3GPP TSG-RAN WG2 Meeting #119-e R2-2208641

e-Meeting: August 15th – 26th, 2022

**Title:** **Discussion on ephemeris usage for NR NTN**

**Source: Turkcell, Deutsche Telekom**

**T****ype: Discussion**

**Document for: Decision**

**Agenda Item: 8.7.4 NTN-TN and NTN-NTN mobility and service continuity enhancements**

**Release: 18**

1 Introduction

During the NR-NTN Rel 17 Work Item (WI), the impact of ephemeris usage on the idle and active mode procedures has been discussed. It was recommended in RAN2 #117-e that improvements might be needed for efficient idle/inactive mode mobility in Rel-18. The below highlights the major RAN2 recommendations for ephemeris in NR-NTN.

From RAN2 #118-e [1], the agreements related to AI 6.10.3.1 Idle/inactive mode aspects are below:

Agreements:

1. Ephemeris, common TA parameters, epoch time and validity duration can be updated without invoking the SI modification procedure
2. Regarding ephemeris, common TA parameters, epoch time and validity duration, UE considers the parameters as valid during validity duration, but the NW is not prevented from triggering the SI modification if there are major changes. No spec impact is introduced. RAN2 understands that the NW should not change validity duration alone
3. On-demand SIB19 is not supported for UEs in RRC\_CONNECTED state in NR NTN Rel-17

From RAN2 #117-e [2], the agreements related to AI 8.10.3.1 Idle/inactive mode aspects are at below:

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).

This contribution provides recommendations for satellite ephemeris in active and idle/inactive mode operations.

2 Discussion

2.1 System Information

The serving and neighbour satellite’s ephemeris can include different parameters such as position, velocity state vector and orbital parameters. Neighbour cells of the same satellite and orbit can share the same parameters. It may not need to provide the entire configuration for each cell separately. Parameters included in system information as part of ephemeris can be individually configured to be enabled or disabled.

**Observation 1:** Ephemeris parameters for the cells from the same satellite, orbit or constellation may be the same. Using delta configuration can reduce the number of bits.

Many neighbour cells of the same satellite and orbit can share the same orbital parameters. An indication can be used either for intra-frequency or inter-frequency neighbours that orbital parameters are the same as for the serving cell. We have the following proposal:

**Proposal 1:** The neighbor cells of the same satellite and orbit can support the delta configuration of the ephemeris information of the serving cell. We can use the partial orbital parameters from ephemeris info of the serving cells indicated in intra-frequency and inter-frequency neighbours.

Different parameters included in system information as part of ephemeris can be individually configured to be enabled or disabled. The power constraints of UEs become more critical with ephemeris update periodicity. Too frequent ephemeris updates can consume UE power unnecessarily. A high number of SIB ephemeris updates needs more frequent system information modifications.

**Observation 2:** Ephemeris parameters can have different validity duration requirements. Two other/different mechanisms can address slowly and quickly changing parameters in the satellite ephemeris.

We have the following proposal:

**Proposal 2:** SIB ephemeris update can be triggered with defined fields in different ephemeris parameters, although a change on these parameters does not always imply a SIB update. Parameters may need other update times. We can use different SIB trigger duration for slowly and quickly varying parameters. We need to minimize the power consumption of UEs by using different maximum validity times of the satellite ephemeris without having acquired new satellite ephemeris.

3 Conclusion

In this contribution, we provide our views related to satellite ephemeris to decrease the power consumption of UEs and system information loads. We support the minimum changes in UE behaviour and 3GPP technical specifications. Our observations and proposals are shared below:

**Observation 1:** Ephemeris parameters for the cells from the same satellite, orbit or constellation may be the same. Using delta configuration can reduce the number of bits.

**Observation 2:** Ephemeris parameters can have different validity duration requirements. Two other mechanisms can address slowly and quickly changing parameters in the satellite ephemeris.

We have the following proposals:

**Proposal 1:** The neighbor cells of the same satellite and orbit can support the delta configuration of the ephemeris information of the serving cell. We can use the partial orbital parameters from ephemeris info of the serving cells indicated in intra-frequency and inter-frequency neighbours.

**Proposal 2:** SIB ephemeris update can be triggered with defined fields in different ephemeris parameters, although a change on these parameters does not always imply a SIB update. Parameters may need other update times. We can use different SIB trigger duration for slowly and quickly varying parameters. We need to minimize the power consumption of UEs by using different maximum validity times of the satellite ephemeris without having acquired new satellite ephemeris.

4 References

1. Chair's Notes RAN2#118-e R17 NTN-REDCAP-CE\_EOM
2. Chair's Notes RAN2#117-e R17 NTN-REDCAP-CE\_EOM

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