**3GPP TSG-SA5 Meeting #158 *S5-246626***

Orlando, USA, 18 - 22 November 2024

**Source: Huawei**

**Title: pCR TR 28.874 Providing NTN gNB supported TAIs to AMF**

**Document for: Approval**

**Agenda Item: 6.19.15**

# 1 Decision/action requested

***The group is asked to discuss and agree on the proposal.***

# 2 References

[1] 3GPP TR 28.874: Study on management aspects of NTN – Phase 2

[2] 3GPP R3-245845: LS on OAM requirements to support regenerative payload

# 3 Rationale

RAN3 discussed the potential issues on support of regenerative payload for NR NTN and has agreed OAM based solution, which assumes that the information of supported TAIs for NTN gNB is provided to AMF by OAM [2]. This contribution proposes to add a potential solution to meet this requirement.

# 4 Detailed proposal

This document proposes the following changes in TR 28.874 [1].

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| **1st Change** |

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.423: "Technical Specification Group Radio Access Network; NG-RAN; Xn application protocol (XnAP)".

[3] 3GPP TS 38.300: "Technical Specification Group Radio Access Network; NR; NR and NG-RAN Overall Description; Stage 2".

[4] 3GPP TR 38.821: "Technical Specification Group Radio Access Network; Solutions for NR to support non-terrestrial networks (NTN)".

[5] 3GPP TR 22.865: "Technical Specification Group Services and System Aspects; Study on satellite access Phase 3".

[6] 3GPP TS 23.501: " Technical Specification Group Services and System Aspects; System architecture for the 5G System (5GS) ); Stage 2".

[7] 3GPP TS 23.401: "Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[8] 3GPP TS 23.682: "Technical Specification Group Services and System Aspects; Architecture enhancements to facilitate communications with packet data networks and applications".

[9] 3GPP TS 28.530: "Technical Specification Group Services and System Aspects; Management and orchestration; Concepts, use cases and requirements".

[10] 3GPP TS 38.331: "Technical Specification Group Radio Access Network; NR; Radio Resource Control (RRC) protocol specification".

[11] 3GPP TS 22.261: " Technical Specification Group Services and System Aspects; Service requirements for the 5G system; Stage 1".

[12] 3GPP TR 23.700-29: "Technical Specification Group Services and System Aspects; Study on integration of satellite components in the 5G architecture; Phase 3".

[13] 3GPP TS 28.541: "Technical Specification Group Services and System Aspects; Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[y] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

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| **Next Change** |

### 5.2.2 Use case #2: NTN Tracking area management

#### 5.2.2.1 Description

Tracking areas (TAs) and cell identities (cell IDs) represents a fixed geographic area within the network where a mobile device can move without requiring an update of its location information. The respective mapping is generally assigned and planned in advance by the operator and configured in the RAN and CN by 3GPP management system. The typical beam footprint size of an NTN cell is much larger compared to usual TN cell, therefore, the coverage of one cell in NTN may cover multiple TAs, the relationship between Cell and TA in NT and NTN is illustrated by Figure 5.2.2.1-1.



Figure 5.2.2.1-1: Cell-TA relationship in TN and NTN

The NTN can support Earth-fixed cell, quasi-Earth-fixed cell or Earth-moving cell. To avoid Tracking Area Codes (TAC) fluctuations in the NTN earth-moving cells case, the network may broadcast multiple Tracking Area Codes per PLMN ID in an NR NTN cell (see TS 38.300 [3] clause 16.14.3.1). As illustrated in Figure 5.2.2.1-2, the tracking area is designed to be fixed on ground, when cells sweep on the ground, the tracking area code (i.e. TAC) broadcasted is changed when the cell arrives to the area of next planned earth fixed tracking area location. This implies that the TAC or a list of TACs configuration on gNB needs to be frequently updates by 3GPP management system.



Figure 5.2.2.1-2: An example of updating TACs in LEO earth-moving scenario

#### Another issue in NTN tracking area management is that how does AMF capture the information of NTN gNB supported TAIs which will change as the satellite moving. One way to solve it is that management system configures the AMF with TAIs supported by NTN gNB.5.2.2.2 Potential requirements

**REQ-NTN-FUN-01:** The 3GPP management system shall have the capability to configure/update TACs for NTN earth-moving cells.

