SA5 Rel-19 23Q3 moderated discussion – NTN management (continuation) and Satellite Backhaul management - Version 0.0.2

SA5

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1 Introduction

Based on the SA5#100 guidance provided in S5-236126, this moderated discussion on 5G satellite access and Satellite Backhaul management is initiated.

SA5 has finished study for management and orchestration aspects with integrated satellite components for both NR-NTN and IOT-NTN, normative phase is ongoing for Rel-18.

The ubiquity of the satellite link, ensuring full connectivity around the globe, has been studied in TR 22.822, and service requirements are documented in TS 22.261 in SA1. In Rel-18, SA2 has enhanced the 5GS to support satellite access and satellite backhaul as specified in the TS 23.501, TS 23.502 and TS 23.503, and TSG RAN also started work items to define enhancements for NR NTN and IoT NTN as specified in several RAN sepecifications (see RP-231484 and RP-223519).

Rel-17 and Rel-18 assume transparent mode satellite access.

In Rel-19, SA1 developed a TR 22.865 that captures a set of use cases and potential service requirements related to the 5G system with satellite access considering new capabilities, such as Store and Forward (S&F) satellite operation and UE-Satellite-UE communication without going through the ground network which should be based on regenerative payload generic architecture. SA2 has approved study item to investigate further 3GPP core network function enhancements to support NTN.

In general, SA5 has supported primitively features for NTN transparent mode in Rel-18. It is expected to consolidate a R19 SA5 study able to enhance the management and orchestration capabilities to support new use cases or to optimise network operation, in accordance with RAN and SA2 scoping.

The work tasks in section 2.1 are proposed as a starting point for the discussion, based on S5-236126, June 2023 SA/RAN workshop outcomes, S2 SID and outcomes from RAN PR#101 as follows:

SWS-230081 Satellite Access - SA Rel-19 topics and priorities

S2-231199 New SID on Study on Integration of satellite components in the 5G architecture Phase III

RP-232610 Moderator's summary for REL-19 RAN2 topic NTN for NR

RP-232621 Moderator's summary for REL-19 RAN2 topic NTN for IoT

2 Scoping

2.1 Work Tasks based on RAN2/RAN3/SA2

WT-1: Support of Regenerative payload generic architecture

R17 and R18 assume transparent mode satellite access. Regenerative payloads, i.e., embedding RAN and CN 3GPP functions, are being considered by SA1 in Rel-19 for example to support store and forward satellite operation (e.g. for mMTC services) or to support Inter Satellite Links (e.g. for eMBB services).

WT-1.1: Study management and orchestration capabilities to support new network architecture or functions for satellite regenerative payloads, considering different types of satellite constellations (both GSO and NGSO).

WT-1.2: Requirements and potential solutions to support end to end NTN management (including RAN domain and CN domain) in NTN scenarios, such as coordinate with non-3GPP part (e.g. Satellite Control System, Transport System) to provide the NTN specific requirements.

WT-1.3: Management aspects on other features, such as support RedCap via NTN.

WT-2: Support of Store and Forward Satellite operation

Along with support for discontinuous coverage, support for S&F operation is key to facilitate cost-effective deployment of IoT NTN services and enable an immediate operational service with sparse LEO constellations and reduced ground segment infrastructure.

WT-2.1: Study potential management requirement of the S&F communication scheme.

WT-2.2: Management and orchestration requirement, usecase and solution to support Store and Forward (S&F) satellite operation and UE-Satellite-UE communication.

NOTE 1: This depends on the progress in SA2.

WT-3: Support of NTN Mobility management enhancement

Ensure service continuity in connected mode when an integrated service offer provided by a single network operator leveraging NTN and TN access networks.

WT-3.1: Study NTN Mobility management enhancement for TN-NTN coordination enhancement for better service continuity.

NOTE 2: SA5 will need to align with the RAN scope and RAN study outcomes.

WT-4: Support management aspects of 5G System with Satellite Backhaul

WT-4.1: Management and orchestration capabilities to support Satellite Backhaul, especially when UPF is deployed on satellite.

WT-4.2: Management enhancement to support local switch and edge computing via UPF deployed on GEO satellite.

