3GPP RAN WG2 Meeting #117-e R2-2203543

eMeeting February 21st – March 3rd, 2022

Agenda Item: 8.10.3.1.1

Source: ZTE corporation,Sanechips

Title: Report of [AT117-e][102][NTN] Idle mode open issues – 2nd Round

Document for: Discussion, Decision

# Introduction

This document is intended to further discuss the remaining idle mode open issues as per the following email discussion guidelines:

* [AT117-e][102][NTN] Idle mode open issues (ZTE)

Updated scope:

1. Continue the discussion on idle mode open issues
2. Update the 38.304 CR

Updated intended outcome: Summary of the offline discussion with e.g.:

* + - List of proposals for agreement (if any)
    - List of proposals that require online discussions
    - List of proposals that should not be pursued (if any)
    - Updated 38.304 CR

Please note the following deadlines:

* Updated deadline (for companies' feedback): **Thursday 2022-02-24 1400 UTC**
* Updated deadline (for rapporteur's summary in R2-2203543): Thursday 2022-02-24 1600 UTC
* Deadline (for 38.304 CR in R2-2203548): Thursday 2022-03-03 1000 UTC

Please also note the following chair guidance:

* Proposals marked "for agreement" in R2-2203543 not challenged until Friday 2022-02-25 1000 UTC will be declared as agreed via email by the session chair (for the rest the discussion will continue offline).

# First Round

## [Pre117e] proposals – Agreeable part

In pre-meeting discussions [11], the following proposals have in general received the majority’s support:

**[14/23] Proposal 1: A threshold of the distance between UE and the cell reference location should be introduced and only neighbor cells with distance shorter than this threshold will be evaluated by UE during cell reselection.**

Contribution input on proposal 1:

* + Nokia(R2-2202466):
    - Distance-based ranking is not supported for cell reselection in NTN.
    - There is no UE behavior specified for location-based cell reselection in NTN IDLE mode.
  + Samsung(R2-2203049): Apply RSRP/RSRQ criteria at first then apply distance criteria to the candidate cells which passed RSRP/RSRQ criteria when distance criteria are configured.
  + Vivo(R2-2202774)
    - If the distance between the UE and the reference location of a cell on a higher priority frequency is less than a configured threshold, cell reselection to a cell on a higher priority frequency than the serving frequency shall be performed.
    - If the distance between the UE and the reference location of the serving cell is larger than a configured threshold, and the distance between the UE and the reference location of a cell on a lower priority frequency is less than another configured threshold, cell reselection to a cell on a lower priority frequency than the serving frequency shall be performed.

**[14/23] Proposal 2: Satellite ephemeris based cell reselection is represented by time and location based cell reselection. No further enhancement in this release for ephemeris based cell reselection.**

**[23/23] Proposal 4: No further enhancement on cell reselection priority in NTN. Remove the corresponding FFS from 38.304 CR.**

**[14/23] Proposal 5: No need to provide the timing information about the new upcoming cell for either earth fixed scenario or earth moving scenario.**

**[13/23] Proposal 7: No further enhancement on the SMTC broadcast for measurements in idle and inactive mode.**

**[19/23] Proposal 8: No further enhancement on cell reselection procedure to support TN prioritization over NTN in Rel-17.**

To avoid repeat discussion, companies are invited to comment on the above proposals *only* if there are serious technical objections. If a company does not comment on a proposal is it implicitely assumed to be acceptable.

**Question 1) If you object to one or more of the above proposal(s), please: 1) Indicate which proposal(s) is unnacceptable; 2) Provide technical justification why the above proposal is unacceptable; and 3) Suggest an alternative acceptable wording (if available).**

**Note: If a company does not comment on a proposal, it is assumed to be aggreable.**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Lenovo, Motorola Mobility | For Proposal 5 we would like to add “in Rel-17” or “in this release”, as in future releases we may consider this for optimization if necessary. |
| vivo | For P1, we think the following two questions should be clarified before it is agreed:  1. The proposal says “A threshold” (in the 1st part). Does it mean that only one threshold will be introduced irrespective of different sizes of different neighbour cells?  2. The proposal says the threshold will impact how the UE “evaluates” neibour cells (in the 2nd part). Since cell reselection evaluation (5.2.4) includes many subclauses, corresponding to different specific features, we wonder which specific feature within cell reselection evaluation process is actually impacted. |
| CATT | For Proposal 5, we prefer to agreeing with Lenovo, Motorola Mobility. |
| Samsung | For P1, we would like to see the complete picture on how it works before it is agreed. At least we would like to check the following two questions.  1. Whether legacy cell reselection criteria should be applied in addition to location based cell reselection criteria or not.  2. If legacy cell reselection criteria is applied, which cell reselection criteria (between legacy cell reselection criteria and location based cell reselection criteria) will be applied in the first.  For P5, we still think timing information for upcoming cell can save UE power consumption much especially in quasi-fixed cell. When t-service is coming and measurement is triggered, in most cases measuring only upcoming cell would be enough.  For P7, we think it is related to the discussion what information is needed for UE-based SMTC adjustment (P6). First we need to discuss and decide P6 before we agree P7. |
| Nokia | We think using location in IDLE is still questionable. If P1 is adopted then Samsung’s approach makes sense.  P2: what does it actually mean? Ephemeris is limited to cell reselection parameters (time/location)? This does not make sense (RAN1 has decided on what the ephemeris actually is).  [Rapporteur] P2 is to address the agreement and FFS we had in RAN2#111e.  “Satellite/HAPS ephemeris based cell selection and reselection should be defined for NTN (FFS what the term satellite/HAPS ephemeris actually means). FFS when this ephemeris based cell selection / reselection can be used. FFS whether UE location (and/or other information) based cell selection and reselection should be introduced for NTN.”  Having P2 means we will not further discuss when and how to use the ephemeris to assist cell reselection.  P7: it is unclear how the UE uses SMTC in idle mode. The UE cannot rely on its location as we are not forcing the UE to continuously measure its location. Thus other, non-location related measures need to be applied. |
| LG | For Proposal 5, we have same view with Lenovo. Other proposals are agreeable. |
| Google | For P7, we agree with Samsung that P6 should be determinted first and then come back to P7. |
| MediaTekk | Agree with Nokia that location in IDLE is still questionable. If P1 is adopted then Samsung’s approach makes sense. |
| Xiaomi | For P1, we would like to know how to decide the target cell when the neighbour cells with distance shorter than threshold is evaluated, whether the target cell is determined by distance or by the legacy R criterion. if the target cell is decided by the legacy R criterion, we think P1 can be agreed. |
| NEC | For proposal 1, we are concerned that neighbouring cells with no reference location broadcast would not be considered for cell reselection.  And as asked by vivo, one threshold may not works considering different cell size of neighbour cells (e.g., from LEO, GSO)  Considering the time limitation, it is acceptable for us to delay this feature to later release. |
| Qualcomm | We are also not sure with P7. SMTC alone is not sufficient, additional information such as common TA parameters would be needed for time tracking of neighbor cell SSBs as it is drifting continuously over time.  We are also ok to delay the feature in proposal 1. |

**Rapporteur’s summary:**

11 companies commented on Q1.

P1: Objected by vivo/Samsung/Nokia/MediaTek/Xiaomi/NEC/QC.

P5: Lenovo/CATT/LG would like to revise into “Proposal 5: No need to provide the timing information about the new upcoming cell for either earth fixed scenario or earth moving scenario in Rel-17” and would be then become acceptable.

P7: Objected by Samsung/Nokia/Google/QC.

The following recommendation is given based on the above input:

**Proposals for agreement:**

**Proposal 2: Satellite ephemeris based cell reselection is represented by time and location based cell reselection. No further enhancement in this release for ephemeris based cell reselection.**

**Proposal 4: No further enhancement on cell reselection priority in NTN. Remove the corresponding FFS from 38.304 CR.**

**Proposal 5: No need to provide the timing information about the new upcoming cell for either earth fixed scenario or earth moving scenario in Rel-17.**

**Proposal 8: No further enhancement on cell reselection procedure to support TN prioritization over NTN in Rel-17.**

**Proposals require further discussion:**

**Proposal 1: A threshold of the distance between UE and the cell reference location should be introduced and only neighbor cells with distance shorter than this threshold will be evaluated by UE during cell reselection.**

**Proposal 7: No further enhancement on the SMTC broadcast for measurements in idle and inactive mode.**

## [Pre117e] proposals – Controversial part

**[11/23] Proposal 3: It is up to NW implementation to either configure time based cell reselection or location based reselection or both of them. If both location and time base cell reselection are configured, it is up to UE implementation to apply either one or both of them.**

**[12/23] Proposal 6: For UE-based SMTC adjustment in idle and inactive mode, apart from the ephemeris, no other assistance information will be provided from NW side.**

**[12/23] Proposal 9: No need to define a mechanism in RAN2 to prevent non-NTN capable UE from accessing an NTN cell in Rel-17.**

**[12/23] Proposal 10: No explicit indication to show whether a cell is earth fixed or earth moving.**

### **OI 3:** Configuration of time and location based cell reselection

During the pre-meeting email discussion, 23 companies commented on OI 3:

Support simultaneous configuration:11 companies, i.e. Huawei, HiSilicon/CMCC/Lenovo/Google/Transsion/vivo/CATT/Apple/OPPO/NEC/Thales

Object simultaneous configuration: 11 companies, i.e. Samsung/Nokia/Sony/MediaTek/QC/Xiaomi/Intel/ChinaTelecom/Spreatrum/LG/Sequans

No strong view: 2 companies, i.e.Ericsson/ZTE

Since the supporters and opponents are half to half, the rapporteur provided the following proposal as a compromise but further comments

**[11/23] Proposal 3: It is up to NW implementation to either configure time based cell reselection or location based reselection or both of them. If both location and time base cell reselection are configured, it is up to UE implementation to apply either one or both of them.**

Further comments on proposal 3:

* + OPPO/LG: Do not support simultaneous location-based and time-based cell reselection configuration
  + HW: Support simultaneous location-based and time-based cell reselection configuration and up to UE implementation to decide which one to apply or apply both.

Contribution input on proposal 3:

* + Nokia(R2-2202466):The configuration of simultaneous location-based and time-based cell reselection is not supported in Rel-17 NTN.

**Question 2.1) Do companies support proposal 3 as a compromise? If not, please: 1) Provide technical justification why the above proposal is unacceptable; and 2) Suggest an alternative acceptable wayforward (if available).**

**Note: If a company does not comment on a proposal, it is assumed to be aggreable.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | Yes | For simplicity, we are fine to accept this compromised way. |
| CATT | Yes |  |
| OPPO | No | We are fine that it is up to NW implementation to configure both conditions. However, we think it would be straightforward that UE follows both conditions for the expected UE behaviour when both are configured. If UE can choose either one or both to apply, the UE behaviour might be confused by NW and gainst the agreement as shown below.  **RAN2#115e**   1. For quasi-earth fixed cell, UE should start measurements on neighbour cells before the serving cell stops covering the current area.     The suggested wayforward is that  **Proposal 3a: It is up to NW implementation to either configure time based cell reselection or location based reselection or both of them. If both location and time base cell reselection are configured, UE applies both of them.** |
| Samsung | No | First we don’t really see the need this combination. Second idle mode UE’s distribution/load should be controlled by the network configuration, but if both cell reselection criteria are configured simultaneously and it’s up to UE implementation which one is used (or both is used), then NW cannot control idle mode UE’s distribution/load. |
| Nokia | No | This is not any sort of a compromise. This make the whole thing unpredictable. What is the benefit of configuring both, if we do not specify what is expected from the UE and the UE will perhaps use one or both? Let’s define a clear and simple specification, without the unnecessary vague solutions. |
| Transsion | Yes | Network can configure one of them or both of them base on different deployment scenario.  For UE, it can apply both of them for better service continuity evaluation. |
| LG | No | As we commented via e-mail, we see no need to support such simultaneous configuration. Furthermore, as OPPO provided the previous agreement, the UE should trigger measurements before the serving cell stop time and this is the UE requirement if the information is configured. So it does not make sense UE can choose not to apply it by UE implementation. |
| MediaTek | No | The combnation is not needed. |
| Apple | No | The network may choose to provide both conditions, in which case the UE should apply both. |
| Xiaomi | No | Configuring location-based and time-based cell reselection configuration simultaneously is not needed, and it will lead more measurement and UE power consumption. |
| NEC | No | If both are configured, the UE should apply both of them. |
| Qualcomm | No | Ok not to have combination. |
| ZTE | No | Ok not to have combination. |

**Rapporteur’s summary:**

13 companies commented on Q2.1.

