**3GPP TSG-RAN WG2 Meeting #119bis *R2-2210852***

**Electronic, October 10 – 19, 2022** *rev of R2-2210567*

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.300** | **CR** | **0568** | **rev** |  | **Current version:** | **17.2.0** |  |
|  |
| *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 | **X** | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | Corrections to TS 38.300 for Rel-17 NR NTN |
|  |  |
| ***Source to WG:*** | Moderator of stage 2’s NR-NTN email disc (previously Samsung) |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_NTN\_solutions-Core |  | ***Date:*** | 2022-10-10 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | 1. Abbreviation of GNSS and SMTC not notated.
2. Remove RAN1 related details of applying kmac in beam failure recovery, and add general description for applying kmac in random access procedure.
3. The title of 16.14.2.2 is not clear. Figure 16.14.2.2-1 is not needed, as the same figure is given in 38.211 clause 4.3.
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|  |  |
| ***Summary of change:*** | 1. Add GNSS and SMTC in 3.1 Abbreviations
2. Corrections to the explanation and usage of kmac in 16.14.2.1
3. Update the title of clause 16.14.2.2 and remove Figure 16.14.2.2-1 in 16.14.2.2.
4. Editorial corrections
 |
|  |  |
| ***Consequences if not approved:*** | NTN Stage-2 description remains ambiguous. |
|  |  |
| ***Clauses affected:*** | 3.1, 16.14.2.1, 16.14.2.2, 16.14.3.1, 16.14.3.2.1, 16.14.3.2.2, 16.14.3.3, 16.14.4.2, 16.14.5, 16.14.6, 16.14.7, B.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:*** |  |

