**3GPP TSG-RAN WG2 Meeting #128 *DRAFT*\_R2-24xxxx**

**Orlando, USA, Nov. 18th – 22nd, 2024**

**Agenda Item: 8.9.2**

**Source: CATT**

**Title: Report of [AT128][304][R19 IoT NTN] Satellite IDs for S&F (CATT)**

**Document for: Discussion and Decision**

1. Introduction

This contribution reports the progress of the following offline discussion:

* **[AT128][304][R19 IoT NTN] Satellite IDs for S&F (CATT)**

Scope: Discuss RAN2 assumption on use of satellite IDs for S&F and draft LS to SA2

Intended outcome: report of offline discussion and draft LS

Deadline for rapporteur's summary (in R2-2410974): Friday 2024-11-23 08:00

1. Discussion

As some preliminaries of SA2 progress to facilitate the discussion:

* In TR23.700-29, CONCLUSION part, the MME-configured satellite ID was concluded as the outcome of SA2’s Rel-19 study item FS\_5GSAT\_SEC\_Ph3, and was concluded to be “with normative impacts”. See citation in the [Appendix](#_Appendix: Assistance information from TR23.700-29 conclusion [2]) for information.
  + NOTE that it clearly says that this MME-configured satellites ID impacts both “data and signalling” transmission for the S&F UE, including also both MO and MT.
* SA2 in the normative phase, till now, has agreed the relevant CRs in [3][4][5] to TS23.401, but those CRs looks like not having clearly reflected the above study phase conclusions.

Since at least in SA2’s study item conclusion, there is clear AS-level impact mentioned (e.g. “Satellite IDs based on the SIB information broadcasted by eNB”, “finds the cell which broadcast the Satellite ID”, etc.), RAN2 needs to first understand what SA2 expects RAN2 to do for the related AS procedure, and asks SA2 for calcification (if hard to conclude all by RAN2 itself) .

## 2.1 Disc point 1: RAN2 understanding on how the MME-configured Satellite IDs work in AS for S&F?

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| Check companies’ understanding  For a S&F capable UE with a list of Satellite IDs configured by MME:   * Understanding A: the UE is still allowed to camp on a satellite operating in normal IoT NTN mode (with feeder-link), and perform subsequent access and data/signalling communication with that satellite (if there is also a normal IoT NTN satellite available). * Understanding B: the UE can only camp on a satellite in the MME-configured satellite list, and perform subsequent access and data/signalling communication with that satellite (if there is a satellite in the MME-configured list available). * Understanding C: the MME-configured satellite list may include both satellites operating S&F and normal IoT NTN satellites. |

*Note that the discussion on above understanding only aims to reach RAN2 understanding on how the MME-confiugred satellite ID works in the AS at a Stage-2 level, without implying any Spec impact yet.*

### **[Question 1-1]** Do companies agree with above Understanding A?

DISCUSSION

* Qualcomm: should be correct understanding. May rely on the CN related procedure to switch to normal IoT NTN mode Sat.
* Google, Nokia, Apple, Samsung, MediaTek: Share the understanding. Making not camping/accessing the normal IoT NTN mode Sat. makes no big sense.
* Samsung: Seems no case for co-existence of two types of Sat. MediaTeK does not agree.
* Nokia: Seems nothing needs to be sent to SA2; we can check SA2 progress by ourselves? But no strong view.
* Session chair: we can wait to see the situation till tomorrow
* Ericsson: We can conclude by RAN2 internally. Samsung agrees.

