**3GPP TSG-RAN WG3 Meeting #115 *R3-222933***

**eLocation, 21st February – 3rd March 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **38.300** | **CR** | **NA** | **rev** | **-** | **Current version:** | **16.8.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network | **X** |

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|  |
| ***Title:***  | Support Non-Terrestrial Networks |
|  |  |
| ***Source to WG:*** | Huawei, Thales, Ericsson, ZTE, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | R3 |
|  |  |
| ***Work item code:*** | NR\_NTN\_solutions |  | ***Date:*** | 20220101 |
|  |  |  |  |  |
| ***Category:*** | **B**  |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Introduction of Non-Terrestrial Networks including Feeder Link Switchover for Transparent Architecture |
|  |  |
| ***Summary of change:*** | Introduction of specitifc NTN vocabulary A tracking area and cell Id are fixed on earth and related specification impactsIntroduction of Feeder Link Switchover |
|  |  |
| ***Consequences if not approved:*** | NTN is not supported in NR |
|  |  |
| ***Clauses affected:*** | 2, 3.1, 3.2, 4.x, 16.3.2.1,16.x, 16.x.4, 16.x.4.1, 16.x.4.2, 16.x.4.3, 16.x.5, 16.x.6, 16.x.7, Annex B |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Rev0: BLCR creation from R3-205714Rev1: merge of R3-207061 and R3-207064 from RAN3#110eRev2: BL CR to RAN3#111eRev3: merge of R3-210704, R3-210987, R3-210020, R3-210152Rev4: merge of R3-211353 and R3-211155 from RAN3#111eRev5: BL CR to RAN3#112e and some typos correctedRev6: merge R3-212244, R3-212789, R3-212793 and R3-212945 from RAN3#112eRev7: BL CR to RAN3#113eRev8: merge R3-214342, R3-214352, R3-214353, R3-214354 and R3-214438 from RAN3#113eRev9: BL CR to RAN3#114eRev10: merge R3-216036, R3-216093 and comment agreeable from R3-215880 from RAN3#114-eRev11: BL CR to RAN3#114biseRev12: merge R3-220465, R3-221293 and R3-221298 agreed from RAN3#114-bisesRev13: merge R3-221742 and R3-221921 agreed from RAN3 #115-e |

<<<<<<<<<<<<<<<<<<<< First Changes Begin >>>>>>>>>>>>>>>>>>>>

# 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: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[3] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[4] 3GPP TS 38.401: "NG-RAN; Architecture description".

[5] 3GPP TS 33.501: "Security Architecture and Procedures for 5G System".

[6] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[7] 3GPP TS 38.322: "NR; Radio Link Control (RLC) protocol specification".

[8] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

[9] 3GPP TS 37.324: " E-UTRA and NR; Service Data Protocol (SDAP) specification".

[10] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state".

[11] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[12] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[13] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[14] 3GPP TS 22.168: "Earthquake and Tsunami Warning System (ETWS) requirements; Stage 1".

[15] 3GPP TS 22.268: "Public Warning System (PWS) Requirements".

[16] 3GPP TS 38.410: "NG-RAN; NG general aspects and principles".

[17] 3GPP TS 38.420: "NG-RAN; Xn general aspects and principles".

[18] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[19] 3GPP TS 22.261: "Service requirements for next generation new services and markets".

[20] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer"

[21] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage-2".

[22] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[23] IETF RFC 4960 (2007-09): "Stream Control Transmission Protocol".

[24] 3GPP TS 26.114: "Technical Specification Group Services and System Aspects; IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[25] Void.

[26] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[27] IETF RFC 3168 (09/2001): "The Addition of Explicit Congestion Notification (ECN) to IP".

[28] 3GPP TS 24.501: "NR; Non-Access-Stratum (NAS) protocol for 5G System (5GS)".

[29] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[30] 3GPP TS 38.415: "NG-RAN; PDU Session User Plane Protocol".

[31] 3GPP TS 38.340: "NR; Backhaul Adaptation Protocol (BAP) specification".

[32] 3GPP TS 38.470: "NG-RAN; F1 application protocol (F1AP) ".

