue. Pls note that Ping-pong detection doesn’t need very accurate time information. The correlation function in MN is too complex already for implementation. To introduce a time stamp is not justified. |
| China Telecom | 2) or 3) | The *time spent without SCG* is useful when the *time UE stayed in the cell* IE exceeds the limit, to make progress on this issue, we can compromise to accept the hybrid solution of option3). |
| Huawei |  | We share similar view as Samsung. We are here talking about information **from SN**. SN report the history collected in this SN. The only problem, for correlation is if the time is exceeded. One simple solution is to extend the max value as Samsung propose. But the problem may still remain, only becomes less frequent. Another solution (while still keeping the concept of stay time) is to allow SN to report the same cell consecutive times if the time is exceeded where the actual stay time is the sum of stay times for a cell. If we talk about information **between MN**, we think the stay time without SCG is very important. In this case, it is not used to correlate the UHI from SN but rather used to understand whether a ping pong occurred between SN cells, or whether the time without SCG was large enough to not treat this as ping pong. In this case, the list is already correlated by the old MN, and the new MN can continue correlation. There is no problem that time thresholds were increased (i.e. the repeated cell from SN does not need to repeated when sent to MN) |
| CATT | 2） | We would like to provide our views on how to make MN and SN correlation and how to indicate the time duration without SCG separately1. indication of the time duration without SCG

For this,we think 2) is needed and we think it is only included in correlated UHI, i.e. after MN finished MN and SN correlation. Because SN cannot calculate Time spent without SCG(SN has been removed) and cannot send Time spent without SCG to MN in SN UHI, it is not useful for MN making correlation. We notice that RAN2 is also discussing to introduce the time without PSCell in UHI from UE as below. PSCell id is absent while time spent exist to indicate the time without PSCell. visitedPSCellInfoList-r17 ::= SEQUENCE (SIZE (1..maxPSCellHistory-r17)) OF VisitedPSCellInfo-r17VisitedPSCellInfo-r17 ::= SEQUENCE { visitedCellId-r17 CHOICE { nr-CellId-r17 CHOICE { cgi-Info-r17 CGI-Info-Logging-r16, pci-arfcn-r17 SEQUENCE { physCellId-r17 PhysCellId, carrierFreq-r17 ARFCN-ValueNR } }, eutra-CellId-r17 CHOICE { cellGlobalId-r17 CGI-InfoEUTRA, pci-arfcn-r17 SEQUENCE { physCellId-r17 EUTRA-PhysCellId, carrierFreq-r17 ARFCN-ValueEUTRA } } } OPTIONAL, timeSpent-r17 INTEGER (0..4095), ...We propose RAN3 to align RAN2 to explicitly introduce the Time spent without SCG in correlated UHI.1. how to make MN and SN correlation

We propose MN make correlation each time receiving SN UHI based on the stay time for each PSCell and the time of adding the SN and removing SN.For stay time exceeds 4095, there is an another solution without more spec impact: a SN Modification Required message is initiated from SN to MN when there is PSCell changed from cell b to cell c. Similar with legacy method, since the stay time in PSCell b exceeds 4095, the PSCell stay time in cell b would be set to 4095.In MN side, it is aware of the time period from the transmission of SN Addition Request message and the reception of SN Modification Required message. Therefore, the time period between these two messages minus the stay time in PSCell a is the accurate time in PSCell b, and then MN can make correct correlation of MN and SN UHI.Since we have agreed to introduce SN UHI in SN Modification Require message, there is no extra signalling impact with above solution. So, we have a slight preference on it.In one word, we believe the existing information captured in the TP can already enable MN to do the correlation completely. |
| CMCC | 2 ）Fine with 3） | We agree with the reason given by CATT, MN can make correlation each time receiving SN UHI based on the stay time for each PSCell and the time of adding the SN and removing SN.We can accept 3) as a compromise |
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## How to achieve the subscription mechanism

In the last meeting, It is still FFS which option below could be pursued to achieve the subscription mechanism.

Option 1: Add a subscription indicator in the SN addition request message to indicate the subscription of PSCell changes. SN sends the full SN UHI to MN during each PSCell change.

Option 2: Use the existing Location Information at S-NODE reporting IE to indicate the the subscription of PSCell changes. SN informs MN with the new PSCell ID during each PSCell change.

The reasons for each camp are listed as follows.

