**3GPP TSG-RAN WG3 Meeting #111-e *R3-21xxxx***

**eLocation, eLocation, 25 Jan – 5 Feb 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.300** | **CR** | **NA** | **rev** | **-** | **Current version:** | **16.4.0** |  |
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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 | | | | | | | | | |
| ***Source to TSG:*** | R3 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_NTN\_solutions-core | | | | |  | ***Date:*** | | | 20201117 |
|  |  | | | |  | |  | | |  |
| ***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 can be 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  Introduction of Feeder Link Switchover | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | NTN is not supported in NR | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 3.2, 4.x, 4.x.1, 4.x.2, 4.x.3, 4.x.4, 4.x.5, 4.x.5.1, 4.x.5.2, 4.X.5.3, 4.X.5.4 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 R3-205714  Rev1: merge of R3-207061 and R3-207064 from RAN3#110e  Rev2: BL CR to RAN3#111  Rev3: merge of R3-210704, R3-210987, R3-210020, R3-210152 | | | | | | | | |

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

# 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

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

GEO Geostationary Earth Orbit

GFBR Guaranteed Flow Bit Rate

HRNN Human-Readable Network Name

HAPS High Altitude Platform Station

IAB Integrated Access and Backhaul

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

KPAS Korean Public Alarm System

LDPC Low Density Parity Check

LEO Low Earth Orbit

MDBV Maximum Data Burst Volume

MEO Medium Earth Orbit

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

NGEO Non-Geostationary Earth Orbit

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

NTN Non-Terrestrial Network

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

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

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.

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

**Geostationary Earth Orbit**: a circular geosynchronous orbit 35,786 kilometres above Earth's equator and following the direction of Earth's rotation.

**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**: airborne vehicle embarking the NTN payload placed at an altitude between 8 and 50 km.

**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.

**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-Geostationary Earth Orbit:** Satellite orbit that is not GEO.

**Non-terrestrial network:** An NG-RAN consisting of gNBs, which provides 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, and providing connectivity to the NTN payload using the feeder link. An NTN Gateway is a transport network layer (TNL) node.

**NTN payload**: a network node, embarked on board a satellite or high altitude platform station, providing connectivity functions, between the service and the feeder link. In the current version of this specification, the NTN payload is a transport network layer (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:** a space-borne vehicle embarking the NTN payload, placed into Non-Geostationary Earth Orbit (NGEO) or Geostationary Earth Orbit (GEO).

**Ephemeris**:data describing the orbital information i.e., the position (and possibly velocity) over time, for all NTN payloads.

**Service link:** Wireless link between NTN payload and the UE.

**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 the general architecture 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 logical architecture of a NTN (FFS)**

NOTE: Figure 4.x-1 depicts the logical architecture of an NTN; RAN4 aspects are out of scope.

Three types of service link provision are supported.

* + Earth-fixed: provision by beam(s) covering the same geographical areas all the time (e.g., the case of GEO satellites and HAPS);
  + quasi-Earth-fixed: provision by beam(s) covering one geographic area for a finite period and a different geographic area during another period (e.g., the case of NGEO satellites generating steerable beams);
  + Earth-moving: provision by beam(s) covering one geographic area at one instant and a different geographic area at another instant (e.g., the case of NGEO satellites generating fixed or non-steerable beams).

NGEO encompass constellation of satellites with circular orbits at altitude greater than or equal to 300 km. This includes Low-Earth Orbit at altitude lower than 1500 km and Medium Earth Orbit at altitude greater than 7000 km

Depending on NGEO satellites, a gNB can provide either quasi-Earth-fixed cells or Earth-moving cells, while gNB operating with GEO satellite can provide Earth fixed cells.

The NG-RAN architecture specified in section 4 is applicable for NTN with the following constraints and additions:

The current version of this specification supports an NTN payload transparently forwarding the radio protocol received from the UE (via the service link) to the NTN Gateway (via the feeder link) and vice-versa. . In such case

* + A gNB may serve multiple NTN payloads;
  + An NTN payload may be served by multiple gNBs.

NOTE: In the current version of this specification, the NTN-payload may change the carrier frequency, filter and amplify the received RF signal, before re-transmitting it on the service link, and vice versa (respectively on the feeder link).

The current version of this specificationassumes that UEs supporting NTN are GNSS-capable

For Network Identities the following applies in addition: [RAN3]

- A Tracking Area of a NTN corresponds to a fixed geographical area;

- A NCGI of a NTN provided to the 5GC within the User Location Information as specified in TS 38.413 [26] corresponds to a fixed geographical area.

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## 16.x Non-Terrestrial Networks

### 16.x.1 User Plane aspects

#### 16.x.1.1 Timing advance and pre-compensation

Editor’s note: In RRC\_IDLE, UE is required to support UE specific TA calculation based on its GNSS-acquired position and the serving satellite ephemeris.

Editor’s note: FFS: for RRC\_INACTIVE.

Editor’s note: FFS how this is calculated and what/if anything needs to be broadcasted for the different pre-compensation methods (e.g. common TA) to help the UE to obtain the full UE-gNB RTT.

#### 16.x.1.2 Random Access Procedure

The gNB shall ensure sufficient time on UE side for the Msg3 transmission and shall apply an offset to the start of the response window taking into account the UE-gNB RTT:

Editor’s note: FFS beam specific offset.

Editor’s note: FFS additional enhancements to RACH to accommodate the NTN environment, e.g, TA report, RA type selection.

#### 16.x.1.3 HARQ

For DL, HARQ feedback can be enabled/disabled, per HARQ process via RRC signalling. It is signalled to the UE via RRC.

Editor’s Note: Details and other solutions for enabling/disabling HARQ UL reTX are not precluded and FFS.