[33] 3GPP TS 38.425: "NG-RAN; NR user plane protocol".

[34] 3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC); Stage 2".

[35] 3GPP TS 38.101-2: "User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[36] 3GPP TS 38.101-3: "User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[37] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access".

[38] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[39] 3GPP TS 22.104 "Service requirements for cyber-physical control applications in vertical domains".

[40] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[41] 3GPP TS 23.285: "Technical Specification Group Services and System Aspects; Architecture enhancements for V2X services".

[42] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[43] 3GPP TS 37.355: "LTE Positioning Protocol (LPP)".

[44] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[x] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[y] NIMA TR 8350.2, Third Edition, Amendment 1, 3 January 2000: “DEPARTMENT OF DEFENSE WORLD GEODETIC SYSTEM 1984”, https://gis-lab.info/docs/nima-tr8350.2-wgs84fin.pdf.

# 3 Abbreviations and Definitions

## 3.1 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], in TS 36.300 [2] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 36.300 [2].

5GC 5G Core Network

5GS 5G System

5QI 5G QoS Identifier

A-CSI Aperiodic CSI

AKA Authentication and Key Agreement

AMBR Aggregate Maximum Bit Rate

AMC Adaptive Modulation and Coding

AMF Access and Mobility Management Function

ARP Allocation and Retention Priority

BA Bandwidth Adaptation

BCH Broadcast Channel

BH Backhaul

BL Bandwidth reduced Low complexity

BPSK Binary Phase Shift Keying

C-RNTI Cell RNTI

CAG Closed Access Group

CAPC Channel Access Priority Class

CBRA Contention Based Random Access

CCE Control Channel Element

CD-SSB Cell Defining SSB

CFRA Contention Free Random Access

CHO Conditional Handover

CIoT Cellular Internet of Things

CLI Cross Link interference

CMAS Commercial Mobile Alert Service

CORESET Control Resource Set

CP Cyclic Prefix

CPC Conditional PSCell Change

DAG Directed Acyclic Graph

DAPS Dual Active Protocol Stack

DFT Discrete Fourier Transform

DCI Downlink Control Information

DCP DCI with CRC scrambled by PS-RNTI

DL-AoD Downlink Angle-of-Departure

DL-SCH Downlink Shared Channel

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

E-CID Enhanced Cell-ID (positioning method)

EHC Ethernet Header Compression

ETWS Earthquake and Tsunami Warning System

FS Feature Set

GFBR Guaranteed Flow Bit Rate

HRNN Human-Readable Network Name

HAPS [RAN2]

IAB Integrated Access and Backhaul

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

KPAS Korean Public Alarm System

LDPC Low Density Parity Check

MDBV Maximum Data Burst Volume

MIB Master Information Block

MICO Mobile Initiated Connection Only

MFBR Maximum Flow Bit Rate

MMTEL Multimedia telephony

MNO Mobile Network Operator

MPE Maximum Permissible Exposure

MT Mobile Termination

MU-MIMO Multi User MIMO

Multi-RTT Multi-Round Trip Time

NB-IoT Narrow Band Internet of Things

NCGI NR Cell Global Identifier

NCR Neighbour Cell Relation

NCRT Neighbour Cell Relation Table

NGAP NG Application Protocol

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

NTN [RAN2]

P-MPR Power Management Maximum Power Reduction

P-RNTI Paging RNTI

PCH Paging Channel

PCI Physical Cell Identifier

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PLMN Public Land Mobile Network

PNI-NPN Public Network Integrated NPN

PO Paging Occasion

PRACH Physical Random Access Channel

PRB Physical Resource Block

PRG Precoding Resource block Group

PS-RNTI Power Saving RNTI

PSS Primary Synchronisation Signal

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QFI QoS Flow ID

QPSK Quadrature Phase Shift Keying

RA Random Access

RA-RNTI Random Access RNTI

RACH Random Access Channel

RANAC RAN-based Notification Area Code

REG Resource Element Group

RIM Remote Interference Management

RMSI Remaining Minimum SI

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RNTI Radio Network Temporary Identifier