Ok with the P3: vivo/CATT/Transsion – 3 companies

No need for combination: Samsung/Nokia/LG/MediaTek/Xiaomi/QC/ZTE – 7 companies

Support combination and UE should apply both: OPPO/Apple/NEC – 3 companies

The following proposal is given based on the above input:

**[Revised] Proposal 3: Simultaneous configuration of location-based and time based reselection is not supported.**

### **OI 6:** NW assistance information for SMTC adjustments in idle and inactive mode

During the pre-meeting email discussion, 23 companies commented on Q6:

* Support to provide other assistance information for UE-based SMTC adjustments in idle and inactive mode: - 8 companies
  + Samsung/vivo: The feeder link delay information
  + Google:a drifting rate indicating the amount of time shift per time unit regarding the SMTC offset, a validity timer associated with an SMTC, or a start/end time pair associated with an SMTC.
  + Nokia:Broadcasting the threshold which will tell the UE when it shall shift the SMTC configuration and by how much (i.e. the size of such step).
  + QC/Intel: Common common TA parameters would be needed as the feeder link will be drifting at a rate, which could be 25us/s.
  + Intel:Neighbour cell list associated to this satellite.
  + Spreadtrum: Epoch time.
  + Ericsson:SMTC drift information (time derivative) and drift variation information (second time derivative) of the feeder link delays of the relevant neighbor cells.
* Object: 12 companies
  + Huawei, HiSilicon/CMCC/Lenovo/Transsion/Sony/MediaTek/CATT/Xiaomi/Apple/LG/NEC/ZTE
* Other:
  + OPPO:If feeder link delay is compensated by NW, then it would require more SMTC to be signaled in SIB, in such case, no other assistance information is needed. Otherwise, existing SMTC would be sufficient, but serving/neighbor cell’s feeder link delay are needed.

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

**[12/23] Proposal 6: For UE-based SMTC adjustment in idle and inactive mode, apart from the ephemeris, no other assistance information will be provided from NW side.**

Contribution input on proposal 6:

* + Nokia(R2-2202466): provided via system information and contains the threshold and size of the step by which the UE shifts SMTC window.
  + Samsung(R2-2203049):
    - In idle/inactive mode, if the feeder link delays of the serving cell/satellite and the neighbour cell(s)/satellite(s) are not compensated by the network, they are provided as assistance information to the UE for UE-based SMTC adjustment.
    - adjustment periodicity and offset threshold(s) for UE-based SMTC adjustment.
    - list of PCIs to be measured in SMTC window.

**Question 2.2) Do companies support proposal 6? If not, please: 1) Provide technical justification why the above proposal is unacceptable; and 2) Suggest an alternative acceptable wayforward (if available).**

**Note: If a company does not comment on a proposal, it is assumed to be aggreable.**

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| **Company** | **Yes/No** | **Comments** |
| vivo | Yes | For simplicity, we are fine to accept this compromised way. In our understanding, the consequence would be that for a given frequency, only cell reselection on the same satellite orbit may be supported (since SMTC is broadcast per frequency for measurements in idle and inactive mode). |
| CATT | Yes | The drift information of SMTC can be discussed in future release. |
| OPPO | No | This depends on how many SMTCs are signaled in SIB and whether feeder link delay is compensated by NW. If feeder link delay is compensated by NW, then it would require more SMTC to be signaled in SIB, in such case, no other assistance information is needed. Otherwise, existing SMTC would be sufficient, but serving/neighbor cell’s feeder link delay are needed in order to calculate the delay difference between serving cell and neighbour cell.  The suggested wayforward is that  **Proposal 6a: For UE-based SMTC adjustment in idle and inactive mode, apart from the ephemeris, the fedder link delay of neighbor cell is needed.** |
| Samsung | No | UE-based SMTC adjustment would be based on the delay, without feedlink delay information (common TA parameter), how does the UE can estimate the delay? Also dependent on how we define UE based SMTC adjustment, we may need some kind of SMTC offset / change rate. In general, we need clearer picture how UE-based SMTC adjustment works before agreeing P6. |
| Nokia | No | How does the UE measure SMTCs in IDLE based on the ephemeris? What is the ephemeris, actually, as within certain questions that seems to be equivalent to cell reselection parameters? Our technical comment is the same as in our paper [4]: we have not defined solid requirements on how to UE measures its location in IDLE mode. So how can we trust the UE will be able to track SMTC on this basis? |
| Google | No | UE will not know how to adjust the SMTC broadcasted in system information, if the UE does not know based on which point of time this SMTC is set up. Therefore, at lease a reference time (similar to the epoch time of the common TA) needs to be provided and linked to the SMTC.  In addition, we think completely relying on the UE itself to adjust the SMTC setting is not always feasible (as inactive/idle UE may not have full and up-to-date ephemeris information), and may consume UE’s power in a way that is not desirable for idle/inactive UEs. Broadcasting a drift/change rate that is associated to the SMTC offset would significantly reduce the complexity at the UE side. |
| MediaTek | Yes |  |
| Xiaomi | Yes | We think the network can compensate the feederlink delay and configure different SMTC for different neighbour cells. |
| Qualcomm | No | For IDLE mode UEs, SMTC compensation is not feasible.  The neighbor cell SSBs would be drifting constantly and rate of change could be as large as 25us/s. Broadcasting common TA parameters would be very helpful. |
| ZTE | No | The delay difference between the serving and neighbor cell is needed. |

**Rapporteur’s summary:**

10 companies commented on Q2.2.

* Support P6: vivo/CATT/MediaTek/Xiaomi – 4 companies
* More assistance information needed – 5 companies
  + OPPO: feeder link delay of neighbor cellls
  + Samsung: feeder link delay information (common TA parameter) and SMTC offset / change rate
  + Nokia
  + Google: Reference time of the SMTC and a drift/change rate that is associated to the SMTC offset
  + QC: common TA parameters
  + ZTE: Delay difference between the serving and neighbor cell

**[Revised] Proposal 6: In addition to the ephemeris information, to discusss whether assistance information is needed for UE-based SMTC adjustment in idle and inactive mode. If Yes, down select from the following options:**

* **Option 1:** **feeder link delay of neighbor cells**
* **Option 2: Common TA paramaters of neighbor cells**
* **Option 3: SMTC offset or change rate of neighbor cells**
* **Option 4: Reference time of the SMTC of neighbor cells**
* **Option 5: Delay difference between the serving and neighbor cell**

### **OI 9:** Prevent non-NTN capable UEs from accessing an NTN cell

During the pre-meeting email discussion, 23 companies commented on Q9:

* Support to define a mechanism in RAN2 to prevent non-NTN capable UE from accessing an NTN cell: -10 companies
  + Huawei, HiSilicon/CMCC/vivo/: The For non-NTN capable UEs, cellReservedForOtherUse IE and cellReservedForFutureUse-r16 IE in SIB1 can be set true. For NTN capable Ues, cellReservedForOtherUse IE and cellReservedForFutureUse-r16 IE should be ignored, and a new IE should be introduced in SIB1, e.g., cellReservedForFutureUse-r17.
  + Samsung: Yes if we consider TN and NTN cells in a given carrier/band
  + Transsion: RAN#2 can introduce new indication in MIB or SIB1 to indicate cell type.
  + QC/Intel/ZTE: Similar approach can be adopted like IOT-NTN.
  + Spreadtrum: The presence of SIBX indicates the NTN cell.
  + NEC: A new single bit to solve this issue for future NTN band allocations.
* Object: - 10 companies
  + Google/MediaTek/CATT/Xiaomi/Apple/ChinaTelecom/OPPO/LG/Thales
  + Nokia: Not in this release when the band overlapping happens.
* Open
  + Lenovo/Sony: May not be that essential in this release, as for now NTN and TN have no overlap in frequency.

Since the supporters and opponents are half to half, while two companies open to this discussion understand this issue is not essential in this release, the following proposal is given based on the majority’s preference:

**[12/23] Proposal 9: No need to define a mechanism in RAN2 to prevent non-NTN capable UE from accessing an NTN cell in Rel-17.**

**Question 2.3) Do companies support proposal 9? If not, please: 1) Provide technical justification why the above proposal is unacceptable; and 2) Suggest an alternative acceptable wayforward (if available).**

**Note: If a company does not comment on a proposal, it is assumed to be ggregable.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | No | Even though NTN and TN have no overlap in frequency in Rel-17, non-NTN capable UE can measure the NTN frequency and may erroneously attempt access to an NTN cell as per the current Spec. |
| CATT | Yes |  |
| OPPO | Yes |  |
| Ericsson | no | To follow IoTNTN |
| Samsung | Yes (see comment) | Yes if no NTN and non-NTN in a given frequency in Rel-17 is confirmed. |
| Nokia |  | Depends on the bands agreed by RAN4. If no overlap, Rel-17 can be closed without a dedicated solution. |
| Huawei, HiSilicon | No | According to RAN4 progress, there is some overlap between NTN bands and IMT bands, and different band numbers are used (i.e. n255 is overlapping with IMT band n24, n256 is partially overlapping with IMT band 65/66). Since they use different band numbers, UEs can differentiate between TN and NTN from the band number in SIB1, but this is only for satellite service. For HAPS, RAN4 agreed that “NR band n1 as example band for HAPS related coexistence studies at 2GHz”, so a new barring bit is a safer solution. |
| Transsion | No | Considering there may be frequency overlap between NT and NTN network. Both using new indication or reuse reserved IE in MIB or SIB1 are both ok, which can help UE quickly distinguish different network type |
| LG | Yes |  |
| MediaTek | Yes |  |
| Xiaomi | Yes |  |
| NEC | No | An additional bar bit is agreed in IoT NTN. |
| Qualcomm | No | RAN4 has already agreed TN and NTN bands are overlapped. This means the legacy UEs will detect the NTN frequency/cell and attempt to select the cell again. Same applies to HAPS. So it is cleaner and simple just to add 1 single bit solution. |
| ZTE | No | An additional bar bit is agreed in IoT NTN. |

**Rapporteur’s summary:**

14 companies commented on Q2.3.

* Support P9: vivo/CATT/OPPO/Samsung/LG/MTK/Xiaomi – 7 companies
* Introduce an additional bar bit: Ericsson/HW/Transsion/NEC/QC/ZTE – 6 companies
* Nokia: Depends on the bands agreed by RAN4. If no overlap, Rel-17 can be closed without a dedicated solution.

The following proposal is given based on the majority’s preference (7 VS 6).

