**3GPP TSG-RAN WG2 Meeting #117-e *R2-220xxxx***

**Electronic, 21st Feb – 3rd Mar 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
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| *For* [***HELP***](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 |  |

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|  |
| ***Title:***  | NB-IoT/eMTC support for Non-Terrestrial Networks  |
|  |  |
| ***Source to WG:*** | Ericsson, Eutelsat |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | LTE\_NBIOT\_eMTC\_NTN |  | ***Date:*** | 2022-02-21 |
|  |  |  |  |  |
| ***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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | Introduction of NB-IoT/eMTC support for Non-Terrestrial Networks |
|  |  |
| ***Summary of change:*** | Introduction of NTN-specific vocabulary, architecture and protocol aspects.This CR captures Stage 2 for support of NTN in NB-IoT and eMTC. Changes to Stage 2 includes: - Section 3.1/3.2: Definitions and abbreviations of NTN.- Section 4.x: General section on NTN. - Section 7.4: NTN-specific SIB and SIB for discontinuous coverage. - Section 23.x: Capturing general, uplink synchronization, discontinuous coverage and mobility management aspects   |
|  |  |
| ***Consequences if not approved:*** | NB-IoT/eMTC for Non-Terrestrial Networks does not have proper stage 2 description.  |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **Y** |  |  Other core specifications  | TS 36.304 CR 0843TS 36.321 CR ...TS 36.331 CR ... |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | RAN2#177-e Revision 1: R2-2203455RAN2#116-e endorsed running CR version: R2-2111405 RAN2#115-e endorsed running CR version: R2-2108977 |

Next change

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

Editor’s Note: definitions may need to be aligned with NR NTN stage 2 CR and RAN3 or provided by the relevant 3GPP WG.

For the purposes of the present document, the following terms and definitions apply.

**Access Control:** the process that checks whether a UE is allowed to access and to be granted services in a closed cell.

**Aerial UE communication**: functionality enabling Aerial UE function as defined in 23.17.

**Anchor carrier**: in NB-IoT, a carrier where the UE assumes that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.

**Carrier frequency**: center frequency of the cell.

**Cell:** combination of downlink and optionally uplink resources. The linking between the carrier frequency of the downlink resources and the carrier frequency of the uplink resources is indicated in the system information transmitted on the downlink resources.

**Cell Group**: in dual connectivity, a group of serving cells associated with either the MeNB or the SeNB.

**CHO candidate cell: a** candidate cell for CHO, for which UE has been configured with a CHO configuration.

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

**Control plane CIoT 5GS Optimisation**: Enables support of efficient transport of user data (IP, Ethernet and Unstructured) or SMS messages over control plane via the AMF without triggering user-plane resource establishment, as defined in TS 24.501 [91]. In the context of this specification, a NB-IoT UE that only supports Control plane CIoT 5GS Optimisation is a UE that does not support User plane CIoT 5GS Optimisation and NG-U data transfer but may support other CIoT 5GS Optimisations.

**Control plane CIoT EPS optimisation**: Enables support of efficient transport of user data (IP, non-IP or SMS) over control plane via the MME without triggering data radio bearer establishment, as defined in TS 24.301 [20]. In the context of this specification, a NB-IoT UE that only supports Control plane CIoT EPS optimisation is a UE that does not support User plane CIoT EPS optimisation and S1-U data transfer but may support other CIoT EPS optimisations.

**CSG Cell:** a cell broadcasting a CSG indicator set to true and a specific CSG identity.

**CSG ID Validation:** the process that checks whether the CSG ID received via handover messages is the same as the one broadcast by the target E-UTRAN.

**CSG member cell:** a cell broadcasting the identity of the selected PLMN, registered PLMN or equivalent PLMN and for which the CSG whitelist of the UE includes an entry comprising cell's CSG ID and the respective PLMN identity.

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

**DCN-ID:** DCN identity identifies a specific dedicated core network (DCN).

**Dual Connectivity**: mode of operation of a UE in RRC\_CONNECTED, configured with a Master Cell Group and a Secondary Cell Group.

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

**en-gNB**: as defined in TS 37.340 [76].

**Ephemeris:** A set of parameters that describe the movement of an NTN node over time.

**E-RAB:** an E-RAB uniquely identifies the concatenation of an S1 Bearer and the corresponding Data Radio Bearer. When an E-RAB exists, there is a one-to-one mapping between this E-RAB and an EPS bearer of the Non Access Stratum as defined in [17].

