3GPP TSG-RAN WG2 Meeting #115 Electronic R2-2108903

Elbonia, 16 – 27 August 2021

**Agenda item: 8.10.3.2**

**Source: ZTE corporation, Sanechips**

**Title: Report of [AT115-e][108][NTN] idle mode aspects (ZTE) – Third Round**

**Document for: Discussion and Decision**

# 1 Introduction

This is the summary of the following email discussion in RAN2#115-e meeting.

* [AT115-e][108][NTN] idle mode aspects (ZTE)

Final scope: Continue the discussion to clarify the understanding of the expiry time and its implications as well as a possible acceptable rewording of p4.1 from [R2-2108899](file:///C%3A%5CData%5C3GPP%5CRAN2%5CInbox%5CR2-2108899.zip)

Intended outcome: Summary of the offline discussion with e.g.:

* + - List of proposals for agreement (if any)
		- List of proposals for further discussion

Final deadline (for companies' feedback): Thursday 2021-08-26 1000 UTC

Final deadline (for rapporteur's summary in R2-2108903): Thursday 2021-08-26 1500 UTC

Proposals marked "for agreement" in R2-2108903 not challenged Friday 2021-08-27 0300 UTC will be declared as agreed via email by the session chair (for the rest the discussion might continue online during the CB session).

Status: Ongoing

# 2 Contact information

|  |  |
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|  |  |

# 3 Discussion

## 3.1 Usage of the cell expire time to assist idle mode mobility

### 3.1.1 The start time for measurements on neighbor cells in earth fixed cell

The rapporteur understands there are three possible scenarios for the earth fixed cell case.

* Scenario 1: New cell#2 starts covering the same area before the previous cell#1 is switched off



In this scenario, the new cell#2 starts to cover the same area as cell#1 at T2 and cell#1 is switched off at T3.

UE is expected to start measurements before T2 or within [T2, T3] so that cell#2 or other suitable neighbour cells can be selected before the serving cell#1 is switched off at T3.

* Scenario 2: New cell#2 starts covering the same area exactly when the previous cell#1 is switched off



In this scenario, the new cell#2 starts to cover the same area at T3 which is exactly the time when cell#1 is switched off.

To avoid being out of coverage when the previous cell is switching off, UE is expected to start measurements sometime before T3 so that another neighbour cell, e.g. cell#X/Y, can be selected before the serving cell#1 is switched off and UE may select back to cell#2 after T3.

* Scenario 3: New cell#2 starts covering the same area after the previous cell#1 is switched off



In this scenario, the new cell#2 starts to cover the same area as cell#1 at T4 which is some time after T3 when cell#1 is switched off.

To avoid being out of coverage when the previous cell is switching off, UE is expected to start measurements sometime before T3 so that another cell, e.g. cell#X/Y/Z, can be selected before the serving cell#1 is switched off and UE may select back to cell#2 after T4.

With the above analysis on the start time of measurements, the rapporteur understands that UE shall start measurements on neighbour cells before the serving cell is switched off.

**Q1: Do companies agree that, for quasi-earth fixed cell, UE shall start measurements on neighbour cells before the serving cell is switched off?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Detailed Comments |
| MediaTek | Yes |  |
| Intel | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| Ericsson | yes |  |
|  |  |  |
| Xiaomi | Yes |  |
| Huawei,HiSilicon | Yes |  |
| vivo | Yes |  |
| Nokia |  | In fact, the UE shall finalize these measurements before the serving cell is switched off if a smooth and on-time reselection is to be ensured. |
| Convida | Yes, with comments | We think the question/proposal should be modified slightly for clarity: for quasi-earth fixed cell, UE shall start measurements on neighbour cells before the time when the serving cell will no longer serve the area in which the UE is located. |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |
| ETRI | Yes |  |
| China Telecom | Yes |  |
| ZTE | Yes | Agree with Nokia that UE is actually expected to finalize the measurements and find a cell to camp on before the serving cell is switched off. But it is hard to define what is “finalizing the measurements” so maybe we can have a minimum requirement that UE shall at least start measurements before the serving cell is switched off or stops covers the current area. |
| Rakuten Mobile | Yes |  |

**Rapporteur’s summary:**

18 companies commented and 17 companies agree that, for quasi-earth fixed cell, UE shall start measurements on neighbour cells before the serving cell is switched off or stops covering the current area.