**Proposal 9: No need to define a mechanism in RAN2 to prevent non-NTN capable UE from accessing an NTN cell in Rel-17 for NR-NTN.**

### **OI 10:** UE awareness of whether an NTN cell is quasi-fixed or earth moving

During the pre-meeting email discussion, 23 companies commented on Q10: -9 companies

* Support that UE should be aware of whether the serving cell and/or neighbour cell is quasi-earth fixed or earth moving:
  + Huawei, HiSilicon/Google/OPPO/LG/Thales
  + QC/Intel/Ericsson/NEC:Cell stop time can indicate the cell is quasi-fixed cell.
* Object: -12 companies
  + Samsung/CMCC/Lenovo/vivo/Nokia/Sony/MediaTek/CATT/Xiaomi/Apple/ChinaTelecom/ZTE
* Other:
  + Transsion:RAN#2 should consider moving cell scenarios and usages first, it there is a new configuration is needed, then it can be used to indicate, implicit or explicit, cell type.

12 companies understand UE does not need to be aware whether a cell is earth fixed or moving. 9 companies understand such knowledge would be useful while 4 of them understand it can be inferred implicitly via the cell stop time.

With the above understanding and preference from companies, the following proposal is given:

**[12/23] Proposal 10: No explicit indication to show whether a cell is earth fixed or earth moving.**

**Question 2.4) Do companies support proposal 10? If not, please: 1) Provide technical justification why the above proposal is unacceptable; and 2) Suggest an alternative acceptable wayforward (if available).**

**Note: If a company does not comment on a proposal, it is assumed to be ggregable.**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | Yes |  |
| CATT | Yes | For Rel-17. |
| OPPO | No | Implicit indication does not work because we haven’t agreed to broadcast stop-time for neighbour cells. Explicit indication from serving cells would be required for UE to prioritize cell reselection to quasi-earth fixed cells. |
| Samsung | Yes (see comment) | Yes at the moment. We’re still not clear on how earth moving case is supported. Maybe it’s somewhat early to make a decision before we have clearer picture on earth moving case. |
| Nokia |  | UE can figure it out from some typical values of the NTN parameters. No need to define a solution. |
| Huawei, HiSilicon | No | If the cell is a moving cell, UE may need to predict the reference location by combing the moving trajectory and the coverage information, at least for location-based CHO. |
| Transsion | Yes | Not in this release. |
| LG | See comment | First, we should clarify whether earth moving cell is defined in Rel-17. |
| MediaTek | Yes |  |
| Apple | No | Agree with OPPO |
| Xiaomi | Yes |  |
| Qualcomm | See comments | First we need to clarify whether there is any prioritization defined for selecting fixed cell vs moving cell. |
| ZTE | Yes |  |

**Rapporteur’s summary:**

14 companies commented on Q2.4.

* Support P10: vivo/CATT/Samsung/Nokia/Transsion/MTK/Xiaomi/ZTE -8 companies
* Explicit indication needed: OPPO/HW/Apple -3 companies

The following proposal is given based on the majority’s preference (8 VS 3).

**Proposal 10: No explicit indication to show whether a cell is earth fixed or earth moving in Rel-17.**

## Contribution input not overed by the pre-meeting email discussion

### **OI 11:** Information about the incoming new cell

Contribution input:

* QC(R2-2202566):The network can provide the information of the next candidate cell(s) for cell reselection.
* Samsung(R2-2203049):For quasi-earth fixed NTN system, a network can configure the incoming neighbouring cell which will replace the serving cell coverage at t-Service expiry in system information.

**Question 3.1) Do companies support to provide information, e.g. the PCI, about the incoming new cell to assist cell reselection? If Yes, what kind of information should be provided?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | No |  |
| CATT | See the comment | We agree to broadcast the frequency and/or PCI of upcoming cell, but not the start serving time for Rel-17. |
| OPPO | No | The optimisation on providing information about the incoming new cell could be considered in future release if necessary. |
| Ericsson | yes | Can be in SI or dedicated, PCI and time |
| Samsung | Yes | We think the frequency information and PCI about incoming new cell which replaces the current serving cell would be helpful to reduce UE power consumption much. When t-service is coming and measurement is triggered, in most cases measuring only upcoming cell would be enough. |
| Nokia | No | Unclear how does it work and what are the benefits. |
| Huawei, HiSilicon | Yes but | Broadcasting the frequency/PCI information of upcoming cell can be useful in:  1) Measurements: UE can start measuring the upcoming cell.  2) Cell ranking: UE can prioritize the upcoming cell, or only consider the upcoming cell as target cell.  However, we are not sure whether this has any spec impact. The network can configure the upcoming cell in intraFreqWhiteCellList or interFreqWhiteCellList, and the UE shall consider only the white listed cells, if configured, as candidates for cell reselection. |
| Transsion | No | So far, both time base and location base resleecion are sufficient for quasi-earth fixed cell. For moving cell, it need more assistant information for cell reselection, which could be discussed in next release. |
| LG | See comments | We should clarify validity of NTN SIBxx. Once UE acquires the NTN SIB, there is neither SI update notification nor valuetag update, the UE would re-acquire the SIBxx when the validity timer expires. Then, does the network guarantee that the contents of the SIBxx will not be updated until the validity timer expiry of the UE? If not, incoming new cells until the validity timer expiry should be provided in the NTN SIB. If not provided, the UE cannot be provided with the new cells until the validity timer expiry. |
| MediaTek | No |  |
| Apple | No | Seems like optimizations that can be discussed in next Release |
| Xiaomi | No | We already introduce two different solutions for cell reselection, other optimization can be considered in the future release if necessary. |
| NEC | No | Not in this release. |
| Qualcomm | Yes | Agree with Samsung. |
| ZTE | No | Unclear how does it work and what are the benefits. |

**Rapporteur’s summary:**

15 companies commented on Q3.1.

* Support to provide PCI of the upcoming cell: CATT/Ericsson/Samsung/QCC- 5 companies
  + HW: Agree with the intention but expect no spec impac.
* Object: vivo/OPPO/Nokia/Transsion/MTK/Apple/Xiaomi/NEC/ZTE – 9 companies

The following proposal is given based on the majority’s preference (9 VS 5).

**Proposal 11: No specific enhancement to provide the PCI of the incoming cell, can be provided as one element in the existing intraFreqWhiteCellList or interFreqWhiteCellList.**

### **OI 12:** Orbital parameters and timing drift parameters of the neighbor satellites

Contribution input:

* QC(R2-2202566):The list of orbital parameters and timing drift parameters of the neighbor satellites are broadcast in the SIB as delta to the orbital parameters of the serving satellite.

**Question 3.2) Do companies support to broadcast the list of orbital parameters and timing drift parameters of the neighbor satellites as delta to the orbital parameters of the serving satellite?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Lenovo, Motorola Mobility | Yes | We think providing the delta values can reduce signalling overhead. |
| Vivo | No | Such signaling optimization can be postponed to the future releases. |
| CATT | No | There is no agreement that the timing drift parameters is provided. See our comment in Question 2.2). |
| OPPO | See comments | This is up to RAN1 to decide as those configurations are provided by RAN1. Without RAN1 input, RAN2 has no idea how much information each satellite shares in common |
| Ericsson | yes | But need to work also here how the delta is represented in RRC |
| Nokia | Not in this release, not in all cases. | Timing drift of what? Feeder link? Shouldn’t the feeder link drift be solved with the appropriate SMTC configuration?  The neighbour satellite on the same orbit requires less information to be signalled and can be done in delta manner, indeed. However for satellites on another orbit, this is not so easy. |
| Huawei, HiSilicon | No | We are not sure how this delta signalling works and how much signalling overhead is saved. Maybe some details are needed. |
| Transsion | No | The timing drift parameters may be used in moving cell, which is better for next release. |
| LG | No | We do not have time to discuss such issue in this release. We could discuss in the future releases if needed. |
| MediaTek | No |  |
| Apple | No | Not essential |
| Xiaomi | No | How to define delta ephemeris data needs RAN1 input. |
| NEC | No | Optimisation for future release. |
| Qualcomm | Yes | Open to discuss how this can be done for satellites, and mostly it is for satellites in the same constellation |
| ZTE | No |  |

**Rapporteur’s summary:**

15 companies commented on Q3.2 while 10 companies understand such information is not essential and prefer not to have it.

**Proposal 12: Broadcasting the list of orbital parameters and timing drift parameters of the neighbor satellites as delta to the orbital parameters of the serving satellite is not supported.**

### **OI 13:** SIB4 enhancement

Contribution input:

* Apple(R2-2202548):SIB4 be enhanced by geographic tags, with each tag corresponding to a set of (legacy) cell reselection information.
* QC(R2-2202566):An indication is provided in the inter frequency list in SIB4 to associate the frequency with the corresponding satellite in the neighbor satellite list.

**Question 3.3) Do companies support to enhance SIB4 to provide more assistance information to assist cell reselection? If Yes, what kind of information should be provided, the geographic tag associated with a set of cell reselection information, asscociation between the frequency and the neighbour satellite or some other information?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | No |  |
| CATT | No | Not for Rel-17. |
| OPPO | No | This is no essention in Rel-17. |
| Ericsson | yes | Same discussion is in RRC open issue |
| Samsung | Yes (see comment) | In quasi earth fixed cell, we don’t think the new upcoming cell which replace the current serving cell would be in the same frequency as the current serving cell (otherwise two cells with the same coverage on the same frequency at the same time would bring the interference issue), we may need the information what frequency is for the change of the serving cell. |
| Nokia | Yes | Rough (not very accurate) geo information could be helpful to trigger search and measurements. |
| Huawei, HiSilicon | No |  |
| LG | No | Not for Rel-17. |
| Google | No | Not for Rel-17. |
| MediaTek | No | Defer for later releases |
| Apple | Yes | Proponent of (some form of) geographic tagging; otherwise UEs will unnecessarily look for cells it will never find. |
| Xiaomi | No |  |
| NEC | Yes | Geographical information can help for cell reselection to avoid scanning frequencies of neighbouring cells that are too far away. |
| Qualcomm | Yes | Open to discuss this. If neighbor satellite ephemeris is being broadcast, then it can be simply associated with the neighbor frequency list in SIB4 one way or another (it does not mean SIB must be extended). |
| ZTE | No |  |

**Rapporteur’s summary:**

15 companies commented on Q3.3 while 9 companies understand there is no need to provide the geographic tag associated with a set of cell reselection information or asscociation between the frequency and the neighbour satellite in Rel-17.

**Proposal 13: No need to provide the geographic tag associated with a set of cell reselection information or asscociation between the frequency and the neighbour satellite in Rel-17.**

### **OI 14:** Another alternative to capture the location based measurement related agreements in idle mode

The following text proposal has been provided by OPPO(R2-2203725) as another alternative to capture the location based measurement related agreements in idle mode and the rapporteur understand the suggested change is reasonable.

|  |
| --- |
| CHANGE START |

5.2.4.2 Measurement rules for cell re-selection

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ

- If *distanceThresh* is broadcasted in SIBxx, and if UE supports location-based measurement initiation and has valid UE location information:

- If the distance between UE and the serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform intra-frequency measurements;

- Otherwise, the UE shall perform intra-frequency measurements;

- Otherwise, the UE may choose not to perform intra-frequency measurements;- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NR inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

- If the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ ; and

- If *distanceThresh* is broadcasted in SIBxx, and if UE supports location-based measurement initiation and has valid UE location information:

- If the distance between UE and the serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority;

- Otherwise, the UE shall perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority according to TS 38.133 [8];

- Otherwise, the UE may choose not to perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority;- Otherwise,the UE shall perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority according to TS 38.133 [8].