**Feeder link:** Wireless link between the NTN Gateway and the NTN payload [provided by RAN3 36.300 CR].

**Frequency layer**: set of cells with the same carrier frequency.

**FeMBMS:** further enhanced multimedia broadcast multicast service.

**FeMBMS/Unicast-mixed cell**: cell supporting MBMS transmission and unicast transmission as SCell.

**Geosynchronous Orbit:** Earth-centred orbit at approximately 35,786 kilometres in altitude above Earth’s surface and synchronised with Earth’s rotation. A geostationary orbit is a non-inclined geosynchronous orbit, i.e in the Earth’s equator plane.

**Handover**: procedure that changes the serving cell of a UE in RRC\_CONNECTED.

**Hybrid cell**: a cell broadcasting a CSG indicator set to false and a specific CSG identity. This cell is accessible as a CSG cell by UEs which are members of the CSG and as a normal cell by all other UEs.

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

**Local Home Network**: as defined in TS 23.401 [17].

**LTE bearer**: in LTE-WLAN Aggregation, a bearer whose radio protocols are located in the eNB only to use eNB radio resources only.

**LWA bearer**: in LTE-WLAN Aggregation, a bearer whose radio protocols are located in both the eNB and the WLAN to use both eNB and WLAN resources.

**LWAAP PDU**: in LTE-WLAN Aggregation, a PDU with DRB ID generated by LWAAP entity for transmission over WLAN.

**Make-Before-Break HO/SeNB change**: maintaining source eNB/SeNB connection after reception of RRC message for handover or change of SeNB before the initial uplink transmission to the target eNB during handover or change of SeNB.

**Master Cell Group**: in dual connectivity, a group of serving cells associated with the MeNB, comprising of the PCell and optionally one or more SCells.

**Master eNB**: in dual connectivity, the eNB which terminates at least S1-MME.

**MBMS-dedicated cell**: cell dedicated to MBMS transmission.

**MBMS/Unicast-mixed cell**: cell supporting both unicast and MBMS transmissions.

**MCG bearer**: in dual connectivity, a bearer whose radio protocols are only located in the MeNB to use MeNB resources only.

**Membership Verification:** the process that checks whether a UE is a member or non-member of a hybrid cell.

**Multi-Connectivity**: Mode of operation whereby a multiple Rx/Tx UE in the connected mode is configured to utilise radio resources amongst E-UTRA and/or NR provided by multiple distinct schedulers connected via non-ideal backhaul.

**NB-IoT:** NB-IoT allows access to network services via E-UTRA with a channel bandwidth limited to 200 kHz.

**NB-IoT UE**: a UE that uses NB-IoT.

**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.

**Non-anchor carrier**: in NB-IoT, a carrier where the UE does not assume that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.

**Non-geosynchronous orbit**: Earth-centred orbit with an orbital period that does not match Earth’s rotation on its axis. This includes Low Earth Orbit (LEO) and Medium Earth Orbit (MEO).

**Non-terrestrial networks:** An E-UTRAN consisting of eNBs, which provide non-terrestrial LTE access to UEs by means of an NTN payload embarked on an airborne or space-borne NTN vehicle and an NTN Gateway[provided by RAN3 36.300 CR].

**NR:** NR radio access

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [93], 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 [provided by RAN3 36.300 CR].

**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 [provided by RAN3 36.300 CR].

**PLMN ID Check:** the process that checks whether a PLMN ID is the RPLMN identity or an EPLMN identity of the UE.

**Power saving mode**: mode configured and controlled by NAS that allows the UE to reduce its power consumption, as defined in TS 24.301 [20], TS 23.401 [17], TS 23.682 [57].

**Primary PUCCH group:** a group of serving cells including PCell whose PUCCH signalling is associated with the PUCCH on PCell.

**Primary Timing Advance Group**: Timing Advance Group containing the PCell. In this specification, Primary Timing Advance Group refers also to Timing Advance Group containing the PSCell unless explicitly stated otherwise.

**ProSe-enabled Public Safety UE:** a UE that the HPLMN has configured to be authorized for Public Safety use, and which is ProSe-enabled and supports ProSe procedures and capabilities specific to Public Safety. The UE may, but need not, have a USIM with one of the special access classes {12, 13, 14}.