The following proposal is given based on the majority’s preference:

**[17/18] Proposal 1: For quasi-earth fixed cell, UE shall start measurements on neighbour cells before the serving cell stops covering the current area.**

### 3.1.2 Understanding on the broadcast timing information

The following agreements have been made at RAN2#114e on the usage and provisioning of the cell expire time for quasi-earth fixed case.

*1. At least in the quasi-earth fixed case (FFS for moving case),* ***the timing information on when a cell is going to stop serving the area*** *is needed to assist cell reselection in NTN for earth fixed scenario.*

*2. At least in the quasi-earth fixed case (FFS for moving case),* ***the timing information on when a cell is going to stop serving the area*** *is used to decide when to perform measurement on neighbor cells.*

*3. At least in the quasi-earth fixed case (FFS for moving case),* ***the timing information on when a cell is going to stop serving the area*** *for earth fixed scenario is broadcast to UE via system information.*

Based on the online discussion, there are two possible understanding on “the timing information on when a cell is going to stop serving the area”:

* Understanding 1: The timing information refers to the time when the serving cell is switched off, e.g. T3 in the above scenarios.



With such understanding, UE shall start measurements on neighbour cells some time before the T3 and the following options can be considered:

* Option 1: A threshold or offset or timing information is configured and the latest time for UE to start measurements on neighbour cells would be: (T3- threshold/offset).

(T3- threshold/offset) is the latest start time as UE may start measurements on neighbour cells before (T3- threshold/offset) if the existing measurement rules based on RSRP is fulfilled.

* Option 2: Specify that UE shall start measurements on neighbour cells before T3 and the exact time to start measurements is up to UE implementation.
* Understanding 2: The timing information refers to sometime before the serving cell is switched off and UE shall consider it as the latest start time for measurements on neighbour cells. UE may start measurements before this broadcast timing information if the existing measurement rules based on RSRP are fulfilled.



**Q2: What is companies’ understanding on the broadcast “timing information on when a cell is going to stop serving the area”?**

|  |  |  |
| --- | --- | --- |
| Company | Understanding 1/Understanding 2/Other understanding | Detailed Comments |
| MediaTek | Understanding 1 (Option 2) | We think the timing information refers to the time when the serving cell is switched off. |
| Intel | Understanding 1 |  |
| Lenovo | Understanding 1 |  |
| OPPO | Understanding 1 |  |
| CATT | Understanding 1 |  |
| Ericsson | Understanding 1 |  |
| Xiaomi | Understanding 1 |  |
| Huawei, HiSilicon | Understanding 1 (Option 2) | Option 2 is simpler. |
| vivo | Understanding 1 or 2 | We are OK to follow the majority’s view on keeping the previous agreement (i.e. stopping time of cell #1). But at the same time, if the timing information is only used to control when the UE should/shall start measurements on the neighbor cells w/o other usage (as per the agreements till now), why not directly configure the time point itself, but instead use an indirectly way like Option 1/2?  |
| Nokia | Understanding 1 |  |
| Convida | Understanding 1 | We think that understanding 1 best reflects the discussion to this point. The UE can then be configured with measurement rules to determine when to start measurements on neighbor cells, including re-use existing measurement rules based on when RSRP criteria is fulfilled in addition to the broadcasted time info when a cell will stop serving the area. Understanding 2 may be problematic as the “latest start time” for measurements may be difficult to determine/vary based on UE implementation and cell coverage. |
| Samsung | Understanding 1 | Note we’ve add “or timing information” in the option1 since there are multiple ways to indicate timing Tx. |
| Qualcomm | Understanding 1 | Ok with option 2. |
| Apple |  Understanding 1  | Option 2. But either understanding is fine. Design changes based on that and it is not that one is going to end up more complicated than the other.  |
| ETRI | Understanding 1 |  |
| China Telecom | Understanding 1 | The exact time for UE early measurement depends on UE implementation. |
| ZTE | Understanding 1 |  |
| Rakuten Mobile | Understanding 1 |  |