*First Modified Subclause*

## 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

AGC Automatic Gain Control

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

BCCH Broadcast Control Channel

BCH Broadcast Channel

BFD Beam Failure Detection

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

CG Configured Grant

CHO Conditional Handover

CIoT Cellular Internet of Things

CLI Cross Link interference

CMAS Commercial Mobile Alert Service

CORESET Control Resource Set

CP Cyclic Prefix

CPA Conditional PSCell Addition

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

FSA ID Frequency Selection Area Identity

G-CS-RNTI Group Configured Scheduling RNTI

G-RNTI Group RNTI

GFBR Guaranteed Flow Bit Rate

GIN Group ID for Network selection

GNSS Global Navigation Satellite System

GSO Geosynchronous Orbit

H-SFN Hyper System Frame Number

HAPS High Altitude Platform Station

HRNN Human-Readable Network Name

IAB Integrated Access and Backhaul

IFRI Intra Frequency Reselection Indication

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

KPAS Korean Public Alarm System

L2 Layer-2

L3 Layer-3

LDPC Low Density Parity Check

LEO Low Earth Orbit

MBS Multicast/Broadcast Services

MCE Measurement Collection Entity

MCCH MBS Control Channel

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

MRB MBS Radio Bearer

MT Mobile Termination

MTCH MBS Traffic Channel

MTSI Multimedia Telephony Service for IMS

MU-MIMO Multi User MIMO

Multi-RTT Multi-Round Trip Time

MUSIM Multi-Universal Subscriber Identity Module

NB-IoT Narrow Band Internet of Things

NCD-SSB Non Cell Defining SSB

NCGI NR Cell Global Identifier

NCL Neighbour Cell List

NCR Neighbour Cell Relation

NCRT Neighbour Cell Relation Table

NGAP NG Application Protocol

NGSO Non-Geosynchronous Orbit

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

NSAG Network Slice AS Group

NTN Non-Terrestrial Network

P-MPR Power Management Maximum Power Reduction

P-RNTI Paging RNTI

PCH Paging Channel

PCI Physical Cell Identifier

PDC Propagation Delay Compensation

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PEI Paging Early Indication

PH Paging Hyperframe

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

PRS Positioning Reference Signal

PS-RNTI Power Saving RNTI

PSS Primary Synchronisation Signal

PTM Point to Multipoint

PTP Point to Point

PTW Paging Time Window

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QFI QoS Flow ID

QMC QoE Measurement Collection

QoE Quality of Experience

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

RLM Radio Link Monitoring

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

RTT Round Trip Time

SCS SubCarrier Spacing

SD Slice Differentiator

SDAP Service Data Adaptation Protocol

SDT Small Data Transmission

SFI-RNTI Slot Format Indication RNTI

SHR Successful Handover Report

SIB System Information Block

SI-RNTI System Information RNTI

SLA Service Level Agreement

SMC Security Mode Command

SMF Session Management Function

SMTC SS/PBCH block Measurement Timing Configuration

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

SRAP Sidelink Relay Adaptation Protocol

SRS Sounding Reference Signal

SRVCC Single Radio Voice Call Continuity

SS Synchronization Signal

SSB SS/PBCH block

SSS Secondary Synchronisation Signal

SSSG Search Space Set Group

SST Slice/Service Type

SU-MIMO Single User MIMO

SUL Supplementary Uplink

TA Timing Advance

TB Transport Block

TCE Trace Collection Entity

TNL Transport Network Layer

TPC Transmit Power Control

TRP Transmit/Receive Point

TRS Tracking Reference Signal

U2N UE-to-Network

UCI Uplink Control Information

UDC Uplink Data Compression

UE-Slice-MBR UE Slice Maximum Bit Rate

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

VR Virtual Reality

V2X Vehicle-to-Everything

Xn-C Xn-Control plane

Xn-U Xn-User plane

XnAP Xn Application Protocol

*Next Modified Subclause*

### 7.3.1 Overview

System Information (SI) consists of a MIB and a number of SIBs, which are divided into Minimum SI and Other SI:

- **Minimum SI** comprises basic information required for initial access and information for acquiring any other SI. Minimum SI consists of:

- *MIB* contains cell barred status information and essential physical layer information of the cell required to receive further system information, e.g. CORESET#0 configuration. *MIB* is periodically broadcast on BCH.

- *SIB1* defines the scheduling of other system information blocks and contains information required for initial access. SIB1 is also referred to as Remaining Minimum SI (RMSI) and is periodically broadcast on DL-SCH or sent in a dedicated manner on DL-SCH to UEs in RRC\_CONNECTED.

- **Other SI** encompasses all SIBs not broadcast in the Minimum SI. Those SIBs can either be periodically broadcast on DL-SCH, broadcast on-demand on DL-SCH (i.e. upon request from UEs in RRC\_IDLE, RRC\_INACTIVE, or RRC\_CONNECTED), or sent in a dedicated manner on DL-SCH to UEs in RRC\_CONNECTED (i.e., upon request, if configured by the network, from UEs in RRC\_CONNECTED or when the UE has an active BWP with no common search space configured or when the UE configured with inter cell beam management is receiving DL-SCH from a TRP with PCI different from serving cell's PCI). Other SI consists of:

- *SIB2* contains cell re-selection information, mainly related to the serving cell;

- *SIB3* contains information about the serving frequency and intra-frequency neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency as well as cell specific re-selection parameters);

- *SIB4* contains information about other NR frequencies and inter-frequency neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency as well as cell specific re-selection parameters), which can also be used for NR idle/inactive measurements;

- *SIB5* contains information about E-UTRA frequencies and E-UTRA neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency as well as cell specific re-selection parameters);

- *SIB6* contains an ETWS primary notification;

- *SIB7* contains an ETWS secondary notification;

- *SIB8* contains a CMAS warning notification;

- *SIB9* contains information related to GPS time and Coordinated Universal Time (UTC);

- *SIB10* contains the Human-Readable Network Names (HRNN) of the NPNs listed in SIB1;

- *SIB11* contains information related to idle/inactive measurements;

- *SIB15* contains information related to disaster roaming;

*- SIB16* contains slice-based cell reselection information;

- *SIB17* contains information related to TRS configuration for UEs in RRC\_IDLE/RRC\_INACTIVE;

- *SIBpos* contains positioning assistance data as defined in TS 37.355 [43] and TS 38.331 [12];

- *SIB18* contains information related to the Group IDs for Network selection (GINs) associated with SNPNs listed in SIB1.

For sidelink, Other SI also includes:

- *SIB12* contains information related to NR sidelink communication;

- *SIB13* contains information related to *SystemInformationBlockType21* for V2X sidelink communication as specified in TS 36.331 clause 5.2.2.28 [29];

- *SIB14* contains information related to *SystemInformationBlockType26* for V2X sidelink communication as specified in TS 36.331 clause 5.2.2.33 [29].