Option 1:

* The Location Reporting procedure is originally designed to acquire the UE location related information and initiated by AMF. It would be better to avoid reusing the same procedure for a different purpose [1][2][3].
* It is up to MN to do correlation, but MN would have to correlate UHI every time it receives the new PSCell ID. But MN can choose when to perform the correlation if full SN UHI is received [2].
* Since the SN UHI is already collected in the SN node, it is not preferred to let MN do the duplicated work [3].
* There may be a mismatch issue to let both SN and MN collect SN UHI [3][9].
* The existing IE is not suitable for subscription as it is a CN feature with strong constraints of usage [6].
* Option 1 is future proof, and it can still work if more parameters are added for SN UHI [9].

Option 2:

* No new IE or no new message is needed. There is no restriction in the specification that the MN can only include Location Information at S-NODE reporting IE when receiving request from the AMF. And in option1, for each PScell change, SN sends the list of 16 PSCell UHI which is really duplicated [15].

It seems hard to agree on option 1 based on the discussion of last meeting, and thus moderator would propose a compromise solution as option 3 to try to move forward.

**Question 2: Companies are kindly asked which option below is preferred.**

1. **Add a subscription indicator in the SN addition request message to indicate the subscription of PSCell changes. SN sends the full SN UHI to MN during each PSCell change.**
2. **Use the existing Location Information at S-NODE reporting IE to indicate the the subscription of PSCell changes. SN informs MN with the new PSCell ID during each PSCell change.**
3. **Add a new codepoint to the existing Location Information at S-NODE reporting IE to indicate the subscription of PSCell changes. SN sends the full SN UHI to MN during each PSCell change.**
4. **Add a subscription indicator in the SN addition request message to indicate the subscription of PSCell changes. SN sends the full SN UHI to MN if there are intra-SN PSCell changes.**

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| Company | Option | Comment |
| ZTE | 1. or 3)
 | Adding a new indicator for subscription initiated by NG-RAN is more straightforward, and it is not a big cost. It seems duplicated to let both SN and MN collect SN UHI, and this may also cause the mismatch issue. Considering above reasons, we prefer 1) but we can accept 3) as a compromise.  |
| Nokia | 2 or 3  | We do not think adding yet another subscription flag makes sense – the existing one hall rather be extended.Since this is the last meeting, we could accept also (1), but only if absolutely everybody else prefers it. |
| Lenovo | 1) | The existing Location Information at S-NODE reporting IE is used for Location Reporting procedure initiated by AMF, it is better to introduce a new indicator IE for SN UHI subscription that initiated by RAN node. |
| Qualcomm | Option 1 or Option 4 | Firstly, we think we can use a different mechanism than the existing Location Reporting procedure for the benefits highlighted by the moderator.Also in our understanding, the whole subscription mechanism being introduced is for MN to be aware of intra-SN PSCell changes without MN involvement (MN is aware of all other PSCell changes).To keep it simple (not send the full SN UHI every time there is a PSCell change), why not SN sends the full SN UHI to MN only during intra-SN PSCell changes?We therefore propose a 4th option:*Option 4: Add a subscription indicator in the SN addition request message to indicate the subscription of PSCell changes. SN sends the full SN UHI to MN* ***if there are intra-SN PSCell changes.*** |
| Samsung | 23 could be acceptable for compromise | We have good principle for RAN3 speciation design. RAN3 has been intentionally written in the way that one functionality is not restricted to one use case e.g. description from the receiver side, another example is that Retrieve UE Context procedure can be used for both RRC Reestablishment and RRC inactive mode. To say “the current PSCell ID reporting can only be triggered by the AMF” is not following the current specification. From one hand, in the specification, there is no description on when the MN trigger the procedure. From another handover, the MN shall store the PScell ID and may transfer it to the AMF. This means the MN may not transmit it to the AMF. *If the Location Information at S-NODE IE is included in the S-NODE ADDITION REQUEST ACKNOWLEDGE, the M-NG-RAN node shall store the included information so that it may be transferred towards the AMF。*To report the list of 16 PSCell UHI for each PScell change bring too much redundant. We already have query procedure for full SN UHI reporting.With all above and in our contribution, we support 2).But we can accept 3) as a compromise. |
| China Telecom | 1) or 3) | Add an optional new IE is more clearly and would not cause to much overhead, it is more suitable for MN to subscribe to PSCell changes, to make progress on this issue, we can compromise to accept option3). |
| Huawei | 4 | We prefer a separate mechanism. Impact on spec is small and it is better to separate this functionality.We see the benefit of sending the full history. This means the MN can use the same mechanism for correlation. This also mean that the MN can choose to make the correlation just before mobility. Otherwise, we get two separate functionalities for the same thing. |
| CATT | 1) | 1. Since the SN UHI is already collected in the SN node, it is not preferred to let MN do the duplicated work. What’s more, if we also let MN to collect SN UHI, it may happen that the SN UHI collected by SN and MN is different since the calculation in MN node would be impacted by the transport delay

If we decided that the subscription is used for the report of SN UHI, it should definitely use the different procedure with location report. |
| CMCC |  | In our view, it is not a technical issues. Both options works and does not have much difference. Although we prefer a new procedure, we can accept any one. |
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## Stage 3 details

It is noted that the maximum number of last visited PSCell is not aligned in the BL CRs. Thus, moderator would suggest setting this value to 16 based on experience.