WT-4.3: Potential new configuration and performance measurements related to Qos control, especially when

dynamic Satellite Backhaul is used;

Feedback Form 1: Which of the above Work Tasks should be in scope of Rel-19?

1 – China Telecommunications

We support WT-1, WT-2 and WT-4 to be part of Rel-19.

For WT-3, the scenario is not clearly described, is that related to dual steer?

2 – CATT

It may be more about cell reselection enhancement/handover or other mobility enhancement from TN to NTN, OAM may need to enhance management aspects to support configure neighbour cell list, PCI etc, which depends on RAN2/RAN3/SA2 output.

3 – Huawei Technologies France

Hi, Here are my comments:

WT-1: Please add a note: This depends on the progress in RAN WGs and SA2.

- **WT-1.2**: According to latest approved SA2 R19 SID (see SP-231199): Inter Satellite Link capability by default supported as a transport link (not in the scope of 3GPP standards to specify). Do we need to take it within SA5 scope?

- **WT-1.3**: What is management requirement here? BTW, this objective was deleted in latest SA2 R19 SID (see SP-231199)

- **WT-1.4:** Where is the corresponding feature defined/to be defined in RAN/SA2?

WT-2: Please add a note: This depends on the progress in RAN WGs and SA2.

- **WT-2.2**: This relies on the R19 study outcomes of RAN/SA2□I suggest to delete 'mobility management/ paging/ discontinuous coverage' as we don't know now whether R19 study outcomes of RAN/SA2 will have impact for these parts.

- **WT-2.3**: Similar to WT-2.2, I suggest to remove this objective to align with SA2 SID.

WT-3: There is no TN-NTN coordination study in SA2/RAN, I suggest to remove it; Again, I didn't find the study outcome/plan in SA2/RAN for discontinuous coverage caused by no feeder link, so I suggest to remove it.

WT-4: Satellite Backhaul is finished in SA2 R18, we will define corresponding management solution (the concrete NRM and mesurements) to support this feature defined in SA2. Do we need to study it in SA5 R19 SID? Or go for SA5 R19 normative work directly ?

4 – CATT

Hi, many thanks for the comments, and please see the answer as follows:

- For WT-1, it's OK to add note to reflect the dependency with RAN WGs and SA2 progress.
- For WT-1.2, the aim is not to management the ISL(inter satellite link). In order to provide end-to-end communication server, management system needs to coordinate with non-3GPP part(e.g. Satellite Control System, Transport System) to provide the NTN specific requirements (e.g. the network topology and the related QOS requirements) and other requirements on the non-3GPP parts. I assume that SA5 has such mechanism to handle it (see clause 4.7 of TS 28.530).
- For WT-1.3, this reqirement is derived from RP-231565 2.1.2.2. Since it is not in the scope of the latest TSG RAN agreement and SA2 SID, I think it could be removed.
- For WT-1.4 This item could be combined with other topics which mainly refer to backhaul/feeder links/ISL.
- For WT-2.2/2.3 it's OK to add note and sync up with output of RAN/SA2.
- FOR WT-3, pls see RP-232610 (latest agreement by TSG RAN) clause 2.4 NTN/TN Mobility enhancements. Anyway, it depends on the outcome of the RAN rel-18 discussions.
- FOR WT-4, I suggest to study it firstly since Satellite Backhaul is totally new to us.

Feedback Form 2: Can any of the Work Tasks above be combined/merged?

Feedback Form 3: Should any of the Work Tasks above be reworded? If so, propose the required rewording.

1 – China Telecommunications

General:

- WT-1 and WT-2 have SA2 and RAN dependencies. We should add a note like "Alignment with the SA2&RAN scope and SA2&RAN study outcome is needed."

WT-1: Support of Regenerative payload generic architecture

- ISL may not be managed by SA5, but its introduction will bring new requirements to the 3GPP

management system. We suggest rewriting WT-1.3 and adding some examples to illustrate its impact on SA5.

- Without any SA2&RAN conclusion in place about what is onboard, it is hard to define what impact to SA5 now. So, we suppose WT-1.4 can be addressed in the context of Regenerative architecture, i.e., WT-1.1.