**Rapporteur’s summary:**

18 companies commented while 17 companies agree with understanding 1 that the broadcast “timing information on when a cell is going to stop serving the area” refers to the time when a cell stops covering the current area.

One company are fine with both understanding 1 and understanding 2.

The following proposal is given based on the majority’s preference:

**[17/18] Proposal 2: For quasi-earth fixed cell, the broadcast “timing information on when a cell is going to stop serving the area” refers to the time when a cell stops covering the current area.**

**Q3: If understanding 1 is selected in Q2, please further indicate which option is preferred to specify the latest time for UE to start measurements on neighbour cells for the quasi-earth fixed cell?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/Option 2/Other option | Detailed Comments |
| MediaTek | Option 2 | Only mentioning T3 should be enough and the rest should be left to UE implementation. |
| Intel | Option 2 | We are ok leaving this to UE and if any additional requirement is needed, we suggest that this is discussed, if any, by RAN4 |
| Lenovo | Option 2 | We notice that in the measurement rules for cell re-selection, UE “may choose not to” perform measurements to limit needed measurements. It means that UE can perform measurements based on its implementation. |
| OPPO | Option 2 with comments | We think that both serving cell’s leaving time and neighbor cell’s coming time can be used for UE to start neighbor cell measurements. For example, for the above scenario 3 where serving cell’s leaving time T3 is earlier than neighbor cell’s coming time T4, neigbhor cell measurement can be started at T4. In any case, we prefer to leave the detailed timing for neighbor cell measurement up to UE implementation. |
| CATT | Option 2 | When to start the measurement can be left to UE implementation. |
| Ericsson | Option 2 |  |
| Xiaomi | Option 2 |  |
| Huawei, HiSilicon | Option 2 |  |
| vivo | Option 1 or others | As for the “others”, it is to directly configure the starting time for measurements as per our replies in Q2. |
| Nokia | Option 2 | RAN4 requirements on how long it takes to measure the neighbor cells should be employed here.  |
| Convida | Option 2 with comments | We think that Option 2 is a good starting point. However, if the UE receives broadcast timing information on when a cell is to stop serving an area that the UE is located, simple rule(s) can be defined when the UE shall start measurements on neighbour cells before T3 in the Figure based on RSRP, timing information/satellite ephemeris/UE location. The exact time to start measurements can be left to implementation. |
| Samsung | Option1 is preferred, and option2 is acceptable | We think option1 is best option but we also think option2 can also work with less optimization in the UE power consumption, e.g. when the UE starts the neighboring cells measurements earlier before the neighboring cell(s) becomes available.  |
| Qualcomm | Option 2 |  |
| Apple | Option 2 |  |
| ETRI | Option 2 | The start time for measurements is left up to the UE implementation. |
| China Telecom | Option 2 |  |
| ZTE | Option 2 |  |
| Rakuten Mobile | Option 2 |  |

**Rapporteur’s summary:**

18 companies commented while 16 companies agree with option 2 to specify that UE shall start measurements on neighbour cells before the broadcast time info of the serving cell, i.e. the time when the serving cell stops covering the current area, and the exact time to start measurements is up to UE implementation. Vivo and Samsung prefers option 1 with a threshold or offset or timing information configured and the latest time for UE to start measurements on neighbour cells would be: (T3- threshold/offset) while Samsung thinks option 2 is also acceptable.