- If the UE supports relaxed measurement and *relaxedMeasurement* is present in *SIB2*, the UE may further relax the needed measurements, as specified in clause 5.2.4.9.

If the t-Service of the serving cell is present in SIBX, UE should start to perform intra-frequency, inter-frequency or inter-RAT measurements before the t-Service, regardless of the distance between UE and the serving cell reference location or whether the serving cell fulfils Srxlev > SIntraSearchP and Squal > SIntraSearchQ, or Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ . For quasi earth fixed cell, UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8] regardless of the remaining service time of the serving cell.

NOTE: Whether the UE has valid location information is up to UE implementation.

Editor’s note: FFS on whether the timing information about new upcoming cell is needed for quasi earth fixed cell and/or earth moving cell. FFS if such information is known from system information and/or the ephemeris. FFS on the utilization of such information.

|  |
| --- |
| CHANGE END |

**Question 3.4) On capturing the location based measurements related agreements in idle mode, which option do companies prefer:**

* + **Option 1: The changes in running 304 CR (R2-2203385) by introducing a separate paragraph.**
  + **Option 2: The above changes proposed in OPPO(R2-2203725) by merging with the existing paragraphs.**
  + **Other option?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option1/2/**  **other** | **Comments** |
| vivo | Option 2 | Furthermore, we think whether the *distanceThresh* for intra-frequency measurements and inter-frequency measurements is same or different should be further discussed. |
| CATT | No strong view | The change suggested by OPPO seems reasonable. |
| OPPO | Option 2 | Some issues of current running 304 CR are seen as below:  **Issue (1)** For an NTN UE that supports location-based measurement initiation, if the cell broadcasts location-related parameters (e.g. a threshold), only if legacy Srxlev/Squal condition and distance condition are both met, UE may choose not to perform neighbour cell measurements. According to the current spec wording in running 304 CR, even if a threshold *distanceThresh* is broadcasted, the UE can still behave as legacy, i.e., as long as the Srxlev/Squal condition is met, the UE might choose not to perform neighbour cell measurements regardless of the distance condition, since the legacy behaviour (i.e., the legacy paragraph of clause 5.2.4.2) cannot be bypassed by NTN-specific behaviour (i.e., the new paragraph for location-based measurement initiation).  **Issue(2)** In legacy, the Srxlev/Squal thresholds for neighbour cell measurement initiation are different between the intra-frequency case (i.e., SIntraSearchP/SIntraSearchQ) and non-intra-frequency case (i.e., SnonIntraSearchP/SnonIntraSearchQ). Another issue is that the current spec wording for location-based measurement initiation doesn’t consider it.  **Issue(3)** Note that in RAN2#116bis-e meeting, the following agreement was agreed, which is against the previous agreement in RAN2#116-e meeting as shown below.  RAN2#116bis-e agreements:  5. Location-based measurement initiation is only applied if the cell broadcasts location-related parameters (e.g. a threshold) and by implementation the UE has location information.  RAN2#116-e agreements:  1. When UE uses location based cell reselection enhancements, it's up to UE implementation to guarantee that a valid location information is available  According to the new agreement, in the current 38304 running CR, the NOTE related to the old agreement is also needed to be updated.  Therefore, we propose Option 2 as the baseline. |
| Ericsson | 2 | Not sure but maybe prefer separate |
| Samsung | Option2 |  |
| Nokia | Option 2 | OPPO’s changes are OK. |
| Huawei, HiSilicon | Option 2 |  |
| Apple | Option 2 |  |
| Xiaomi | Option 2 |  |
| NEC | Option 2 |  |
| Qualcomm | See comments | Ok with OPPO’s change but we may need to check this in running CR if aany change or rephrasing is needed. |

**Rapporteur’s summary:**

12 companies commented on Q3.4 and all of them support the text proposal in R2-2203725.

**Proposal 14: Adopt the text proposal in R2-2203725 to capture the location based cell reselection agreements in 38.304.**

### Any other idle mode issues not covered in pre-meeting discussion or this offline discussion

|  |  |
| --- | --- |
| **Company** | **Any other idle mode issues not covered in pre-meeting discussion or this offline discussion** |
| Ericsson | CT1 is discussing how to handle situation when UE has selected a cell as suitable cell and then TAI list in SI is updated such that all TAIs are forbidden. This is either AS or NAS to have rule what haååens. In our view it should be AS. |
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## Conclusion – First round

**Proposals for agreement:**

**Proposal 2: Satellite ephemeris based cell reselection is represented by time and location based cell reselection. No further enhancement in this release for ephemeris based cell reselection.**

**Proposal 4: No further enhancement on cell reselection priority in NTN. Remove the corresponding FFS from 38.304 CR.**

**Proposal 5: No need to provide the timing information about the new upcoming cell for either earth fixed scenario or earth moving scenario in Rel-17.**

**Proposal 8: No further enhancement on cell reselection procedure to support TN prioritization over NTN in Rel-17.**

**Proposals require further discussion:**

**Proposal 1: A threshold of the distance between UE and the cell reference location should be introduced and only neighbor cells with distance shorter than this threshold will be evaluated by UE during cell reselection.**

**[Revised] Proposal 3: Simultaneous configuration of location-based and time based reselection is not supported.**

**[Revised] Proposal 6: In addition to the ephemeris information, to discusss whether assistance information is needed for UE-based SMTC adjustment in idle and inactive mode. If Yes, down select from the following options:**

* **Option 1:** **feeder link delay of neighbor cells**
* **Option 2: Common TA paramaters of neighbor cells**
* **Option 3: SMTC offset or change rate of neighbor cells**
* **Option 4: Reference time of the SMTC of neighbor cells**
* **Option 5: Delay difference between the serving and neighbor cell**

**Proposal 7: No further enhancement on the SMTC broadcast for measurements in idle and inactive mode.**

**Proposal 9: No need to define a mechanism in RAN2 to prevent non-NTN capable UE from accessing an NTN cell in Rel-17 for NR-NTN.**

**Proposal 10: No explicit indication to show whether a cell is earth fixed or earth moving.**

**Proposal 11: No specific enhancement to provide the PCI of the incoming cell, can be provided as one element in the existing intraFreqWhiteCellList or interFreqWhiteCellList.**

**Proposal 12: Broadcasting the list of orbital parameters and timing drift parameters of the neighbor satellites as delta to the orbital parameters of the serving satellite is not supported.**

**Proposal 13: No need to provide the geographic tag associated with a set of cell reselection information or asscociation between the frequency and the neighbour satellite in Rel-17.**

**Proposal 14: Adopt the text proposal in R2-2203725 to capture the location based cell reselection agreements in 38.304.**

# First GTW session outcome

[R2-2203533](file:///C:\Data\3GPP\Extracts\R2-2203533_%5bAT117-e%5d%5b102%5d%5bNTN%5d%20Idle%20mode%20open%20issues_v21_Summary.docx) [offline-102] Idle mode open issues ZTE corporation discussion Rel-17 NR\_NTN\_solutions-Core

Agreements:

1. Satellite ephemeris based cell reselection is represented by time and location based cell reselection. No further enhancement in this release for ephemeris based cell reselection.
2. No further enhancement on cell reselection priority in NTN. Remove the corresponding FFS from 38.304 CR.
3. No need to provide the timing information about the new upcoming cell for either earth fixed scenario or earth moving scenario in Rel-17.
4. No further enhancement on cell reselection procedure to support TN prioritization over NTN in Rel-17.
5. RAN2 assumes that in addition to the ephemeris information, assistance information is needed for UE-based SMTC adjustment in idle and inactive mode. (FFS on the option to enable this)
6. Adopt the text proposal in R2-2203725 to capture the location based cell reselection agreements in 38.304.

Working Assumption:

1. To prevent non-NTN capable UE from accessing an NTN cell in Rel-17, for NR-NTN RAN2 follows a similar solution as in IoT-NTN (FFS on the details and whether this is always needed or not).

Proposals require further discussion:

Proposal 1: A threshold of the distance between UE and the cell reference location should be introduced and only neighbor cells with distance shorter than this threshold will be evaluated by UE during cell reselection.

* ZTE thinks the target cell would be selected using legacy criteria
* Oppo thinks this would not work for cell reselection among different constellations. VC thinks this might not be a realistic scenario in Rel-17
* Continue offline

[Revised] Proposal 3: Simultaneous configuration of location-based and time based reselection is not supported.

* HW thinks there is no problem with simultaneous configuration
* Samsung thinks there is, at least we need to have more specification effort, e.g. to specify the UE behaviour.
* Continue offline

[Revised] Proposal 6: In addition to the ephemeris information, to discusss whether assistance information is needed for UE-based SMTC adjustment in idle and inactive mode. If Yes, down select from the following options:

Option 1: feeder link delay of neighbor cells

Option 2: Common TA paramaters of neighbor cells

Option 3: SMTC offset or change rate of neighbor cells

Option 4: Reference time of the SMTC of neighbor cells

Option 5: Delay difference between the serving and neighbor cell

* RAN2 assumes that in addition to the ephemeris information, assistance information is needed for UE-based SMTC adjustment in idle and inactive mode. (FFS on the option to enable this)
* Continue offline to discuss the specific option

Proposal 7: No further enhancement on the SMTC broadcast for measurements in idle and inactive mode.

Proposal 9: No need to define a mechanism in RAN2 to prevent non-NTN capable UE from accessing an NTN cell in Rel-17 for NR-NTN.

* ZTE indicates this proposal is based on slight majority. One alternative is to go for the IoT-NTN approach
* Samsung thinks we should discuss the scenario first and whether this is an issue in Rel-17
* VC thinks it would be good to adopt a solution that avoids future compatibility issues
* WA: We follow a similar solution as in IoT-NTN for this (FFS on the details and whether this is always needed or not).
* Continue offline

[12/23] Proposal 10: No explicit indication to show whether a cell is earth fixed or earth moving.

* Continue offline

Proposal 11: No specific enhancement to provide the PCI of the incoming cell, can be provided as one element in the existing intraFreqWhiteCellList or interFreqWhiteCellList.

* Continue in offline 101

Proposal 12: Broadcasting the list of orbital parameters and timing drift parameters of the neighbor satellites as delta to the orbital parameters of the serving satellite is not supported.

* Continue in offline 101

Proposal 13: No need to provide the geographic tag associated with a set of cell reselection information or asscociation between the frequency and the neighbour satellite in Rel-17.

* Continue in offline 101

# Second Round

## Location based cell reselection enhancement

In the pre-meeting discussion and first round discussion, the majority prefers to introduce a threshold of the distance between UE and the cell reference location and only neighbor cells with distance shorter than this threshold will be evaluated by UE during cell reselection.

Regarding the co-existence of the new location based criteria and existing cell reselection priority, S-criterion and R-criterion, the rapporteur understand:

* Inter-frequency and inter-RAT cell reselection criteria

**Existing UE behaviour:** UE follow the reselection priority configured and shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

**=> No impact after the distance threshold is introduced.**

* Intra-frequency and equal priority inter-frequency

**Exising UE behavior:** UE shall perform ranking of all cells that fulfil the cell selection criterion S. And ranking is performed based on cell-ranking criterion Rs for serving cell and Rn for neighbouring cells.