For non-terrestrial network, Other SI also includes:

- *SIB19* contains NTN-specific parameters for serving cell and optionally NTN-specific parameters for neighbour cells as defined in TS 38.331 [12].

For MBS broadcast, Other SI also includes:

- *SIB20* contains MCCH configuration;

- *SIB21* contains information related to service continuity for MBS broadcast reception.

Figure 7.3.1-1 below summarises System Information provisioning.



Figure 7.3.1-1: System Information Provisioning

For a cell/frequency that is considered for camping by the UE, the UE is not required to acquire the contents of the minimum SI of that cell/frequency from another cell/frequency layer. This does not preclude the case that the UE applies stored SI from previously visited cell(s).

If the UE cannot determine the full contents of the minimum SI of a cell by receiving from that cell, the UE shall consider that cell as barred.

In case of BA, the UE only acquires SI on the active BWP.

If the UE is configured with inter cell beam management:

- the UE is not required to acquire the SI from the serving cell while it is receiving DL-SCH from a TRP with PCI different from serving cell's PCI.

*Next Modified Subclause*

#### 16.14.2.1 Scheduling and Timing

To accommodate the propagation delay in NTNs, several timing relationships are enhanced by a Common Timing Advance (Common TA) and two scheduling offsets and illustrated in Figure 16.14.2.1-1:

- is a configured offset that corresponds to the RTT between the Reference Point (RP) and the NTN payload.

- is a configured scheduling offset that need to be larger or equal to the sum of the service link RTT and the common TA.

- is a configured offset that need to be larger or equal to the RTT between the RP and the gNB.



Figure 16.14.2.1-1: Illustration of timing relationship

DL and UL are frame aligned at the uplink time synchronization reference point (RP) with an offset given by NTA,offset (see clause 4.3 of TS 38.211 [52]).

 is a scheduling offset for MAC CE timing relationship enhancement and estimation of UE-gNB RTT. It is provided by the network if downlink and uplink frame timing are not aligned at gNB. It is needed for UE timing of downlink configuration change indicated by a MAC-CE command in PDSCH. The is also used in the random access procedure, to determine the start time of RAR window/MsgB window after a Msg1/MsgA transmission and contention resolution timer after a Msg3 transmission.

*Next Modified Subclause*

#### 16.14.2.2 Timing Advance and Frequency Pre-compensation

For the serving cell, the network broadcasts satellite ephemeris information and common TA parameters. The UE shall have valid GNSS position as well as the satellite ephemeris and common TA before connecting to an NTN cell. To achieve synchronisation, before and during connection to an NTN cell, the UE computes the service link RTT based on the GNSS position and the satellite ephemeris, computes the common TA based on the common TA parameters (see clause 4.2 in TS 38.213 [38]), and autonomously pre-compensates the TTA for the RTT between UE and the RP as illustrated in Figure 16.14.2.1-1 (see clause 4.3 of TS 38.211 [52]).

The UE computes the frequency Doppler shift of the service link, and autonomously pre-compensates for it in the uplink transmissions, by considering UE position and the satellite ephemeris. If the UE does not have a valid GNSS position and/or valid satellite ephemeris, it does not communicate with the network until both are regained.

In connected mode, the UE should be able to continuously update the Timing Advance and frequency pre-compensation.

The UE may be configured to report Timing Advance during Random Access procedures or in connected mode. In connected mode, event-triggered reporting of the Timing Advance is supported.

While the pre-compensation of the instantaneous Doppler shift experienced on the service link is to be performed by the UE, the management of Doppler shift experienced over the feeder link and transponder frequency error is left to the satellite network implementation.

*Next Modified Subclause*

#### 16.14.3.1 Mobility in RRC\_IDLE and RRC\_INACTIVE

The same principles as described in 9.2.1 apply to mobility in RRC\_IDLE for NTN and the same principles as described in 9.2.2 apply to mobility in RRC\_INACTIVE for NTN unless hereunder specified.

The network may broadcast multiple Tracking Area Codes (TACs) per PLMN in an NR NTN cell. A TAC change in the System Information is under network control, i.e. it may not be exactly synchronised with real-time illumination of beams on ground.

The UE can determine the network type (terrestrial or non-terrestrial) implicitly by the existence of *cellBarredNTN* in SIB1.