WT-2: Support of Store and Forward Satellite operation

- S&F data storage is a typical operational example. We recommend that WT-2.3 be consolidated into WT-2.1, and rephrase WT-2.1 as such ”Study, and if applicable, potential management requirements and enhancement to support S&F Satellite data operation.”

WT-4: Support management aspects of 5G System with Satellite Backhaul

- WT-4 should be divided into the following four sub-tasks to study the corresponding management aspects of 5G systems with satellite backhaul based on the ongoing R18 work.

  WT-4.1: Study management enhancement for reporting of satellite backhaul.

  WT-4.2: Study potential enhancement for the performance measurements, especially when dynamic Satellite Backhaul is used.

  WT-4.3: Study management enhancement for edge computing via UPF deployed on satellite.

  WT-4.4: Study management enhancement for local switch for UE-Satellite-UE communications via UPF deployed on satellite.

- Since SA2 is not yet clearly intended to study UPF onboard LEO satellite, we propose to first delete the “WT-4.2: UPF onboard LEO satellite.”

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2 – CATT

Hi, many thanks for the comments.

Some part of WT1 has been study in RAN (TR38.821) and SA5 (TR 28.808), and we should enhance and align with the latest outcome of RAN/SA2. WT-1.3 and WT-1.4 will be updated.

It’s OK to reword WT-2 as your suggestion.

It’s a bit contradictory that remove ” UPF onboard LEO satellite” but adding WT 4.3 ”Study management enhancement for edge computing via UPF deployed on satellite”

3 – China Unicom

We propose to align the work tasks with the R19 SID/WID division into **IOT-NTN** and **NR-NTN**. This alignment not only preserves consistency with the R18 SID/WID but also ensures continuity in the work task allocation.

Follow this, the work task allocation could be as follows:

IoT-NTN Work Tasks (corresponding to WT-2):

1)WT-chinaunicom-2: IOT-NTN Support

WT-2.1: Study potential management requirements for the Store and Forward (S&F) communication scheme.

WT-2.2: Study potential management requirements to support S&F related parameters and their impact on mobility management, paging, and discontinuous coverage management.

WT-2.3: Study management aspects related to the feeder link when user data is stored on the satellite.

NR-NTN Work Tasks (corresponding to WT-1 and WT-3):

2)WT-chinaunicom-1: NR-NTN Support

WT-1.1: Study management and orchestration capabilities to support new network architecture or functions for satellite regenerative payloads, considering different types of satellite constellations (both GSO and NGSO).

WT-1.2: Study management aspect with regard to Inter Satellite Link communication (ISL) schemes.

WT-1.3: Study the flexibility in the deployment of the ground segment/NTN gateways regarding the deployment of the space segment and addressing feeder link service availability issues.

WT-1.4: Study management enhancement for NTN frequent NG connection changes and dynamic configuration of RAN and AMF for NTN.

Mobility Management Enhancement (corresponding to WT-3):

3)WT-chinaunicom-3: NR-NTN and IoT-NTN Mobility Management Enhancement

WT-3.1: Study management enhancements for power saving in cases of discontinuous coverage caused by the absence of a feeder link. Also, investigate TN-NTN coordination enhancements for better service continuity.

This work task reallocation not only better reflects the division by NR-NTN and IOT-NTN within the RAN groups but also addresses various standardization requirements related to regenerative payloads, S&F communication, and mobility management. It aligns with the R18 structure, ensuring consistency and continuity.

4 – China Telecommunications

SA2 R19 approved SID SP-231199-Study on Integration of satellite components in the 5G architecture Phase III clearly points out that the Regenerative payload generic architecture (WT-1) and Store and Forward (WT-2) will be studied both for NR NTN (5GS) and IOT NTN (EPS). So, we suggest the WT allocation remains unchanged.

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2.2 Additional Work Tasks

As well as the initial set of Work Tasks in section 2.1 companies can request to add additional Work Tasks. The naming of these additional Work Tasks should follow the format: WT-company name-# (eg WT-Samsung-1) so that other participants can reference them.

Feedback Form 4: Are there any additional Work Tasks that should be part of Rel-19?