**Impact after distance threshold is introduced:**

**Case 1:** The reference location of neighbour cell is broadcast and UE is able to evaluate the distance to the reference location to compare it with the threshold

=> Neighbour cell whose distance to UE is shorter than or equal to the threshold will be ranked by UE based on R-criterion, i.e. neighbour cells provided with reference location but the distance to UE is larger than the threshold will be excluded in cell ranking.

**Case 2:** The reference location of a neighbour cell is not broadcast

=> UE does not estimate the distance to this cell and the legacy behaviour applies, i.e. this cell will still be ranked based on R-criterion.

**Case 3:** UE is unable to evaluate the distance to the reference location, e.g. due to no available UE location at its own side.

=> UE does not estimate the distance to this cell and the legacy behaviour applies, i.e. UE rank all the candidate cells based on R-criterion.

**Question 1.1) Do companies support the observation that introduction of a distance threshold for cell reselection would not impact the inter-frequency and inter-RAT cell reselection criteria based on cell reselection priority?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Google | See comment | If UE detects a ‘qualified’ inter-freqeuncy (or inter-RAT) cell that has higher priority than the serving frequency does, UE will reselect to that cell based on the legacy operation. Now if the distance threshold is provided, it is unclear whether the UE shall take into account the distance factor while evaluating whether a higher-priority inter-frequency cell is a ‘qualified’ cell. |
| Intel | Yes | This distance threshold is only used to determine a group of neighbour cells, and it doesn’t affect the existing rules. |
| Apple | Yes | Location based cell reselection is not used for higher priority frequency and inter-RAT cells |
| MediaTek | Yes | Inter-frequency and inter-RAT cell reselection will be based on legacy (R16) priorities. |
| Qualcomm | Yes | Agree with google. Reference location of neighbor cell will not be always available, besides beam information could be different for different satellites. So gain of this enhancement is not entirely clear. |
| Lenovo | Yes | Distance ony decides whether to consider a neighbour cell as candidate. |
| Huawei, HiSilicon | No | In our understanding, the inter-frequency and inter-RAT reselection also involves cell ranking. The following paragragh exists in TS 38304 Chapter 5.2.4.5 NR Inter-frequency and inter-RAT Cell Reselection criteria:  *If more than one cell meets the above criteria, the UE shall reselect a cell as follows:*  *- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;*  *- If the highest-priority frequency is from another RAT, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.*  Therefore, if location information is used to filter cells too far away before ranking, it also impacts inter-frequency and inter-RAT reselection. |
| vivo | No | Our understanding is that the location-based cell reselection impacts the condition when the UE shall perform inter-frequency cell reselection in the cell reselection criteria subclauses (i.e. 5.2.4.5). Particularly, we think only the neighbour cells with distance shorter than the threshold will be considered to determine whether the UE shall perform cell reselection to a cell on a higher-priority inter-frequency and/or lower-priority inter-frequency. |
| OPPO | Yes with comment | To be more precise, it should be no impact on the inter-RAT and non-equal priority inter-frequency cell reselection. |
| Samsung | No (see comment) | Agree with Google. To us, if far-away neighboring cells should not be considered for the cell reselection even though the measured RSRP is good enough (that’s why we introduced distance-based cell reselection criteria), that principle should be applied to both intra-F and inter-F cell reselections. What’s the reason far-away neighbouring cell should be considered for inter-F cell reselection while it should not be considered for intra-F cell reselection? |
| Xiaomi | Yes | UE location based cell reselection only be used for intra-frequency and equal priority inter-frequency. |
| Spreadtrum | No | Agree with Google. The distance threshold for cell reselection would impact the ranking order for all the neighbour cells, and further impact the reselection result. |
| ITRI | Yes | Distance is used in determining whether the neighbour cell could be considered in cell ranking. |
| CMCC | Yes | The distance threshold solution is just a assistance for reselection, which should not have an impact on the legacy mechanism. |
| Transsion | Yes | For neighbor cells with higher priority than serving cell, the legacy reselection rule is sufficed. |
| Nokia | Yes | Agree with the principle described above for inter-f and inter-RAT. |
| CATT | See the comment | Agree with Google and Qualcomm. The target of cell reselection criteria is to select a cell that can provide a better service for UE, however the location cannot do this in case of NTN has different radius. Just based on the RSRP in Rel 17. |

**Question 1.2) Do companies agree with the following understanding on the expected UE behaviour for intra-frequency and equal priority inter-frequency cell reselection in the following three cases after the introduction of a distance threshold for cell reselection? If no, please share your understanding on the expected UE behaviour in the “comments” row.**

**Case 1:** The reference location of neighbour cell is broadcast and UE is able to evaluate the distance to the reference location to compare it with the threshold

=> Neighbour cell whose distance to UE is shorter than or equal to the threshold will be ranked by UE based on R-criterion, i.e. neighbour cells provided with reference location but the distance to UE is larger than the threshold will be excluded in cell ranking.

**Case 2:** The reference location of a neighbour cell is not broadcast

=> UE does not estimate the distance to this cell and the legacy behaviour applies, i.e. this cell will still be ranked based on R-criterion.

**Case 3:** UE is unable to evaluate the distance to the reference location, e.g. due to no available UE location at its own side.

=> UE does not estimate the distance to this cell and the legacy behaviour applies, i.e. UE rank all the candidate cells based on R-criterion.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Google | Yes |  |
| Intel | Yes |  |
| Apple | Yes |  |
| MediaTek | Yes |  |
| Qualcomm | No | It is not clear how it is guaranteed that the neighbor cell whose distance to UE is longer is not better if it can meet S-criteria? It may be the best one as it is incoming satellite. |
| Lenovo | Yes |  |
| Huawei, HiSilicon | No for Case 2 | According to the pre-meeting summary R2-2203386, Option 1 gained the majority support and the proposal is formulated accordingly. The difference between Option 1 and Option 1 b is that, in Option 1, cells without a reference location will not be ranked whereas in Option 1b they will.  *- Option 1: only neighbor cells with distance shorter than a threshold will be considered during cell reselection;*  *- Option 1b: exclude neighbor cells too far away i.e., distance longer than a threshold will not be considered during cell reselection;*  Based on this, Case 2 should be revised to: UE does not estimate the distance to this cell and the cell will not be ranked. |
| vivo | Yes |  |
| OPPO | No | We are wondering how this really works.  Firstly, whether case 1 and case 2 are exclusive? We doubt. It is up to network whether to broadcast the reference location for neighbour cells. It is possible to broadcast for some neighbour cell, but not for some others.  Secondly, for the neighbour cell for which reference location is provided, if the distance does not satisfy the configured threshold, does it mean UE has no candidate cells left as shown in case 1? Or should UE then follow case 2 to evaluate those neighbour cells for which reference location is not broadcasted? We think this kind of two-step reselection would be complicated and spec impact would be large.  In general, we think using an absolute distance threshold to filter candidate cells is problematic, and we should rather consider ranking using the distance information, e.g. UE selects the target cell with the shortest distance to the satellite’s cell center among the N best cells using RSRP ranking. This can at least prioritize reselection to those quasi-earth fixed cells. And if no distance is obtained, UE follows legacy rules. |
| Samsung | No | For case 1, it sounds the UE first applies location-based cell reselection criteria then the UE applies legacy cell reselection criteria among the neighboring cells that meet the location-based cell reselection criteria. We have concern on this way since the UE always need to turn on GNSS to evaluate location-based cell reselection criteria (because location-based cell reselection criteria is the first checking), it will require more UE power consumption. Instead, we prefer legacy cell reselection criteria should be applied first then only if there is better ranked neighbouring cell, the UE turns on GNSS to evaluate location-based criteria only for better ranked cell. |
| Xiaomi | No | For the current case 1 and case 2, we agree there will be some issues as indicated by OPPO. So we suggest to revise the case 2 as following:  UE does not estimate the distance to this cell and it will be excluded in cell ranking. |
| Spreadtrum | Yes with comments | The order of ranking for case 1 shall be included. Firstly the legacy cell reselection criteria, secondly, the distance. |
| ITRI | Yes |  |
| CMCC | Yes |  |
| Transsion | Yes |  |
| Nokia | No for Case 1 | In our opinion, even if the reference location is broadcast and the UE is able to evaluate the distance, the UE shall still first perform the legacy ranking and then apply the distance (i.e. first selection based on RSRP/RSRQ criteria) criteria. |
| CATT | See the comment | Even if the distance threshold between UE and neighbour cell is introduced, the R-criterion doesn’t need to consider the distance information. It should only consider the RSRP for the ranking.  As for the above understanding, we are wondering how to capture ”neighbour cells provided with reference location but the distance to UE is larger than the threshold will be excluded in cell ranking” and “UE does not estimate the distance to this cell”. |

## Simultaneous configuration of location-based and time based reselection

During the first round discussion, the main concern for supporting simultaneous configuration of location-based and time based reselection is the unclear UE behaviour upon reception of such configuration.

The location based cell reselection here refers to the measurement related agreement we made last meeting that *UE may choose not to perform neighbour cell measurements of “NR intra-freq or inter-freq with equal or lower priority, or inter-RAT freq with lower priority”, if (the distance between UE and serving cell reference location is shorter than a threshold) and (legacy Srxlev/Squal condition is met, i.e., serving cell’s Srxlev/Squal is better than a threshold)*.

The time based reselection here refers to the measurement related agreement that UE should start measurements on neighbour cells before the serving cell stops covering the current area.

The following options have been raised on the expected UE behaviour:

* Option 1: Leave to UE implementation to apply either one or both of them.
  + Option 1.1: Apply time based
  + Option 1.2: Apply location based
  + Option 1.3: Same as option 2
* Option 2: UE should apply both if configured simultaneously

The following cases needs to be considered when both t-service and the distance threshold are broadcast:

|  |  |  |
| --- | --- | --- |
| **Cases** | **Option 1** | **Option 2** |
| **Case 1:**  t-service is approaching;  and distance between UE and the serving cell reference location is shorter than the threshold. | * Option 1.1: UE start to peform measurments on neighbour cells. * Option 1.2: UE may choose not to perform cell measurments of NR intra-freq or inter-freq with equal or lower priority, or inter-RAT freq with lower priority. | UE start to perform measurements on neighbour cells as we use “should” for the time based agreement but “may” for location based agreements. |
| **Case 2:**  t-service is approaching;  but distance between UE and the serving cell reference location is larger than or equal to the threshold. | * Option 1.1: UE start to peform measurments on neighbour cells. * Option 1.2: The legacy behaviour applies. | UE start to perform measurements on neighbour cells. |
| **Case 3:**  t-service is not approaching;  but the serving cell reference location is shorter than the threshold. | * Option 1.1: The legacy behaviour applies. * Option 1.2: UE may choose not to perform cell measurments of NR intra-freq or inter-freq with equal or lower priority, or inter-RAT freq with lower priority. | UE may choose not to perform cell measurments of NR intra-freq or inter-freq with equal or lower priority, or inter-RAT freq with lower priority. |
| **Case 4:**  t-service is not approaching;  and the serving cell reference location is larger than or equal to the threshold | * Option 1.1: The legacy behaviour applies. * Option 1.2: The legacy behaviour applies. | The legacy behaviour applies. |

The rapporteur would like to clarify companies’ understanding on the options on table under all the possible cases.