**Question 3: Do companies agree to set the maximum number of last visited PSCell to 16?**

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| Company | Yes/No | Comment |
| ZTE | Yes |  |
| Nokia | Yes, but | Is this limit per list, so that it will be possible to have up to 16 PSCells per each PCell? If so, the extended UHI may be huge… Perhaps we could have a lower limit of PSCells per PCell? Like 8? |
| Lenovo | Yes  |  |
| Qualcomm |  | No strong view on the number. RAN2 agreed to have 4 PSCells per PCell. We can align with RAN2 or have 8 or 16 as well. |
| Samsung | Yes |  |
| China Telecom | Yes |  |
| Huawei | Yes |  |
| CATT | Yes |  |
| CMCC | Yes |  |
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In the current TS 38.413 BL CR, the structure of the Last Visited PSCell Information in 9.2.3.X is a bit complicated as shown below.

9.2.3.X Last Visited PSCell Information

The Last Visited PSCell Information may contain cell specific information.

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| --- | --- | --- | --- | --- |
| **IE/Group Name** | **Presence** | **Range** | **IE type and reference** | **Semantics description** |
| CHOICE *Last Visited PSCell Information* | M |  |  |  |
| >*NG-RAN Cell* |  |  |  |  |
| >>Last Visited NG-RAN PSCell Information | M |  | 9.2.3.X1 |  |
| >*E-UTRAN Cell* |  |  |  |  |
| >>Last Visited E-UTRAN PSCell Information | M |  | 9.2.3.X2 |  |

9.2.3.X1 Last Visited NG-RAN PSCell Information

The Last Visited NG-RAN PSCell Information contains information on the PSCell used and the time the UE accessed the cell.

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| **IE/Group Name** | **Presence** | **Range** | **IE type and reference** | **Semantics description** |
| PSCell ID | M |  | NR CGI9.3.1.7 |  |
| Time UE Stayed in Cell | M |  | INTEGER (0..40950) | The duration of time the UE stayed in the cell, or set of NR cells with the same NR ARFCN for reference point A, in 1/10 seconds. If the duration is more than 4095s, this IE is set to 40950. |

9.2.3.X2 Last Visited E-UTRAN PSCell Information

The Last Visited NG-RAN PSCell Information contains information on the PSCell used and the time the UE accessed the cell.

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| **IE/Group Name** | **Presence** | **Range** | **IE type and reference** | **Semantics description** |
| PSCell ID | M |  | E-UTRA CGI9.3.1.9 |  |
| Time UE Stayed in Cell | M |  | INTEGER (0..40950) | The duration of the time the UE stayed in the cell in 1/10 seconds. If the UE stays in a cell more than 4095s, this IE is set to 40950. |

Thus [13] propose to simplify the structure of the Last Visited PSCell information as below. In this simplified structure, only 9.2.3.X is kept while 9.2.3.X1 and 9.2.3.X2 are deleted.

9.2.3.X Last Visited PSCell Information

The Last Visited PSCell Information may contain cell specific information.

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| **IE/Group Name** | **Presence** | **Range** | **IE type and reference** | **Semantics description** | **Criticality** | **Assigned Criticality** |
| PSCell ID | M |  | NG-RAN CGI9.3.1.73 |  | - |  |
| Time UE Stayed in Cell | M |  | INTEGER (0..40950) | The duration of the time the UE stayed in the cell in 1/10 seconds. If the UE stays in a cell more than 4095s, this IE is set to 40950 | - |  |
| Time Stamp | O |  | 9.3.1.75 | Indicates the UTC time when the PSCell was added. | YES | ignore |
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**Question 4: Do companies agree to simplify the structure of the Last Visited PSCell Information in 9.2.3.X of TS 38.413 as above?**