CONCLUSION

**=> RAN2 to make the assumption on Understanding A. FFS whether to ask SA2 for confirmation.**

### **Proposal 1: RAN2 understands that the UE configured with a satellite ID list by MME is still allowed to camp on a satellite operating in normal IoT NTN mode (i.e. with feeder-link connection), and perform subsequent access and data/signalling communication with that satellite. FFS whether RAN2 asks SA2 for confirmation.**

### **[Question 1-2]** Do companies agree with above Understanding B?

DISCUSSION

* Apple: Depends on how the MME provides the list, whether those sats are available. May be related to conclusion on Understanding C.
* QC: Understanding A should be the case. The UE shall follow the NW configuration. Can ask SA2 for clarification.
* Apple: Only Intra-MNO case is mentioned in SA2 TR conclusion.
* Goggle: How to realize mechinism in Understanding B?
* Huawei: change Understanding B. Remove the “camp” part.
* MediaTek: Different understanding as B. This is just assistance info.
* vivo: Same understanding as MediaTek. OK to check with SA2. Merge question for Understanding B and C.
* Nokia: Depends on whether UE chooses to use S&F mode.
* ZTE: Since it is present, this is recommendation.
* Samsung: There is still freedom for UE not camping/accessing to the MME-configured satellite.

CONCLUSION

**=> RAN2 assumes that such UE with a list of Satellite IDs configured by MME is still allowed to camp on, access to and communicate with the satellite which is not included in the MME-configured Sat list. Ask SA2 for confirmation.**

### **Proposal 2: RAN2 understands the UE configured with a satellite ID list by MME is still allowed to camp on, access to and communicate with a satellite which is not included in the MME-configured satellite list. Ask SA2 for confirmation.**

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### **[Question 1-3]** Do companies agree with above Understanding C?

DISCUSSION

* Huawei: We can directly ask SA2 to answer.
* Apple: Agree with Huawei on directly asking.
* CATT: Seems directly asking a question is the clear majority’s view.

CONCLUSION

**=> Ask SA2 the question “Can the MME-configured Satellite ID list include both the satellite operating in S&F mode and the satellite operating in normal IoT NTN mode (i.e. with feederlink connection like in Rel-17/18)?”.**

### **Proposal 3: RAN2 asks SA2 to provide an answer for the below question:**

* **Can the MME-configured Satellite ID list include both the satellites operating in S&F mode and the satellites operating in normal IoT NTN mode (i.e. with feederlink connection like in Rel-17/18)?**

## 2.2 Disc Point 2: Potential RAN2 assumption on IDLE mode impact

During Wednesday’s on-line discussion, a tentative RAN2 understanding was drafted as follows:

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| * **Discuss in offline 304 whether we can confirm the RAN2 assumption that:if the R19 UE supporting S&F determines that it is out of coverage of all target satellite(s) indicated by MME, a UE operating in S&F mode may not need to perform NTN idle mode tasks related to S&F operation (e.g. cell (re)selection, paging monitoring, etc.). The determination of "in coverage/out of coverage" of a target satellite is up to UE implementation. This does not prevent a UE to perform a network selection** |

If some forms of consensus can be made on above Understanding A/B, it seems this RAN2 assumption can be made in the case of only S&F mode satellite available. So below discussion is an attempt to confirm this potential RAN2 assumption, based on companies’ understanding in section 2.1.

RAPP’s REMARK

Since above Understandings in Section 2.1 still need SA2 to check/answer. No discussion was carried out for the above potential RAN2 assumption. So it cannot be confirmed now.

## 2.3 LS to SA2

A draft LS based on the conclusions/proposals is provided in R2-2411205 for RAN2 approval.

### **Proposal 4: RAN2 approves the LS in R2-2411205 to SA2 on MME-configured satellite list.**

3. Conclusion

Based on the offline discussion conclusion in clause 2, the proposals from this offline discussion are listed as follows:

### **Proposal 1: RAN2 understands that the UE configured with a satellite ID list by MME is still allowed to camp on a satellite operating in normal IoT NTN mode (i.e. with feeder-link connection), and perform subsequent access and data/signalling communication with that satellite. FFS whether RAN2 asks SA2 for confirmation.**

### **Proposal 2: RAN2 understands the UE configured with a satellite ID list by MME is still allowed to camp on, access to and communicate with a satellite which is not included in the MME-configured satellite list. Ask SA2 for confirmation.**