RQA Reflective QoS Attribute

RQoS Reflective Quality of Service

RS Reference Signal

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSSI Received Signal Strength Indicator

RSTD Reference Signal Time Difference

SCS SubCarrier Spacing

SD Slice Differentiator

SDAP Service Data Adaptation Protocol

SFI-RNTI Slot Format Indication RNTI

SIB System Information Block

SI-RNTI System Information RNTI

SLA Service Level Agreement

SMC Security Mode Command

SMF Session Management Function

S-NSSAI Single Network Slice Selection Assistance Information

SNPN Stand-alone Non-Public Network

SNPN ID Stand-alone Non-Public Network Identity

SPS Semi-Persistent Scheduling

SR Scheduling Request

SRS Sounding Reference Signal

SRVCC Single Radio Voice Call Continuity

SS Synchronization Signal

SSB SS/PBCH block

SSS Secondary Synchronisation Signal

SST Slice/Service Type

SU-MIMO Single User MIMO

SUL Supplementary Uplink

TA Timing Advance

TNL Transport Network Layer

TPC Transmit Power Control

TRP Transmit/Receive Point

UCI Uplink Control Information

UL-AoA Uplink Angles of Arrival

UL-RTOA Uplink Relative Time of Arrival

UL-SCH Uplink Shared Channel

UPF User Plane Function

URLLC Ultra-Reliable and Low Latency Communications

V2X Vehicle-to-Everything

Xn-C Xn-Control plane

Xn-U Xn-User plane

XnAP Xn Application Protocol

## 3.2 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], in TS 36.300 [2] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] and TS 36.300 [2].

**BH RLC channel**: an RLC channel between two nodes, which is used to transport backhaul packets**.**

**CAG Cell**:a PLMN cell broadcasting at least one Closed Access Group identity.

**CAG Member Cell**:for a UE, a CAG cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN, and for that PLMN, a CAG identifier belonging to the Allowed CAG list of the UE for that PLMN.

**CAG-only cell**: a CAG cell that is only available for normal service for CAG UEs.

**Cell-Defining SSB**: an SSB with an RMSI associated.

**Child node**: IAB-DU's and IAB-donor-DU's next hop neighbour node; the child node is also an IAB-node.

**Conditional Handover (CHO**): a handover procedure that is executed only when execution condition(s) are met.

**CORESET#0**: the control resource set for at least SIB1 scheduling, can be configured either via MIB or via dedicated RRC signalling.

**DAPS Handover**: a handover procedure that maintains the source gNB connection after reception of RRC message for handover and until releasing the source cell after successful random access to the target gNB.

**Downstream**: Direction toward child node or UE in IAB-topology.

**Early Data Forwarding**: data forwarding that is initiated before the UE executes the handover.

**Earth-centered, earth-fixed**: A global geodetic reference system for the Earth intended for practical applications of mapping, charting, geopositioning and navigation, as specified in NIMA TR 8350.2 [y].

**Feeder link**: Wireless link between the NTN Gateway and the NTN payload.

**gNB**: node providing NR user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**High Altitude Platform Station**: [RAN2]

**IAB-donor**:gNB that provides network access to UEs via a network of backhaul and access links.

**IAB-donor-CU**: as defined in TS 38.401 [4].

**IAB-donor-DU**:as defined in TS 38.401 [4].

**IAB-DU**: gNB-DU functionality supported by the IAB-node to terminate the NR access interface to UEs and next-hop IAB-nodes, and to terminate the F1 protocol to the gNB-CU functionality, as defined in TS 38.401 [4], on the IAB-donor.

**IAB-MT**: IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise. IAB-MT function used in 38-series of 3GPP Specifications corresponds to IAB-UE function defined in TS 23.501 [3].

**IAB-node**: RAN node that supports NR access links to UEs and NR backhaul links to parent nodes and child nodes. The IAB-node does not support backhauling via LTE.

**Intra-system Handover**:Handover that does not involve a CN change (EPC or 5GC).

**Inter-system Handover**:Handover that involves a CN change (EPC or 5GC).

**Late Data Forwarding**: data forwarding that is initiated after the source NG-RAN node knows that the UE has successfully accessed a target NG-RAN node.