The NTN ephemeris is provisioned. It includes serving cell's satellite ephemeris and neighbouring cell's satellite ephemeris.

*Next Modified Subclause*

##### 16.14.3.2.1 Handover

The same principle as described in 9.2.3.2 applies unless hereunder specified:

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

NOTE: NTN-TN hand-over refers to mobility in both directions, i.e. from NTN to TN (hand-in) and from TN to NTN (hand-out).

DAPS handover is not supported for NTN in this release of the specification.

UE may support mobility between gNBs operating with NTN payloads in different orbits (GSO, NGSO at different altitudes).

##### 16.14.3.2.2 Conditional Handover

The same principle as described in 9.2.3.4 applies to NTN unless hereunder specified.

NTN supports the following additional triggering conditions upon which UE may execute CHO to a candidate cell, as defined in TS 38.331 [12]:

- The RRM measurement-based event A4;

- A time-based trigger condition;

- A location-based trigger condition.

A time-based or a location-based trigger condition is always configured together with one of the measurement-based trigger conditions (CHO events A3/A4/A5). Location is defined by the distance between UE and a reference location.

It is up to UE implementation how the UE evaluates the time- or location-based condition jointly with the RRM event Ax

#### 16.14.3.3 Measurements

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

The network can configure:

- multiple SMTCs in parallel per carrier and for a given set of cells depending on UE capabilities using propagation delay difference calculated by UE;

- measurement gaps based on multiple SMTCs;

- satellite assistance information (e.g., ephemeris, common TA parameters) provided via system information for UE to perform measurement on neighbour cells in RRC\_IDLE/RRC\_INACTIVE/RRC\_CONNECTED..

NW-controlled adjustment of SMTCs can be based on UE assistance information reported in RRC\_CONNECTED. UE in RRC\_IDLE/RRC\_INACTIVE can adjust SMTCs based on its location and satellite assistance information (e.g. ephemeris, common TA parameters).

UE assistance information is in the form of the service link propagation delay difference(s) between the serving cell and neighbour cell(s).

When the satellite assistance information of a neighbour cell is absent in SIB19, the neighbour cell can be neglected by the UE when performing measurements.

In the quasi-earth fixed cell scenario, UE can perform time-based and location-based measurements on neighbour cells in RRC\_IDLE/RRC\_INACTIVE:

- The timing and location information associated to a cell are provided via system information;

- Timing information refers to the time when the serving cell is going to stop serving a geographical area;

- Location information refers to the reference location of serving cell and a distance threshold.

Measurement rules for cell re-selection with timing information and location information are specified in clause 5.2.4.2 in 38.304 [10].

*Next Modified Subclause*

#### 16.14.4.2 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 Gateways 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 connects to only one NTN Gateway at any given time, i.e. a radio link interruption may occur during the transition between the feeder links.

*Next Modified Subclause*

### 16.14.5 NG-RAN signalling

The Cell Identity, as defined in TS 38.413 [26] and TS 38.423 [50], 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 Mapped Cell IDs 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. Special Mapped Cell IDs or TACs 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.

### 16.14.6 AMF (Re-)Selection

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

For an RRC\_CONNECTED UE, when the gNB is configured to ensure that the UE connects to 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).

### 16.14.7 O&M Requirements

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

- Ephemeris information describing the orbital trajectory information or coordinates for the NTN payload. 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 [51]:

- Semi-major axis;

- Eccentricity;

- Argument of periapsis;

- Longitude of ascending node;

- Inclination;

- Mean anomaly at epoch time.

- The explicit epoch time associated to ephemeris data;

- The location of the NTN Gateways;

NOTE 1: 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 2: The NTN related parameters provided by O&M to the gNB may depend on the type of supported service links, i.e., Earth-fixed, quasi-Earth-fixed, Earth-moving.

### 16.14.8 Coarse UE location reporting

If user consent is required, the network can only request coarse UE location reporting provided that user consent is available. Upon network request, after AS security is established in connected mode, a UE should report its coarse UE location information (most significant bits of the GNSS coordinates, ensuring an accuracy in the order of 2 km) to the NG-RAN if available.

*Next Modified Subclause*

# B.4 Example implementation of Non-Terrestrial Networks

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



Figure B.4-1: NTN based NG-RAN

The gNB depicted in Figure B.4-1 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 MODIFICATIONS*