**Question 2.1) Do companies agree with the above understanding on the expected UE behaviour under the four cases with different options? If no, please share your understanding on the expected UE behaviour in the “comments” row.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Google | Yes |  |
| Intel | Yes |  |
| Apple | Yes |  |
| MediaTek | No | We don’t think simultaneous configuration of time and location is needed. |
| Qualcomm | Yes |  |
| Lenovo | Yes |  |
| Huawei, HiSilicon | Yes |  |
| vivo | Partial yes | If “The legacy behaviour applies” means that the UE still needs to determine whether to perform measurements of neighbor cells based on legacy Srxlev/Squal condition, we have a different understanding on case 2 with option 1.2, case 4 with option 1.2 and case 4 with option 2.  Particularly, we already had the agreement “*Adopt the text proposal in R2-2203725 to capture the location based cell reselection agreements in 38.304*”. Based on this agreement and the related TP, it means that *as long as* the location-based condition *or* the RRM based condition is not satisfied, the UE shall perform measurements, regardless of the RRM conditions anymore. Then, for case 2 with option 1.2, case 4 with option 1.2 and case 4 with option 2, it is just for the situation that the location based condition is not met, so as per the agreed TP, the UE shall perform intra-/inter-Freq measurements, instead of further checking the RRM based conditions as in the legacy. |
| OPPO | Yes |  |
| Samsung | No | We agree with MediaTek. Note for CHO, we already agreed joint time-based and location-based CHO execution triggering is not supported in Rel-17, then why for idle/inactive we need to support joint configuration of time and location? It’s quite inconsistent for us. |
| Xiaomi | Yes |  |
| Spreadtrum | Yes |  |
| ITRI | Yes |  |
| CMCC | Yes |  |
| Transsion | Yes |  |
| Nokia | No | In our opinion Option 1 is not acceptable and pointless. What is the benefit of configuring both if we then leave it up to the UE to decide if it wants to use both? There needs to be certain predictability. We do not think simultaneous configuration is needed, unless there are strict rules how the UE uses all what has been configured. But it seems to be problematic in Rel-17 NTN to expect the UE in IDLE mode has always a valid location information for such cell reselection evaluations.  Please note that simultaneous configuration of time- and location-based evaluation has been already excluded for CONNECTED mode (CHO). |
| CATT | See the comment | For case 3:  According to the time-based mechanism, If t-service is not approaching, the UE measurements follow Legacy behaviour (i.e., based on Srxlev/Squal) and there is no measurement relaxation (agreement in RAN2# 116bis).  According to the location-based mechanism, If the serving cell reference location is shorter than the threshold, UE may choose not to perform intra-frequency or inter-frequency with equal or lower priority.  So the action of Option 2 should be the same as Option 1.1 of case 3, which is stricter. |

Among all these options, the rapporteur would like to understand which would be the most popular one and also to see whether we need to capture anything in 304 to clarify the UE behaviour, if Yes, what would be the spec impact.

**Question 2.2) If simultaneous configuration of t-service and the distance threshold is supported, which option do companies prefer on the expected UE behaviour? For the option you pick, please clarify the potential spec impact, i.e. what needs to be captured in 304 CR for this option?**

* Option 1: Leave to UE implementation to apply either one or both of them.
  + Option 1.1: Apply time based
  + Option 1.2: Apply location based
  + Option 1.3: Same as option 2
* Option 2: UE should apply both if configured simultaneously
* Other option

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Option?** | **Comments** | **Potential spec impact for the option picked** |
| Google | Optino 2 |  | Even with option 2, there is no need to specifiy specifically the case when both t-service and distance threshold are configured, as the “start to perform” operation should always overwrite the “may choose not to perform” operation in a rational UE implementation. |
| Intel | option 2 | As t-service is used to trigger the neighbour cell measurements, and distance threshold is used to determine a group of qualified neighbour cells, they are not contradictory. |  |
| Apple | Option 2 | The UE needs to apply time based reselection anyways, if configured, otherwise it might go out of coverage. And this can be done in conjunction with location based procedures, if configured. |  |
| MediaTek | Option 1.1 |  |  |
| Qualcomm | Other | It is simple not to have both configured simultaneously and this is also not needed.  But if both configured, the UE should follow the one whichever is satisfied first.  Option 1.1 and 1.2 does not make sense, then why both configurations are provided? |  |
| Lenovo | Option 2 | Distance-based and time-based as defined for now can work simultaneously. |  |
| Huawei, HiSilicon | Option 1 | Both time-based reselection and location-based reselection are only for quasi-fixed cell scenarios according to current agreements.  In quasi-fixed cells, UEs with slow speed only need to consider t-Service. UEs located at cell edge or UEs with a fast speed should consider location-based resection as well. | A note may be needed so say that if the UE applies only one of them, the restriction on the other can be ignored. |
| vivo | Option 2 | We think applying both can be well coordinated by the explanation on Case 1, Option 2 by the Rapp. So, Option 2 can work well w/o problem. | Text proposal in R2-2203725 about the location-based condition and current running CR about the time-based condition are sufficient. |
| OPPO | Option 2 | It would be straightforward that UE follows both conditions for the expected UE behaviour when both are configured. | We don’t see the additional spec impact for Option 2. |
| Samsung | Option 1.1 |  |  |
| Xiaomi | Option 1 |  |  |
| Spreadtrum | Option 2 | If both are configured, UE shall apply all the reselection criterions. | The ranking order shall be included in the specification. |
| ITRI | Option 2 | Time-based would trigger the start of cell reselection, and location-based could further select the neighbour cells visible to UE. |  |
| CMCC | Option2 | T-service is introduced to trigger neighbor measurement, while distance threshold introduction is for reselection as mentioned in above discussion. That is to say, the T-service and distance threshold have different uses, which are not mutually exclusive. |  |
| Transsion | Option2 | Up to UE’s implementation, i.e. UE can use location based as a trigger decision if it’s far from reference location, and using t-service as an trigger condition if the timer is going to expire. |  |
| Nokia | Option 2 if both can be configured | But in principle we do not support the simultaneous configuration. This is excluded already for CONNECTED mode (CHO), so it is especially weird to expect IDLE mode UEs will be using such configuration. |  |
| CATT | Option 2 | But we are wondering the use case for which the simultaneous configuration of t-service and the distance threshold is needed. |  |

## Assistance information for UE-based SMTC adjustment in idle and inactive mode

Based on the outcome of the first GTW session, there will be assistance information provided from NW to UE and we are supposed to down select from the options.

**Question 3) Which option(s) do companies prefer, as the assistance information provided from NW side for UE based SMTC adjustment in idle and inactive mode?**

* Option 1: feeder link delay of neighbor cells
* Option 2: Common TA paramaters of neighbor cells
* Option 3: SMTC offset or change rate of neighbor cells
* Option 4: Reference time of the SMTC of neighbor cells
* Option 5: Delay difference between the serving and neighbor cell
* Other option?

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| Google | Option 3 and 4 | The reference time indicating when the SMTC was set up is required, otherwise the UE may not be able to adjust the SMTC based on whatever assistance information (including ephermis information). This is similar to the case where UE needs the epoch time to calcaulate the common TA.  A drift/change rate to the SMTC offset is also beneficial; it helps UE determine the SMTC offset of the neighbour cell when the ephemeris information of the neighbour cell is not available, or when the UE is not able to access its GNSS data. |
| Intel | option 1 with comments | We think feeder link delay and K-mac should be provided to UE. In this case, UE can estimate the one-way delay values of both serving cell and neighbours, so UE can get the delay difference between them for adjusting SMTCs. The option 5 can’t work because this difference should be per UE, and NW can’t broadcast a common value for all UEs. |
| MediaTek | Option 3 |  |
| Qualcomm | Option 3 = Option 2 | Option 2 in fact can include Option 1. Common TA parameters also include common TA i.e., feeder link delay. Kmac is constant, can be provided if different from serving.  In our understanding, Option 2 or Option 3 would be have same purpose. Common TA parameters in fact can provide both offset (by ephemeris and feeder link delay) and change rate (by drifting parameters). |
| Lenovo | Option 3 | Option 3 can be directly used by UE. |
| Huawei, HiSilicon | Option 1 or 2 with comments | For Option 2, we think Kmac is also needed.  FL delay = common TA + K\_mac. The advantage of Option 1 (FL delay) is that it is simpler and occupies less overhead, while the advatage of Option 2 (common TA parameters + K\_mac) is that UE can predict future values since drifting rates are included in the common TA parameters. |
| vivo | Option 1 | For a given frequency, in order to support measurements on cells deployed in different orbits, the feeder link delay of neighbor cells is needed. |
| OPPO | Option 1 or Option 2 (if including Kmac) | Option 2 needs to include Kmac in addition to common TA because SSB is sent from gNB instead from the RP (designed in RAN1). In our understanding, the difference between Option 1 and Option 2 is that Option 1 uses one parameter for whole feeder link delay, but Option 2 uses common TA with Kmac.  Providing feeder link delay or common TA parameters including common TA and Kmac is both feasible, so that UE can calculate the delay difference between serving cell and neighbour cell. |
| Samsung | Option 1, 2, 3 | Feeder link delay of serving and neighbour cell for UE to calculate propagation delay difference between serving cell and neighbour (UE can determine service link delay difference by location and ephemeris), or NW can directly provides feeder link delay differences. Change rate of feeder link delay (difference). Common TA parameters can replace feeder link information. SMTC offsets for UE to choose from based on the propagation delay difference. |
| Xiaomi | Option 2 with comments | Kmac is also needed for UE to calculate feederlink delay. |
| Spreadtrum | Option 1,3 | For option 1, with feeder link delay, UE could calculate the total transmission delay of neighbour cell, and adjust the SMTC itself.  Option 3 is direct for UE. |
| ITRI | Option 3 | UE could take epoch time as reference time and utilize SMTC offset/update rate to perform UE-based SMTC adjustment. |
| CMCC | Other or Option2 | With ephemeris of both serving satellite and neighbour satellite are enough for UE to adjust SMTC. And if RAN2 think additional NW assistance information is necessary, we are prefer common TA parameters.  Option5 is not correct, because the delay difference between the serving and neighbor cell could not be known by the NW, which is deduced by the UE with the assistance information ephemeris and Common TA parameters(if supported) |
| Transsion | Option 3 |  |
| Nokia | Option 3 | Offset shall tell the UE how much it can individually shift the basic SMTC configuration (read from the SIB by all UEs). |
| CATT | Option 2 | Agree with Qualcomm. |

## Introduction of a new bar bit

According to the latest RAN4 progress, there is some overlap between NTN bands and IMT bands, and different band numbers are used (i.e. n255 is overlapping with IMT band n24, n256 is partially overlapping with IMT band 65/66) as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| **NTN satellite*operating band*** | **Uplink (UL)*operating band* SAN receive / UE transmit**  **FUL,low   –  FUL,high** | **Downlink (DL)*operating band* SAN transmit / UE receive**  **FDL,low   –  FDL,high** | **Duplex mode** |
| n256 | 1980MHz – 2010 MHz | 2170 MHz – 2200 MHz | FDD |
| n255 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |
| NOTE1:NTN bands are numbered indescending order from n256.. | | | |

**TN band:**

|  |  |  |  |
| --- | --- | --- | --- |
| n65 | 1920 MHz – 2010 MHz | 2110 MHz – 2200 MHz | FDD |

|  |  |  |  |
| --- | --- | --- | --- |
| n247 | 1626.5 MHz – 1660.5 MHz | 1525 MHz – 1559 MHz | FDD |

Also considering the future compatibility issues, i.e. potential more overlap between TN and NTN bands in future release, the rapporteur understand it is better to introduce a new bar bit for NTN at the very beginning.