### **Proposal 3: RAN2 asks SA2 to provide an answer for the below question:**

* **Can the MME-configured Satellite ID list include both the satellites operating in S&F mode and the satellites operating in normal IoT NTN mode (i.e. with feederlink connection like in Rel-17/18)?**

### **Proposal 4: RAN2 approves the LS in R2-2411205 to SA2 on MME-configured satellite list.**

4. Reference

1. R2-2409674 Discussion on RAN2 impacts due to the satellite ID list from MME in S&F operation CATT
2. 3GPP TR 23700-29: "Study on integration of satellite components in the 5G architecture
3. S2-2410990 Introduction to Split MME architecture.
4. S2-2410991 Support of Store and Forward Satellite Operation.
5. S2-2412641 23.401 CR3800R11 (Rel-19, 'B'): Introduction to Split MME architecture

## Appendix: Assistance information from TR23.700-29 conclusion [2]

Split MME on-Board architecture

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| With the following normative impacts:  *[unrelated part is omitted]*  2) When UE initiates Attach or TAU procedure, it indicates support for S&F mode to the MME following existing NAS capability, the MME sends Attach or TAU Reject message to the UE if these procedures cannot be completed due to S&F operation. The Attach or TAU Reject message includes:  a) A new information indicating the UE that attach or TAU procedure cannot be completed because of the S&F operation and that the UE can re-attempt the attach or TAU in this PLMN in a next satellite pass. This indicates to the UE that the information contained in the Attach or TAU Request message is stored by the MME and the network will be available to the UE after interaction with ground network.  b) Wait timer: Indicates to the UE the time it should wait before re-attempting the Attach/TAU procedure in the current or another satellite of the same PLMN.  c) Optionally, The list of Satellite IDs over which the UE may re-attempt the Attach/TAU procedure, after wait timer expires. The Satellite IDs are based on the SIB information broadcasted by eNB.  *[unrelated part is omitted]*  5) When the wait timer has expired given to the UE in step 2, if the UE has not successfully attached to another PLMN and the UE finds the cell which broadcast the Satellite ID valid to re-attempt the attach procedure, the UE re-sends the Attach or TAU Request message.  6) During the Attach or TAU procedure with the UE, the MME may also provide a list of Satellite IDs over which the UE may exchange the signalling and data, and a wait-timer that indicates to the UE the time it should wait before attempting signalling and data exchanges in those satellites.  *[unrelated part is omitted]* |

Full CN on-Board architecture

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| The following option is agreed for supporting Store and Forward operation with a full CN onboard the satellite with the following (informative) principles:  - The whole CN including eNB, MME, SGW, PGW, HSS, E-SMLC, SMSC etc are on board each satellite. Proxies are deployed on the satellite and the ground for application traffic, including support of MT traffic, MO traffic, SMS, etc.  - The implementation of the proxies and the interface between them is out of 3GPP scope.  - The UE attaches, transfers data (e.g. SMS, MO and MT data, etc.) and detaches from each satellite as required and as determined by the monitoring list.  *[unrelated part is omitted]*  - Depending on the deployment and implementation (i.e. outside the scope of 3GPP in this release), the HSSs on the satellites may be populated with subscription data either for only the UEs that may access satellite or all UEs that may access the satellite.  *[unrelated part is omitted]*  With the following normative impacts:  - Store and forward is only supported by EPS.  - Optionally the MME provides the UE with a S&F monitoring list of satellites IDs, during attach/TAU. The UE uses the satellites in the S&F monitoring list for MO/MT data/signalling with the CN. The S&F monitoring list can be determination by the CN. How network determines the S&F monitoring list is outside the scope of 3GPP in this release of specification.  NOTE 8: The S&F monitoring list may assist the UE in retrieving MT data.  - The UE needs to be aware that a satellite supports S&F mode.  NOTE 9: How the UE is aware that a satellite supports S&F mode of operation depends on RAN.  - A UE may be rejected if the satellite cannot support the UE at this time. The attach reject may provide a timer for the time the UE should wait before reattempting and S&F monitoring list which the UE can attempt attach again. |