The following proposal is given based on the majority’s preference:

**[17/18] Proposal 3: For quasi-earth fixed cell, specify that UE** **shall start measurements on neighbour cells before the broadcast stop time of the serving cell, i.e. the time when the serving cell stops covering the current area, and the exact time to start measurements is up to UE implementation.**

## 3.2 Location/Ephemeris assisted idle mode mobility

In the first round discussion [1], 20 out of 25 companies support location assisted cell reselection. And in the second round discussion, there is still 11 out of 16 companies support such enhancement [2].

The supporters understand it can be used by UE to identify the cell edge because the RSRP in NTN would not decline rapidly at the cell edge thus UE may not be able to whether it is at cell edge based on the RSRP. The distance from cell center can be used by UE to identify the cell edge and start measurements on neighbour cells.

Since some companies are concerned about the UE power consumption so some condition is added about the validity of the GNSS location at UE side by saying that UE is not required to acquire the GNSS location every DRX cycle in IDLE mode for mobility. However, MediaTek is still not happy with such condition added as any location (GNSS) acquisition triggered for idle mode mobility is not acceptable.

The rapporteur further suggests to modify the proposal as follows:

**Proposal 4.1: Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell, if UE has valid location information, which means location acquisition will not be triggered at UE side only for idle mode mobility. FFS on the details.**

**Q4: Do companies agree with the updated proposal 4.1?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Agree with modification/Disagree | Detailed Comments |
| MediaTek | Agree as a Working Assumption  | We don’t completely understand how this will work, i.e. location assisted reselection without location acquisition in idle mode. However, for the sake of the progress, we are willing to take this as a working assumption, provided that location acquisition will NOT be triggered in the UE for Idle mode mobility. Once the details, which are marked as FFS are clarified, we can make it as an agreement.As a question for clarification, is this made for quasi-earth fixed cell or for GEO cells? The explanation seems to suggest GEO, as the RSRP changes very rapidly for quasi-earth fixed cell. |
| Intel | Neutral | The new wording added seems a little confusing to us (i.e. “*if UE has valid location information, which means location acquisition will not be triggered at UE side only for idle mode mobility*”). We understand that UE should not be mandated to perform location acquisition for cell reselection purposes but should not be restricted either (which current wording seems to restrict). We wonder if the following change may be acceptable by companies:**Proposal 4.1: Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell. UE is not be mandated to perform location acquisition due idle mode mobility. FFS on the details.** |
| Lenovo | Neutral | OK to take this as a working assumption for the sake of the progress. Whether an agreement can be made depends on the details FFS. |
| OPPO | Agree with comments | Agree with Intel |
| CATT | Neutral | Agree with Intel |
| Ericsson | agree | Agree with Intel |
| Xiaomi | Agree with comments | We are fine to take the proposal modified by Intel as working assumption. |
| Huawei, HiSilicon | Neutral | Agree with Intel |
| vivo | Fine with it | A suggested revision as follows (basically with the same meaning as Intel’s suggestion):“**Proposal 4.1: Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell, if UE decides to apply this feature and has valid location information, which means location acquisition will not be triggered at UE side only for idle mode mobility. FFS on the details”** |
| Nokia | Neutral | Intel’s comment is valid, but the clarification does not resolve all of the doubts. If we follow the current proposal (even with Intel’s update) then we have a solution which may work if (by accident) the UE has a location information exactly at the time when cell reselection is to occur, if we are not mistaken? We still think if the expiry time is used properly then there is no need to additionally introduce a location-based idle-mode procedure, defined in a slightly vague way. |
| Convida | Agree with modification | We think that this fine to use as a baseline approach with some modification. There are several details that will still need to be discussed, including how an existing “valid location” is defined or determined. We think that if the UE has valid location can be used to reduce power consumption, but does not necessarily mean that location acquisition could not be triggered at the UE side for idle mode mobility. Suggested modification: **Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell, if UE has valid location information. ~~which means~~ If the UE does not have valid location information, the UE may trigger UE location acquisition ~~will not be triggered at UE side~~ ~~only~~ for idle mode mobility. FFS on the details.** |
| Samsung | See comments | Additional sentence is not clear to us. How location assisted cell reselection can work without location acquisition in idle mode?  |
| Qualcomm | Agree with modification | We understand the IDLE mode feature anyway will be optional. And without making sure it’s location is valid, UE cannot use this feature. Some suggestion**Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell, if UE has valid location information. It is optional for UE to support this feature. FFS on the details (e.g., location validity period).** |
| Apple | Agree as compromise for progress | As long as this is an optional feature. We prefer the suggested text by Qualcomm. |
| ETRI | Neutral | We are not sure what “valid location information” means. Intel’s modification is clearer to us. However, we are not sure if location assisted cell reselection is useful with the condition. |
| China Telecom |  | We have the same concern with Samsung |
| ZTE | Agree with the further modification | This updated part is mainly to address the power consumption concern from MTK, by explaining that UE is not required to trigger location acquisition only for idle mode mobility.Agree with Intel’s modification as the term “valid location information” results in more doubts. |
| Rakuten Mobile | Agree  | We agree with Intel’s less strict modified proposal. |