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| Company | Yes/No | Comment |
| ZTE | Yes |  |
| Nokia | Yes | We assume that the NG-RAN CGI (9.3.1.73) is a choice of NR or E-UTRAN CGI, right? |
| Lenovo | Yes |  |
| Qualcomm | Yes |  |
| Samsung | Yes | But without Time Stamp. |
| China Telecom | Yes |  |
| Huawei | Yes | The time stamp is still FFS. We also think the time without SCG sis needed between MN |
| CATT |  | It is ok simplify the structure. However, it may also relate to the discussion in Q1.As proposed on Q1, if time stay without SCG is introduced, maybe the Pscell in the new structure could be Optional to indication this scenario. And also,it depends on whether we agree to introduce time stamp. |
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## UE history information during SCG activation/deactivation

[6] states that there are currently some discussions in 3GPP on the possibility of activation/deactivation of SCG to save power when the UE does not need additional bandwidth through additional SCells of the the SCG. The activation/deactivation request can come from the MN or the UE. This network state has to be accurately captured by the UHI as to not give wrong information about UE mobility and usage. This information is important for SN mobility optimization, as it is related to the “real” usage of the SCG-leg. This can be done e.g. by collecting information about the duration for which the SCG was deactivated. [6] proposes to further discuss this issue in Rel-18.

**Question 5: Do companies agree to discuss the impact of SCG activation/deactivation on UE history information in release 18?**

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| Company | Yes/No | Comment |
| ZTE | No | This issue has not been discussed and thus it shall not be regarded as a left issue. This can be discussed in a contribution-driven way in the next release.  |
| Nokie | No | It is a bit late to discuss it… Also, from a glance, it seems there is no impact: deactivated SCG is still configured, so the UE has PSCell (which is deactivated).  |
| Lenovo | No | Currently this issue is not included in the scope of R18 WI, it is not mandatory to discuss it in R18.  |
| Qualcomm | Yes | Knowing the SCG activation/deactivation state is important/useful while collecting the PSCell mobility. We can discuss this in Rel-18. |
| Samsung | No | It’s depending on RAN plenary discussion for Rel-18 scope. |
| China Telecom | No |  |
| Huawei | No | We think it is not needed because the MRO does not care the statue of SCG and the network will continue the RRM meas and handover even if the SCG is deactivated. |
| CATT |  | At least we think it does not belong to Rel-17 leftover.It depends on whether we could add new bullet in the Rel-18 WI. |
| CMCC | No | Rel-18 topic |
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## Others

Please add any other issues not covered by the above questions.

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| Company | Comment |
| Huawei | We think RAN3 need to discuss how to design the MN UHI+ SN UHI during the MN change case. In our understanding the SN UHI from the SN may be different from the one used when sending to the target MN. We also need to use the time spent without SCG in this latter message.Therefore we think the messages may need to be different. |
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# Phase 2 discussion

# Conclusion, Recommendations [if needed]

If needed

# References

R3-221712 Consideration on UE history information (China Telecommunication) discussion

R3-221830 (TP for SON BLCR for 38.423, 38.413, 36.413 and 36.423) UE History Information in MR-D (Huawei) other

R3-222011 Enhancement of UE history information in MR-DC scenario (CATT,CMCC) discussion

R3-222012 (TP on SON for 36.413) Addition of UE history information for SN (CATT,CMCC) other

R3-222013 (TP on SON for 36.423) Addition of UE history information for SN (CATT,CMCC) other

R3-222067 (TP for SON BL CR for TS 38.423, TS 38.413, TS 36.413) UE History Information for Secondary Node (Ericsson) other

R3-222268 (TP to SON BLCR TS 38.413)UE history information in MR-DC\_final (CMCC, CATT) other

R3-222269 (TP to SON BLCR TS 38.423)UE history information in MR-DC\_final (CMCC, CATT) other

R3-222378 UE History Information in MR-DC (ZTE, Lenovo, Motorola Mobility, China Unicom) discussion

R3-222379 (TP for SON BL CR for TS 37.340) Introduce UHI in MR-DC (ZTE, Lenovo, Motorola Mobility, China Unicom) other

R3-222380 (TP for SON BL CR for TS 38.423) Introduce UHI in MR-DC (ZTE, Lenovo, Motorola Mobility, China Unicom) other

R3-222381 (TP for SON BL CR for TS 36.423) Introduce UHI in MR-DC (ZTE, Lenovo, Motorola Mobility, China Unicom) other

R3-222382 (TP for SON BL CR for TS 38.413) Introduce UHI in MR-DC (ZTE, Lenovo, Motorola Mobility, China Unicom) other

R3-222383 (TP for SON BL CR for TS 36.413) Introduce UHI in MR-DC (ZTE, Lenovo, Motorola Mobility, China Unicom) other

R3-222387 UE History Information in MR-DC (Samsung R&D Institute UK) other