**Mapped Cell ID**: In NTN, it corresponds to a fixed geographical area.

**MSG1**: preamble transmission of the random access procedure for 4-step random access (RA) type.

**MSG3**: first scheduled transmission of the random access procedure.

**MSGA**:preamble and payload transmissions of the random access procedure for 2-step RA type.

**MSGB**:response to MSGA in the 2-step random access procedure. MSGB may consist of response(s) for contention resolution, fallback indication(s), and backoff indication.

**Multi-hop backhauling**: Using a chain of NR backhaul links between an IAB-node and an IAB-donor.

**ng-eNB**: node providing E-UTRA user plane and control plane protocol terminations towards the UE, and connected via the NG interface to the 5GC.

**NG-C**: control plane interface between NG-RAN and 5GC.

**NG-U**: user plane interface between NG-RAN and 5GC.

**NG-RAN node**: either a gNB or an ng-eNB.

**Non-CAG Cell**: a PLMN cell which does not broadcast any Closed Access Group identity.

**Non-terrestrial network**: An NG-RAN consisting of gNBs, which provide non-terrestrial NR access to UEs by means of an NTN payload embarked on an airborne or space-borne NTN vehicle and an NTN Gateway.

**NR backhaul link**: NR link used for backhauling between an IAB-node and an IAB-donor, and between IAB-nodes in case of a multi-hop backhauling.

**NR sidelink communication**: AS functionality enabling at least V2X communication as defined in TS 23.287 [40], between two or more nearby UEs, using NR technology but not traversing any network node.

**NTN Gateway**: an earth station located at the surface of the earth, providing connectivity to the NTN payload using the feeder link. An NTN Gateway is a TNL node.

**NTN payload:** a network node, embarked on board a satellite or high altitude platform station, providing connectivity functions, between the service link and the feeder link. In the current version of this specification, the NTN payload is a TNL node.

**Numerology**: corresponds to one subcarrier spacing in the frequency domain. By scaling a reference subcarrier spacing by an integer *N*, different numerologies can be defined.

**Parent node**: IAB-MT's next hop neighbour node; the parent node can be IAB-node or IAB-donor-DU

**PLMN Cell**: a cell of the PLMN.

**Satellite**: [RAN2]

**Service link**: [RAN2]

**SNPN Access Mode**: mode of operation whereby a UE only accesses SNPNs.

**SNPN-only cell**: a cell that is only available for normal service for SNPN subscribers.

**SNPN Identity:** the identity of Stand-alone NPN defined by the pair (PLMN ID, NID).

**Transmit/Receive Point:** Part of the gNB transmitting and receiving radio signals to/from UE according to physical layer properties and parameters inherent to that element.

**Upstream**: Direction toward parent node in IAB-topology.

**V2X sidelink communication**: AS functionality enabling V2X communication as defined in TS 23.285 [41], between nearby UEs, using E-UTRA technology but not traversing any network node.

**Xn**: network interface between NG-RAN nodes.

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## 4.x Non-Terrestrial Networks

The Figure 4.x-1 below illustrates an example of a Non-Terrestrial Network (NTN) providing non-terrestrial NR access to the UE by means of an NTN payload and an NTN Gateway, depicting a service link between the NTN payload and a UE, and a feeder link between the NTN Gateway and the NTN payload.



Figure 4.x-1: Overall illustration of an NTN

NOTE: Figure 4.x-1 illustrates an NTN; RAN4 aspects are out of scope.

The NTN payload transparently forwards the radio protocol received from the UE (via the service link) to the NTN Gateway (via the feeder link) and vice-versa. The following connectivity is supported by the NTN payload:

- A gNB may serve multiple NTN payloads;

- An NTN payload may be served by multiple gNBs.

NOTE: In this release, the NTN-payload may change the carrier frequency, before re-transmitting it on the service link, and vice versa (respectively on the feeder link).