#### 16.x.1.4 Scheduling Request

Editors’ note: At least the following methods to enhance UL scheduling are FFS in NTN: configured grant and BSR over 2-step RACH. (other solutions to enhance UL scheduling are not precluded)

### 16.x.2 System information

Editor’s note: The discussion on whether to introduce a new SIB for NTN has been postponed until more progress is made on the content of NTN specific system information.

### 16.x.3 Mobility and State transition

#### 16.x.3.1 Intra-NTN

##### 16.x.3.1.1 Mobility in RRC\_IDLE

The same principles as described in 9.2.1 apply to cell selection and reselection in NTN except for what is described below:

- An NTN UE may perform cell selection and reselection based on the satellite/HAPS ephemeris provisioned.

Editor’s note: FFS on the definition of satellite/HAPS ephemeris. FFS under what circumstance UE will perform cell selection/reselection based on satellite/HAPS ephemeris.

Editor’s note: FFS whether UE location (and/or other information) based cell selection/reselection should be introduced for NTN.

Editor’s note: FFS on any further enhancement on cell reselection priority configuration in NTN.

Editor’s note: Information about when a cell is going to stop serving the area and information about new upcoming cell can be further considered for cell reselection in NTN. FFS in which form and how this is exactly implemented in the cell reselection procedure.

The UE is made aware that a cell is provided by a NTN or a TN network.

Editor’s note: FFS on whether to make the UE aware of NTN in an implicit or explicit way.

##### 16.x.3.1.2 Mobility in RRC\_CONNECTED

###### 16.x.3.1.2.1 Overview

In the case of NGEO, service link switch will occur due to the motion of satellites (respectively HAPS) with respect to a given UE or due to UE mobility.

Editor’s note: Service link switch implies L3 mobility (meaning that at least in case the SSBs are on the same sync raster point the PCIs need to be different) FFS.

Editor’s note: In which form and how this is exactly implemented in the mobility principles is FFS.

Editor’s note: RAN2 will continue working with the assumption that service link switch implies cell level mobility, which means at a minimum, if the SSBs are on the same sync raster point the PCIs need to be different.

Editor’s note: Reconfiguration with sync is the baseline for connected mode mobility in NTN while the use of legacy RLF and re-establishment procedure is not excluded.

###### 16.x.3.1.2.2 Handover

The same principle as described in 9.2.3.2 applies to intra-NTN handover except for what is described below:

Editor's note: DAPS handover for NTN is deprioritized in this release.

###### 16.x.3.1.2.3 Conditional Handover

The same principle as described in 9.2.3.4 applies to intra-NTN conditional handover except for what is described below:

Editor’s note : An execution condition for CHO may consist of location or time(r) based triggering conditions, in combination with the existing measurement events, as defined in [12].

Editor’s note: FFS on how to configure the location based triggering condition and whether location based triggering condition can be configured separately (i.e. not in combination with other events) as an execution condition for CHO.

Editor’s note: FFS on how to configure the time(r) based triggering condition and how to consider the feeder/service link switch timing in configuration.

##### 16.x.3.1.3 Measurements

The same principle as described in 9.2.4 applies to measurements in NTN.

Editor’s note: For NTN, the location-based measurement event, in combination with the existing measurement event in NR, is supported. FFS on how to configure the location based measurement event.

Editor’s note: Support for any new measurement in NTN is not excluded.

#### 16.x.3.2 NTN/Terrestrial Network mobility

During mobility between NTN and Terrestrial Network, a UE is not required to connect to both NTN and Terrestrial Network at the same time.

Editor’s note: Triggers of Terrestrial Network/NTN mobility will be discussed in RAN2 once the intra-NTN mobility has been sufficiently progressed.

### 16.x.4 Switch over

#### 16.x.4.1 Definitions [RAN3]

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

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

Editor’s note: The previous statement on feeder link switch is merely capturing a RAN3 agreement. Terminology, definitions, etc. to follow pending to RAN2.

#### 16.x.4.2 Assumptions [RAN3]

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

For soft feeder link switch over, a NTN payload is able to connect to more than one NTN-GW 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, a NTN payload only connect to one NTN-GW at any given time i.e. a radio link interruption may occur during the transition between the feeder links.

Editor’s Note: Some clarification on example of the temporary overlap and the interruption time may be provided later

#### 16.x.4.3 Operations [FFS] [RAN3]

#### 16.x.4.4Procedures [FFS] [RAN3]

### 16.x.5 Signalling [FFS] [RAN3]

The Cell Identity which is indicated by the gNB to the Core Network as part of the User Location Information (as defined in TS 38.413 [26]) corresponds to a fixed geographical area, irrespective of the orbit of the satellite. The mapping between Cell Identities and geographical areas is configured in the RAN and Core Network.

Editor’s note: It is FFS how the gNB derives the information required to derive the Cell Identity provided to the CN.

### 16.x.6 O&M Requirements [RAN3]

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

- Ephemeris information describing the orbital trajectory information or coordinates for the NTN stations. They are provided on a regular basis or upon demand to the gNB.

Editor’s note: Ephemeris format and usage details are FFS.

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# Annex B.x Example implementation of Non-Terrestrial Networks (informative) [RAN3]

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



**Figure A.X.Y: NTN based NG-RAN architecture (transparent payload scenario)**

The NG-RAN depicted in Figure A.x-1 may be subdivided into non-RF 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 functions of the gNB.

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

Editor’s Note: Whether the provision of the NTN control date is out of scope of 3GPP or rely on 3GPP O&M is FFS.

The transport of NR-Uu protocol between the NTN service link provisioning system and the non-RF functions of the gNB is out of 3GPP scope

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