**REQ-NTN-FUN-0x:** The 3GPP management system shall have the capability to configure AMF with TAIs supported by NTN gNB.

#### 5.2.2.3 Potential solutions

##### 5.2.2.3.1 Potential solution #<1>: Timing window based TAList update

In Rel-17, RAN has defined that NTN cell should broadcast multiple TAIs per PLMN ID, trackingAreaList has been introduced in PLMN-IdentityInfoList information element (see TS 38.331 [10]). It also requires that the field is only present in an NTN cell, network does not configure trackingAreaCode if this field is present.

For non-terrestrial network, RAN has also introduced SIB19 (System Information Block 19) which contains NTN-specific parameters (e.g. ephemeris information) for serving cell and optionally NTN-specific parameters for neighbour cells.

Considering the related TAIs broadcast in each cell change frequently with a foot print moving on earth, may be predictable, e.g. based on the satellite ephemeris information, position of the ground gateways, NTN beam information etc., time windows per TAList, which define the specific period during that the satellite coverage will be available for this location, can be derived and configured when NTN cell sweep over earth.

Following are the proposed solutions to support above requirements for Earth-moving cell scenario based on existing NRM fragment in TS 28.541 [13].

* Attribute "nTNTAClist" per PLMN ID can be defined under NRCellDU IOC (currently only configure gNB level TAClist for NTN), to indicate multiple tracking areas per each NTN cell covers. Moreover, ephemeris information for each satellite should also be referred to the cell when sending SIB19.
* Attribute "availableTimeWindows" as a list of "TimeWindow<<datatype>> " per nTNTAClist can be defined to indicator which time period the coverage will be available for the location.
* NTN neighbour cell might also be configured for each cell, solution under clause 5.2.1.3 could be reused.

##### 5.2.2.3.2 Potential solution #<2>: Pre-configuration based on single time window

The solution for NTN pre-configuration based on single time window can refer to description in clause 5.1.1.3.5.

In this use case, different instances of NRSectorCarrier can be configured as valid for different time windows.

To support REQ-NTN-FUN-0x, new IOC NTNgNBCapability is introduced which is name contained by AMFFunction IOC. Different instances of NTNgNBCapability can be associated to time windows which reflects to their valid durations.



Figure 5.2.2.3.2-x: NRM fragment for NTNgNBCapability

The NTNgNBCapability IOC includes attributes defined in the Table 5.2.2.3.2-x and 5.2.2.3.2-y.

Table 5.2.2.3.2-x: attributes for NTNgNBCapability IOC

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | S | isReadable | isWritable | isInvariant | isNotifyable |
| nTNgNBId | M | T | T | F | T |
| supportedTAIList | M | T | T | F | T |

Table 5.2.2.3.2-y: attributes properties for NTNgNBCapability IOC

| Attribute Name | Documentation and allowedValues | Properties |
| --- | --- | --- |
| nTNgNBId | It identifies a gNB within a PLMN. The gNB ID is part of the NR Cell Identifier (NCI) of the gNB cells.See "gNB Identifier (gNB ID)" of subclause 8.2 of TS 38.300 [3]. See "Global gNB ID" in subclause 9.3.1.6 of TS 38.413 [y]. allowedValues: 0..4294967295 | type: Integermultiplicity: 1isOrdered: N/AisUnique: N/AdefaultValue: NoneisNullable: False |
| supportedTAIList | It contains the list of TAIs that are supported by NTN gNB | type: TAImultiplicity: 1…\*isOrdered: FalseisUnique: TruedefaultValue: NoneisNullable: False |

#### 5.2.2.4 Evaluation of potential solutions

The possible solution for Earth-moving cell scenario described in clause 5.2.2.3.1 adopts the NRM-based approach, which enhances the existing NRM fragment with attributes indicating multiple tracking areas per each NTN cell covers and which time period the coverage will be available for the location, the change is lightweight and it is backward compatible, therefore it is a feasible solution.

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| **End of changes** |