For NTN, the following applies in addition to Network Identities as described in clause 8.2:

- A Tracking Area corresponds to a fixed geographical area. Any respective mapping is configured in the RAN;

- A Mapped Cell ID as specified in subclause 16.x.5.

[RAN2 - TP]

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### 16.3.2 AMF and NW Slice Selection

#### 16.3.2.1 CN-RAN interaction and internal RAN aspects

NG-RAN selects AMF based on a Temp ID or NSSAI provided by the UE over RRC as specified in TS 38.410 [16]. The mechanisms used in the RRC protocol are described in the next clause.

Table 16.3.2.1-1 AMF selection based on Temp ID and NSSAI

|  |  |  |
| --- | --- | --- |
| Temp ID | NSSAI | AMF Selection by NG-RAN |
| not available or invalid | not available | One of the default AMFs is selected (NOTE) |
| not available or invalid | present | Selects AMF which supports UE requested slices |
| valid | not available, or present | Selects AMF per CN identity information in Temp ID |
| NOTE: The set of default AMFs is configured in the NG-RAN nodes via OAM. |

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## 16.x Non-Terrestrial Networks

[RAN2 - TP]

### 16.x.4 Switch over

[RAN2 - TP]

#### 16.x.4.1 Definitions

A feeder link switch over is the procedure where the feeder link is changed from a source NTN Gateway to a target NTN Gateway for a specific NTN payload. The feeder link switch over is a Transport Network Layer procedure.

Both hard and soft feeder link switch over are applicable to NTN.

#### 16.x.4.2 Assumptions

A feeder link switch over may result in transferring the established connection for the affected UEs between two gNBs.

For soft feeder link switch over, an NTN payload is able to connect to more than one NTN Gateway during a given period i.e. a temporary overlap can be ensured during the transition between the feeder links.

For hard feeder link switch over, an NTN payload only connect to one NTN Gateway at any given time i.e. a radio link interruption may occur during the transition between the feeder links.

#### 16.x.4.3 Procedures

The NTN Control function determines the point in time when the feeder link switch over between two gNBs is performed. The transfer of the affected UE(s)’ context between the two gNBs at feeder link switch over is performed by means of either NG based or Xn based handover, and it depends on the gNBs’ implementation and configuration information provided to the gNBs by the NTN Control function.

### 16.x.5 NG-RAN Signalling

The Cell Identity, as defined in TS 38.413 [26] and TS 38.423 [x], used in following cases corresponds to a Mapped Cell ID, irrespective of the orbit of the NTN payload or the types of service links supported.

- The Cell Identity indicated by the gNB to the Core Network as part of the User Location Information;

- The Cell Identity used for Paging Optimization in NG interface;

- The Cell Identity used for Area of Interest;

- The Cell Identity used for PWS.The Cell Identity included within the target identification of the handover messages allows identifying the correct target cell.The Cell Identities used in the RAN Paging Area during Xn RAN paging allow the identification of the correct target cells for RAN paging.NOTE 1: The Cell Identity used for RAN Paging is assumed to typically represent a Uu Cell ID.The mapping between Cell Identities and geographical areas is configured in the RAN and Core Network.

NOTE 2: A specific geographical location may be mapped to multiple Mapped Cell ID(s), and such Mapped Cell IDs may be configured to indicate differerent geographical areas (e.g. overlapping and/or with different dimensions).

The gNB is responsible for constructing the Mapped Cell ID based on the UE location information received from the UE, if available. The mapping may be pre-configured (e.g., up to operator’s policy) or up to implementation.

NOTE 3: As described in TS 23.501 [3], the User Location Information may enable the AMF to determine whether the UE is allowed to operate at its present location. Pre-configuration of special mapped cell identifiers may be used to indicate areas outside the serving PLMN’s country.

The gNB reports the broadcasted TAC(s) of the selected PLMN to the AMF as part of ULI. In case the gNB knows the UE’s location information, the gNB may determine the TAI the UE is currently located in and provide that TAI to the AMF as part of ULI.

### 16.x.6 AMF (Re-)Selection by gNB

The gNB implements the NAS Node Selection Function specified in TS 38.410 [16].