**Question 4.1) Do companies agree that we need to introduce a new bar bit for NTN to bar NTN UEs from accessing a NTN cell?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Google | - | No strong view, but we do not see an immediate need to have it. |
| Thales | Yes |  |
| Intel | Yes |  |
| Apple | Maybe | No strong view. We think it is not really needed in Release 17 time-frame and can always have different band numbers for NTN and TN scnearios with some cooperation from RAN4. |
| MediaTek | Yes |  |
| Qualcomm | No | See our response in Q4.2. If defined this in future, there will be backward compatible issue. |
| Lenovo | - | We don’t see the need but can follow IoT NTN’s agreement. |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes |  |
| OPPO | Yes | We can follow on the agreement made in IoT-NTN. |
| Samsung | No | Question is confusing to us. “to bar NTN UEs from accessing a NTN cell”? Shouldn’t NTN UEs be able to access NTN cell? |
| Xiaomi | Yes |  |
| Spreadtrum | Yes | It is same as the agreement in NB-IoT NTN. |
| ITRI |  | No strong view. |
| CMCC | No for now | No strong view, however there maybe some issue as Qualcomm comments. Therefore, it may be better not to introduce this restriction for now. |
| Transsion | Yes | Both introduce a new bar bit or reuse reserved bit/IE are ok. We can refer to IOT- NTN’s design. |
| Nokia |  | We agree with Samsung that the question should be asked precisely, to begin with, as we are not sure what the companies are actually supporting (to bar the NTN UEs from accessing an NTN cell?).  Based on the tables with band information it seems the NTN frequencies can overlap with IMT carriers, that we confirm. |
| CATT |  | We think for the NTN specific band, the new bit is additional system overhead, because the current bar bit in MIB can also work well. So we think the new bit is not always needed.  But we can follow the majority, considering the possible band overlap of the TN and NTN network and the uniform operation. |

The following agreement has been made in IOT-NTN session on the new bar bit:

* A new bit, e.g. *cellBarred-NTN*, is introduced in SIB1 to bar NTN UEs from accessing a NTN cell. FFS whether to consider MIB instead of SIB1 for NB-IoT. NTN UE ignores the legacy bit.

For NR-NTN, we understand the following options can be considered for the new bar bit:

* Option 1: Introduce the new bar bit in MIB by using the last spare bit.
* Option 2: Introduce the new bar bit in SIB1.
* Other option?

**Question 4.2) On introduction of the new bar bit for NTN, which option do companies prefer?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1/2/other** | **Comments** |
| Google | Option 2 | If the majority would like to have the new bar bit for NTN, we prefer option 2 as it aligns the current design in IoT-NTN. |
| Intel | option 2 |  |
| Apple | Option 2 | If we go with barring bit, then prefer SIB1 |
| MediaTek | Option 2 |  |
| Qualcomm | Other | Do we the option that NTN cell bars only NTN UEs but allows TN UEs?  For NR NTN, barring via SIB would be worse than currently what we have for NR UEs (i.e., barring in MIB).  MIB solution is actually possible without using spare bit. See below   |  |  |  | | --- | --- | --- | |  | cellBarred in MIB | ssb-SubcarrierOffset/ pdcch-ConfigSIB1 in MIB | | TN-only UEs barred  NTN UEs not barred | = barred | UE knows where to find SIB1 | | all UEs barred | = barred | no SIB1 scheduled | | No UEs not barred | = Not barred | Same as today | |
| Lenovo | Option 2 |  |
| Huawei, HiSilicon | Option 2 |  |
| vivo | Option 2 | Similar to the legacy bar bit(s), putting the new bar bit for NTN in SIB1 is reasonable. |
| OPPO | Option 2 | It is not essential to use the last spare bit in MIB for the new bar bit. We prefer to follow the agreement made in IoT-NTN. |
| Samsung | Other (see comment) | First we would like to clarify our question in 4.1. |
| Xiaomi | Option 2 |  |
| Spreadtrum | Option 2 | The legacy bar information is in SIB1, so the new bar bit shall be also in SIB1. |
| ITRI | Option 2 |  |
| CMCC | Pls. See our comments for Q4.1 |  |
| Transsion | Option 2 |  |
| Nokia | Definitely not Option 1 |  |
| CATT | Option 2 |  |

## Indication of earth fixed and earth moving cell

The t-service would only be broadcast for earth fixed cell thus companies understand this can also be considered as an implicit indication of the cell type. Since the t-servcie is optional in SIBxx, the following understanding is shared on the presence of the t-service and what we can infer:

* t-service broadcast
  + the serving cell is earth fixed
* t-service not broadcast
  + the serving cell is earth fixed but NW is not willing to provide the t-service
  + the serving cell is earth moving

**Question 5.1) Do companies agree with the above understanding on the presence of t-service?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Google | Yes |  |
| Thales | No | It should be clarified that it applies to “quasi“ earth fixed.  We recommend an alternative approach:   * t-service broadcast   + the serving cell is quasi earth fixed * t-service not broadcast   + ~~the serving cell is earth fixed but NW is not willing to provide the t-service~~   + the serving cell is earth moving |
| Intel | see comments | agree with Thales |
| Apple | No | Why should a quasi-earth fixed cell not broadcast t-Service? |
| MediaTek | No | Agree with Thales. |
| Qualcomm | Yes | But we agree with Thales. The quasi-earth fixed cell should provide the cell stop time. It could be 5 mins or 10 mins. Only network knows this. If network does not provide, there may be problem. |
| Lenovo | No | Agree with Thales’s proposal |
| Huawei, HiSilicon | See comments | Agree with Thales |
| vivo | Yes |  |
| OPPO | No | Implicit indication works only for the serving cell, but not for neighbour cells, because we haven’t agreed to broadcast t-service for neighbour cells. Broadcasting only for serving cell does not aid anything for cell reselection. We still prefer to have explicit indication for neighbour cells. |
| Samsung | No | Agree with Thales |
| Xiaomi | No | Agree with Thales |
| Spreadtrum | No | Agree with Apple. |
| ITRI | No | Agree with Thales |
| CMCC | No | Agree with Thales |
| Transsion | No | Same view with Thales. |
| Nokia | yes | But we think Thales has a point. We need to discuss again if t-Service should be always provided in quasi-Earth-fixed, while the optionality is due to the same SIB definition for EMC? |
| CATT | No | Agree with Thales. |

During the pre-meeting email discussion and the first round offline discussion, the need or use case for UE to differentiate the earth moving and earth fixed cell has not been acknowledged thus the majority prefer not to have any explicit indication to show whether a cell is earth fixed or earth moving.

As insisted by some proponents to indicate such information to UE, this issue is re-discussed and the use case and need for such differentiation is expected.

**Question 5.2) Do companies see the need to indicate to UE whether a cell (serving cell and/or neighour cell) is earth moving or earth fixed? If Yes, please elaborate the use case in the “comments” row.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Google | No | It is a nice-to-have but not a must-to-have feature. If UE can know implicitly that a cell is a earth-moving or a quasi-earth-fixed cell, certain optimization (e.g., cell reselection) can be achieved by UE implementation. If UE cannot know it implicitly, UE can still live with it. |
| Thales | Yes |  |
| Intel | No | For serving cell, we can rely on t-service, and no other indication is needed. |
| Apple | No |  |
| MediaTek | No |  |
| Qualcomm | No | What matters to UE is how long it can stay in the cell. There is no need to de-prioritize the moving cell. What if all UEs camp in fixed cell and no UEs in moving cell? |
| Lenovo | No | UE can identify by already agreed parameters if necessary. |
| Huawei, HiSilicon | Yes | One use case is location-based CHO.  If the cell is a moving cell, UE may need to predict the reference location by combing the moving trajectory and the coverage information.  If the cell is a quasi-fixed cell, UE knows the reference location is fixed. |
| vivo | No | Also, for the proposal from Phase-1 discussion in question, we don’t think there is a need to further care about whether it is an “explicit” indication or an “implicit” indication implied by the “t-service”. The UE just follows what the NW configures it to do based on the time-based or location-based configurations, w/o a need to know how the NW looks like. So we may simply say “Not any indication on whether a cell is earth moving or earth fixed is needed” |
| OPPO | Yes | Compared with earth moving cells, it would be more preferable for UE to camp on earth fixed cells since they will provide longer serving time and less frequent handover. Therefore, among earth moving cells and earth fixed cells, UE should prioritize the selection towards the earth fixed cells. To enable such prioritization, network can provide information on whether a cell is earth moving or earth fixed. Explicit indication for neighbour cells would be required. |
| Samsung | Maybe yes (see comment) | For neighboring cells, t-service is not applied. Then the question is whether that information is needed for neighboring cell (including inter-F neighboring cell). In our view, it’s still unclear regarding how moving cell is supported. We can determine it only after we have clear understanding for moving cell. |
| Xiaomi | No |  |
| Spreadtrum | No |  |
| ITRI | No | UE can rely on t-Service as an indication if necessary. |
| CMCC | No |  |
| Transsion | No | It may have some gain, but we should calcify moving cell scenario first, which can be discussed in next release. |
| Nokia | No | We understand there are more NTN parameters than just t-Service, which can tell the UE if the cell is EFC or EMC. |
| CATT | No | About the priority problem, Qualcomm’s concern is reasonable. Far to now, we still not clear what aspects the cell type will impact, that we suggest that an indication is not needed in Rel 17. |

**Question 5.3) Only for companies answering “Yes” to 5.2, please share your thoughts on how to indicate the cell type, i.e. earth moving VS earth fixed, of a cell (serving cell and/or neighbour cell) to UE.**

|  |  |
| --- | --- |
| **Company** | **How to indicate the cell type of a cell (serving cell and/or neighbour cell) to UE?** |
| Thales | This will enable the UE to adopt the Cell re selection / CHO strategy:   * Quasi Earth fixed cell: Time based mobility * Earth moving cell: Time & location based mobility |
| Huawei, HiSilicon | It can be indicated though the presence of t-Service (as commented by Thales in Q5.1), or it can be indicated to the UE through RRC message if the network wants to configure location-based CHO to the UE. |
| OPPO | We can explicitly indicate the cell type (i.e. quasi earth fixed cell or Earth moving cell), e.g. indicating per cell or per frequency. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

## SIB content

After further coordination with [AT117-e] [101] rapporteur and the vice chair, the following proposals will be discussed in this offline:

**The following proposals from [AT117-e] [102] first round:**

**Proposal 11: No specific enhancement to provide the PCI of the incoming cell, can be provided as one element in the existing intraFreqWhiteCellList or interFreqWhiteCellList.**

**Proposal 12: Broadcasting the list of orbital parameters and timing drift parameters of the neighbor satellites as delta to the orbital parameters of the serving satellite is not supported.**

**Proposal 13: No need to provide the geographic tag associated with a set of cell reselection information or asscociation between the frequency and the neighbour satellite in Rel-17.**

**Proposal from** **[AT117-e] [101] first round:**

**Proposal 13 The following information to be broadcasted about neighbor cells:**

**- Neighbour cell Ephemeris information.**

**- Validity timer information for neighbour cell’s ephemeris information.**

**- reference location information of neighbour cells**

**FFS any other information**

**At least neighbour cell Ephemeris information shall be broadcast. FFS on other information about neighbour cells**

In summary, the following options have been provided as the information about neighbor cells that should be broadcast to UE:

* Option 1: PCI of the incoming cell
* Option 2: Geographic tag associated with a set of cell reselection information
* Option 3: Asscociation between the frequency and the neighbour satellite
* Option 4: Validity timer information for neighbor cell’s ephemeris information
* Option 5: Reference location information of neighbor cells
* Option 6: timing drift parameters of neighbor cells
* Other information

For option 4, the following understanding has been raised:

* Understanding 1: The validity timer for neighbor cell’s ephemeris information is the same as that for the serving cell.
* Understanding 2: The validty timer for neighbor cell’s ephemeris information is different from that of the serving cell.
  + 2.1: The validty timer is a common timer for all neighbor cells’ ephemeris information.
  + 2.2: The validty timer is provided per cell.
  + 2.3: other granularity

The rapporteur would like to clarify companies’ understanding on option 4 with Question 6.1).