**Rapporteur’s summary:**

18 companies commented with the views summarized below:

* Agree as working assumption: MediaTek/Lenovo (**2** companies)
* Agree with modification: Intel/OPPO/CATT/Ericsson/Xiaomi/Huawei,HiSilicon/vivo/Convida/Qualcomm/ZTE/Apple/Rakuten Mobile (**12** companies)
	+ Intel/OPPO/CATT/Ericsson/Xiaomi/Huawei,HiSilicon/ZTE/Rakuten Mobile (**8** companies)

**Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell. UE is not be mandated to perform location acquisition due idle mode mobility. FFS on the details.**

* + Vivo

**Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell, if UE decides to apply this feature and has valid location information, which means location acquisition will not be triggered at UE side only for idle mode mobility. FFS on the details.**

* + Convida

**Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell, if UE has valid location information. ~~which means~~ If the UE does not have valid location information, the UE may trigger UE location acquisition ~~will not be triggered at UE side~~ ~~only~~ for idle mode mobility. FFS on the details.**

* + Qualcomm/Apple

**Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbour cell) taken into account, is supported for quasi-earth fixed cell, if UE has valid location information. It is optional for UE to support this feature. FFS on the details (e.g., location validity period).**

* Neutral: Nokia/ETRI (**2** companies)
* Other: Samsung/ChinaTelcom (**2** companies)

The following proposal is given based on the majority’s preference and Intel’s wording is recommended:

**[14/18] Proposal 4: Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbor cell) taken into account, is supported for quasi-earth fixed cell. UE is not mandated to perform location acquisition due to idle mode mobility. FFS on the details.**

# 4 Conclusion

All these proposal are supported by over 2/3 companies thus are all marked as **Proposals for email agreement**.

**[17/18] Proposal 1: For quasi-earth fixed cell, UE shall start measurements on neighbour cells before the serving cell stops covering the current area.**

**[17/18] Proposal 2: For quasi-earth fixed cell, the broadcast “timing information on when a cell is going to stop serving the area” refers to the time when a cell stops covering the current area.**

**[17/18] Proposal 3: For quasi-earth fixed cell, specify that UE** **shall start measurements on neighbour cells before the broadcast stop time of the serving cell, i.e. the time when the serving cell stops covering the current area, and the exact time to start measurements is up to UE implementation.**

**[14/18] Proposal 4: Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbor cell) taken into account, is supported for quasi-earth fixed cell. UE is not mandated to perform location acquisition due to idle mode mobility. FFS on the details.**

# 5 References

1. R2-2108889\_ Report of [AT115-e][108][NTN] idle mode aspects (ZTE)
2. R2-2108899\_ Report of [AT115-e][108][NTN] idle mode aspects (ZTE) – Second Round