1 – China Unicom

According to the summary of NR NTN(RP-232610) and IoT NTN(RP-232621) approved from RAN#101, Capacity enhancements for Uplink and REDCAP for NTN are considered as potential focus objectives for the Rel-19 WI, therefore we propose to add 2 WTs:

WT-5: Support Capacity Enhancement

WT-6: Support REDCAP for NTN

2 – China Telecommunications

The status of RP-232610 and RP-232621 is noted, please check it again.

These two docs are just moderator's summaries of potential focus objectives in RAN Rel-19, we cannot determine now whether capacity enhancements for Uplink and REDCAP for NTN are within the scope of Rel-19.

Feedback Form 5: If there are any additional Work Tasks required, describe them

1 – China Unicom

WT-China Unicom-5: NR-NTN and IoT-NTN Support Capacity Enhancement

WT-5.1: Study Management of network capacity enhancement, which may include resource allocation, traffic monitoring, load balancing, and performance optimization

WT-China Unicom-6: NR NTN Support REDCAP

WT-6.1: Study the requirements of REDCAP for NTN to support configuration, monitoring, and optimization of REDCAP parameters and management functions

3 Dependencies

These feedback forms will help define the dependencies between Work Tasks, dependencies of Work Tasks on other Working Groups (SA, RAN or CT), and dependencies on other potential SA5 Rel-19 SIDs and WIDs. The Work Tasks can be from the list in section 2.1, or any additional Work Tasks identified in the feedback in section 2.2

Feedback Form 6: Describe the dependencies that any of the Work Tasks have on other 3GPP Working Groups or between the Work Tasks

1 – China Telecommunications

WT-1 and WT-2 have strong dependency on RAN WGs and SA2 WG.

2 – CATT

Actually, WT-1 which related to regenerative architecture has been study in TR 38.821 in Rel-16 but not standardized, SA5 can start to study the necessary management aspects and work together with RAN WGs and SA2 , as well as reflect the dependency if any. I do not think SA5 can only be kicked off after RAN/SA2 finished their work, maybe it is a better chioce to join them in the early stage and tell them some features might depend on SA5.

4 Partitioning

These questions will help determine whether there is one, or more than one, Study Item, Work Item or TEI-19 item to be created from these Work Tasks.

Feedback Form 7: Should there be more than one SID, WID or TEI-19 item created based on the Work Tasks?

1 – China Telecommunications

As previously stated, WT-1 and WT-2 need to be aligned with the SA2 and RAN scopes and await the outcome of the SA2 and RAN studies. But "**Support management aspects of 5G System with Satellite Backhaul"** already has mature solutions in other WGs, which means that it can start to investigate corresponding management aspects of 5G system with satellite backhaul now, and the follow-up WID can also be developed first.

It makes sense in China Telecom view to create two separated SIDs.

2 – China Unicom

As I clarified, maybe NTN could be seperated to two SIDs: IoT NTN and NR NTN, to aligned with RAN aspect.

This approach allows for a flexible and adaptable structure that can effectively address the diverse standardization requirements associated with satellite communication, ensuring that all scopes are covered within the SIDs.

Feedback Form 8: If the answer to the above question is yes, describe how the Work Tasks should be partitioned into different items.

1 – CATT

Based on the discussion, companies support to consolidate a R19 SA5 study able to enhance the management and orchestration capabilities to support new use cases or to optimise network operation, in accordance with RAN and SA2 scoping. There was common agreement that a sensible selection of objectives for Rel-19 NTN management is needed. Some companies indicated that management aspects on satellite backhaul is considered as one potential focus objectives(potentially requiring study first) for the Rel-18 or Rel-19 WID.

Tasks have been divided into:

OAM_NTN_Ph2□Management Aspects of NTN Phase 2

OAM_5GSATB□Management aspects of 5G system with satellite backhaul

Following are possible proposals from moderator:

option1: one SID&WID for combined OAM_NTN_Ph2 and OAM_5GSATB

option2: one SID&WID for OAM_NTN_Ph2, one WID for OAM_5GSATB (Rel-18 or Rel-19)

option3: one SID&WID for OAM_NTN_Ph2, one SID&WID for OAM_5GSATB

5 Summary

This chapter is to analyze and make synthetic proposals regarding the feedbacks on both Work Tasks based on input to and outcome of the Work Tasks (chap2.1) and Additional Work Tasks (chap2.2).

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