**Question 6.1) Among the understanding 1/2.1/2.2/2.3 summerized above, which is aligned with your understanding? If your understanding on option 4 is not covered above, please elaborate the details in the “comments” row.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Understanding 1/2.1/2.2/2.3 or other?** | **Comments** |
| Intel | other | The validity time can be per satellite as the ephemeris data is per satellite. |
| Apple | other | On 1, we wonder if we should align with IoT-NTN where they are discussing using “mean” ephemeris vs. “instantaneous” ephemeris for neighbor cells. If we use instantaneous ephemeris for serving cell and mean for neighbor cell, then we think using the same validity timer is not justified. |
| Qualcomm | Both 1 and 2 possible | By default (if not provided), it should be same as serving cell. But we prefer to have option for network to indicate different validity timer for the neighbor cell. |
| Lenovo | 1 and 2.1 | For option 4 we think the validity timer can be either different or same to that of serving satellite. |
| Huawei, HiSilicon | 1 |  |
| OPPO | Both 1 and 2 possible | We share the same view as Qualcomm. It is up to network to configure. The signalling option should allow to configure the validity timer per neighbour cell. If a neighbour cell is not configured the validity timer, it can be considered the same as that for serving cell. |
| Samsung | 1,2 are possible | If serving cell and neighbour cell are from the same satellite, UE can use serving cell validity timer also for neighbour cell. NW can provides a different validity timer for neighbour cell if needed, otherwise, UE uses the serving cell validity timer. |
| vivo | 1 | For simplicity, understanding 1 is preferred by us. |
| Xiaomi | 1 |  |
| Spreadtrum | 2.2 | The value of validity time depends on the location of SAT, so it is provided per cell. |
| ITRI | 1 or 2.1 | Ther serving cell could indicate the validity time of the information provided by the serving cell. |
| CMCC | other | It may be more reasonable to provide the validity timer per satellite |
| Nokia | 1 | If the neighbour cell information is conveyed in the same SIB and serving cell info, then the same timer should be used. |
| CATT | other | Agree with Intel. |

The rapporteur would like to understand what information would be needed, the use case and the expected UE behaviour upon reception of such information with Question 6.2).

**Question 6.2) Among all the options listed below, which option(s) are needed? For the option(s) picked, please elaborate the use case and the expected UE behaviour upon reception of such information.**

* Option 1: PCI of the incoming cell
* Option 2: Geographic tag associated with a set of cell reselection information
* Option 3: Asscociation between the frequency and the neighbour satellite
* Option 4: Validity timer information for neighbor cell’s ephemeris information
* Option 5: Reference location information of neighbor cells
* Option 6: timing drift parameters of neighbor cells/satellites
* Other information

|  |  |  |
| --- | --- | --- |
| **Company** | **Option?** | **Comments** |
| Intel | 4 and 5 | For option 5, according to RAN2 agreement, the referfence location is only broadcast in quasi-earth fixed cell. |
| Apple | 2,4,5 | Without geographic tagging (even coarse), UEs will end up wasting time and power looking for neighbors they are never going to see.  PCI and timing drift parameters are not essential in our view. |
| Qualcomm | Option 2,3,4 and 6 | All options 2, 3,4 and 6 are optional for network. But signaling should provide network option to signal these paramaters if they help UE and network has this information to provide to UE.  Option 2 is needed in SIB4 if the frequency belongs to TN.  Option 3 is needed to link frequency and satellite between SIB4 or SIBxx.  Option 4 as explained in Q6.1.  Option 6 is needed for the UE for better operation in tracking SSBs of neighbor cells. The feeder link can change at the rate of 25us/s and the UE needs to know what is the rate. Few microsecond change will make huge difference.  First the UE needs to know timing offset of the neighbor SSB with respect to its Pcell SSB (using differential delay i.e., using both ephemris and feeder link delay). Then it needs to know at what rate this timing offset will vary (as gateway/gNB location would not be known). |
| Lenovo | Option 4, 5 and other | For other info we think epoch time of neighbour satellite is also needed. It can be either different or same to that of serving satellite. |
| Huawei, HiSilicon | Option 4 and 5 |  |
| OPPO | Option 4, 5 and 6 | Option 4 as comment on Q6.1  For Option 5, we have agreed to broadcast that for quasi-earth fixed cell.  Option 6 is needed to broadcast the feeder link delay or common TA parameters.  Other information:  We think that for the target cell, the epoch time also needs to be provided if it is not included as part of ephemeris information. |
| Samsung | Option 1, 3, 4, 5 | We think the frequency information and PCI about incoming new cell which replaces the current serving cell would be helpful to reduce UE power consumption much. When t-service is coming and measurement is triggered, in most cases measuring only upcoming cell would be enough.  Validity timer for neighbour cell ephemeris update, reference location for location-based cell reselection |
| vivo | Option 4 and 5 | Option 4 is used by UE to adjust the SMTC in idle and inactive mode.  Option 5 is needed for location-based cell reselection criterion. |
| Xiaomi | Option 4 and 5 | Option 4 is for UE to adjust the SMTC.  Option 5 is for location based cell reselection. |
| Spreadtrum | Option 4,5,6 | Option 4, see the comments for question 6.1.  Option 5, UE could apply location based cell reselection based on reference location information.  Option 6, UE could track SSB of neighbour cell with this information. |
| ITRI | Option 4 and 6 | Timing drift parameters of neighbour cells/satellites would benefit neighbour cell measurements. |
| Nokia | 3, 4, 5 | The association should be given. Also the validity (could be the same as for serving) and the reference location. |
| CATT | Option 4 | Option 5 need to wait for the discussion result of location based cell reselection criteria. Option 2, 3, 6 belong to enhancement, and we don’t need to consider these problems in Rel 17. |

Proposal 12 is slightly different from other proposals as it is proposing delta configuration of two parameters of neighbour satellites based on the information provided for the serving satellite:

* The orbital parameters of the neighbor satellites
* The timing drift parameters of the neighbor satellites

Since it has been agreed that neighbour cell Ephemeris information shall be broadcast, whether to support delta configuration can be discussed directly.

**Question 6.3) Do companies support delta configuration of neighbour cell ephemeris information based on the ephemeris information of the serving cell?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Intel | No | It would be easier to make them independent. |
| Apple | No |  |
| Qualcomm | Yes | This may be possible for satellites in the same constellation, for example, anomaly will be different as it determines where the satellite is. But the constellation information could be almost same like longitude, inclination etc.  Obviously it is up to network if TBS size allows, it can provide full ephemeris for each satellite. |
| Lenovo | Yes | We agree with Qualcomm’s view. This does not exclude full configuration. |
| Huawei, HiSilicon | No |  |
| OPPO | No | This is up to RAN1 to decide as those configurations are provided by RAN1. Without RAN1 input, RAN2 has no idea how much information each satellite shares in common. Considering RAN1 has finished the NTN WI, we prefer to postpone this enhancement to the future release. |
| Samsung | No | Sounds signalling optimization, which is not really important at this phase. |
| vivo | No | Considering the limited time for Rel-17, such signaling enhancement in not essential from our perspective. |
| Xiaomi | No |  |
| Spreadtrum | No | The number of neighbour cells shall be limited. Usually, the cell of same SAT orbit shall be included in neighbour cell list. |
| ITRI | No |  |
| Nokia | Yes | Qualcomm has a point and this should be relatively easy to implement for the cells from the same satellite or orbit, while the gains are massive (in terms of how many bits can be saved). |
| CATT | No |  |

The need for timing drift parameters has not be confirmed yet (under discussion in Question 6.2), the delta configuration can only be considered when the need for such information is confirmed.

**Question 6.4) Only for companies pick option 6 timing drift parameters of neighbor cells/satellites, do you support delta configuration of neighbour cell timing drift parameters based on the timing drift parameters of the serving cell?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | Reducing overhead is always better. |
| Lenovo | Yes | The overhead can be reduced signafically at least for orbital parameters (e.g. 6 of 7 can be the same (delta=0) as the orbit and 1 as the timing drift). |
| Spreadtrum | Yes | The size of message could be reduced. |
| ITRI | Yes | Delta configuration could reduce the configuration overhead. |
| Nokia | Yes | Agree with QC. |
|  |  |  |
|  |  |  |
|  |  |  |

# Conclusions

*To be added*

# References

[1] [R2-2202235](file:///C:\Data\3GPP\Extracts\R2-2202235_UE%20location%20during%20initial%20access_v04.doc) WF for UE location during initial access in NTN THALES, Leonardo, Avanti, ESA, Sateliot, Omnispace, Novamint, Hispasat, Gatehouse, Hughes network systems, Inmarsat, Viasat, CTTC, Intelsat, Kepler, Ligado, Magister solutions, SES, Airbus

[2] [R2-2202422](file:///C:\Data\3GPP\Extracts\R2-2202422%20Discussion%20on%20SIB%20X%20acquiring%20procedure.doc) Discussion on the SIBX acquiring procedure Spreadtrum Communications

[3] [R2-2202423](file:///C:\Data\3GPP\Extracts\R2-2202423%20Acquiring%20the%20ephemeris%20of%20neighbour%20cell.doc) Acquiring the ephemeris of neighbour cell Spreadtrum Communications

[4] [R2-2202466](file:///C:\Data\3GPP\Extracts\R2-2202466%20Remaining%20Rel-17%20NTN%20open%20issues%20for%20IDLE%20mode.docx) Remaining Rel-17 NTN open issues for IDLE mode Nokia, Nokia Shanghai Bell

[5] [R2-2202548](file:///C:\Data\3GPP\Extracts\R2-2202548%20NTN-TN%20idle%20mode%20mobility.docx) NTN-TN idle mode mobility Apple

[6] [R2-2203049](file:///C:\Data\3GPP\Extracts\R2-2203049.docx) Measurements and cell reselection Samsung Research America

[7] [R2-2202566](file:///C:\Data\3GPP\Extracts\R2-2202566%20Idle%20mode.docx) Assistance information for IDLE mode measurements Qualcomm Incorporated

[8] [R2-2202586](file:///C:\Data\3GPP\Extracts\R2-2202586%20Epoch%20time%20and%20validity%20time%20for%20neighbour%20satellite%20ephemeris.docx) Epoch time and validity time for neighbour satellite ephemeris Lenovo, Motorola Mobility

[9] [R2-2202774](file:///C:\Data\3GPP\Extracts\R2-2202774%20Remaining%20issues%20on%20location-based%20cell%20reselection.docx) Remaining issues on location-based cell reselection vivo

[10] [R2-2203004](file:///C:\Data\3GPP\Extracts\R2-2203004%20-%20Discussion%20on%20measurement%20rules%20for%20cell%20re-selection%20in%20NTN.doc) Discussion on measurement rules for cell re-selection in NTN OPPO

[11] [R2-2203386](file:///C:\Data\3GPP\Extracts\R2-2203386_%5bPre117-e%5d%5b102%5d%5bNTN%5d%20Idle%20mode%20open%20issues%20(ZTE)_v25_Rapporteur.docx) Report of [Pre117-e][102][NTN] Idle mode open issues (ZTE) ZTE corporation,Sanechips