For a RRC\_CONNECTED UE, when the gNB is configured to ensure that the UE is using an AMF that serves the country in which the UE is located. If the gNB detects that the UE is in a different country to that served by the serving AMF, then it should perform an NG handover to change to an appropriate AMF, or initiate an UE Context Release Request procedure towards the serving AMF (in which case the AMF may decide to de-register the UE).

### 16.x.7 O&M Requirements

The following NTN related parameters shall be provided by O&M to the gNB providing non-terrestrial NR access:

- Ephemeris information describing the orbital trajectory information or coordinates for the NTN vehicles. This information is provided on a regular basis or upon demand to the gNB;

- Two different sets of ephemeris format shall be supported

 - Set 1: Satellite position and velocity state vectors:

 - Position;

 - Velocity;

 - Set 2: At least the following parameters in orbital parameter ephemeris format, as specified in NIMA TR 8350.2 [y]:

 - Semi-major axis;

 - Eccentricity;

 - Argument of periapsis;

 - Longitude of ascending node;

 - Inclination;

 - Mean anomaly at epoch time to.

- The explicit epoch time associated to ephemeris data;

- The location of the NTN-Gateways;

NOTE: The ephemeris of the satellites and the location of the NTN-Gateways, are used at least for the Uplink timing and frequency synchronization. It may also be used for the random access and the mobility management purposes.

- Additional information to enable gNB operation for feeder/service link switch overs.

NOTE: The NTN related parameters provided by O&M to the gNB may depend on the type of supported service links e.g. earth fixed beams, quasi earth fixed beams, earth moving beams, etc.

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# Annex X Example implementation of Non-Terrestrial Networks (informative)

The following figure illustrates an example implementation of an Non-Terrestrial Network for transparent NTN payload:



Figure B-1: NTN based NG-RAN

The gNB depicted in Figure B-1 may be subdivided into non-NTN infrastructure gNB functions and the NTN Service Link provisioning System. The NTN infrastructure may be thought of being subdivided into the NTN Service Link provisioning System and the NTN Control function. The NTN Service Link provisioning System may consist of one or more NTN payloads and NTN Gateways.

The NTN payload is embarked on a spaceborne (or airborne) vehicle, providing a structure, power, commanding, telemetry, attitude control for the satellite (resp. HAPS) and possibly an appropriate thermal environment, radiation shielding.

The NTN Service Link provisioning System maps the NR-Uu radio protocol over radio resources of the NTN infrastructure (e.g. beams, channels, Tx power).

The NTN control function controls the spaceborne (or airborne) vehicles as well as the radio resources of the NTN infrastructure (NTN payload(s) & NTN Gateway(s)). It provides control data, e.g. Ephemeris, to the non-NTN infrastructure gNB functions of the gNB.

Provision of NTN control data to the gNB is out of 3GPP scope.

NOTE: The transport of NR-Uu protocol between the NTN Service Link provisioning system and the non-NTN infrastructure gNB functions is out of 3GPP scope.

At least the following NTN related parameters are expected to be provided by O&M to the gNB for its operation

a) Earth fixed beams: for each beam provided by a given NTN-payload:

- The Cell identifier (NG and Uu) mapped to the beam;

- The Cell’s reference location (e.g. cell’s center and range).

b) Quasi Earth fixed beams: for each beam provided by a given NTN-payload:

- The Cell identifier (NG and Uu) and time window mapped to a beam;

- The Cell’s/beam’s reference location (e.g. cell’s center and range);

- The time window of the successive switch overs (feeder link, service link);

- The identifier and time window of all serving satellites and NTN-Gateways;

c) Earth moving beams: for each beam provided by a given NTN-payload:

- The Uu Cell identifier mapped to a beam and mapping information to fixed geographical areas reported on NG, including information about the beams direction and motion of the beam’s foot print on Earth;

- Its elevation wrt NTN-payload;

- Schedule of successive serving NTN-Gateways/gNBs;

- Schedule of successive switch overs (feeder link, service link).

<<<<<<<<<<<<<<<<<<<< End of Changes >>>>>>>>>>>>>>>>>>>>