**ProSe Per-Packet Priority:** a scalar value associated with a protocol data unit that defines the priority handling to be applied for transmission of that protocol data unit.

**ProSe UE-to-Network Relay:** a UE that provides functionality to support connectivity to the network for Remote UE(s).

**ProSe UE-to-Network Relay Selection:** Process of identifying a potential ProSe UE-to Network Relay, which can be used for connectivity services (e.g. to communicate with a PDN).

**ProSe UE-to-Network Relay Reselection:** process of changing previously selected ProSe UE-to-Network Relay and identifying potential a new ProSe UE-to-Network Relay, which can be be used for connectivity services (e.g. to communicate with PDN).

**Public Safety ProSe Carrier:** carrier frequency for public safety sidelink communication and public safety sidelink discovery.

**PUCCH group:** either primary PUCCH group or a secondary PUCCH group.

**PUCCH SCell:** a Secondary Cell configured with PUCCH.

**RACH-less HO/SeNB change**: skipping random access procedure during handover or change of SeNB.

**Receive Only Mode:** See TS 23.246 [48].

**Remote UE:** a ProSe-enabled Public Safety UE, that communicates with a PDN via a ProSe UE-to-Network Relay.

**Satellite:** a space-borne vehicle orbiting the Earth that carries the NTN payload.

**SCG bearer**: in dual connectivity, a bearer whose radio protocols are only located in the SeNB to use SeNB resources.

**Secondary Cell Group**: in dual connectivity, a group of serving cells associated with the SeNB, comprising of PSCell and optionally one or more SCells.

**Secondary eNB**: in dual connectivity, the eNB that is providing additional radio resources for the UE but is not the Master eNB.

**Secondary PUCCH group:** a group of SCells whose PUCCH signalling is associated with the PUCCH on the PUCCH SCell.

**Secondary Timing Advance Group**: Timing Advance Group containing neither the PCell nor PSCell.

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

**Short Processing Time**: For 1 ms TTI length, the operation with short processing time in UL data transmission and DL data reception.

**Short TTI:** TTI length based on a slot or a subslot.

**Sidelink**: UE to UE interface for sidelink communication, V2X sidelink communication and sidelink discovery. The Sidelink corresponds to the PC5 interface as defined in TS 23.303 [62].

**Sidelink Control period**: period over which resources are allocated in a cell for sidelink control information and sidelink data transmissions. The Sidelink Control period corresponds to the PSCCH period as defined in TS 36.213 [6].

**Sidelink communication**: AS functionality enabling ProSe Direct Communication as defined in TS 23.303 [62], between two or more nearby UEs, using E-UTRA technology but not traversing any network node. In this version, the terminology "sidelink communication" without "V2X" prefix only concerns PS unless specifically stated otherwise.

**Sidelink discovery**: AS functionality enabling ProSe Direct Discovery as defined in TS 23.303 [62], using E-UTRA technology but not traversing any network node.

**Split bearer**: in dual connectivity, a bearer whose radio protocols are located in both the MeNB and the SeNB to use both MeNB and SeNB resources.

**Split LWA bearer**: in LTE-WLAN Aggregation, a bearer whose radio protocols are located in both the eNB and the WLAN to use both eNB and WLAN radio resources.

**Switched LWA bearer**: in LTE-WLAN Aggregation, a bearer whose radio protocols are located in both the eNB and the WLAN but uses WLAN radio resources only.

**Timing Advance Group**: a group of serving cells that is configured by RRC and that, for the cells with an UL configured, use the same timing reference cell and the same Timing Advance value.

**User plane CIoT 5GS Optimisation**: Enables support for change from 5GMM-IDLE mode to 5GMM-CONNECTED mode without the need for using the Service Request procedure, as defined in TS 24.501 [91].

**User plane CIoT EPS optimisation**: Enables support for change from EMM-IDLE mode to EMM-CONNECTED mode without the need for using the Service Request procedure, as defined in TS 24.301 [20].

**V2X sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [72], between nearby UEs, using E-UTRA technology but not traversing any network node.

**WLAN Termination**: the logical node that terminates the Xw interface on the WLAN side.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] 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].

1xCSFB Circuit Switched Fallback to 1xRTT

5GC 5G Core Network

ABS Almost Blank Subframe

AC Access Category

ACK Acknowledgement

ACLR Adjacent Channel Leakage Ratio

AM Acknowledged Mode

AMBR Aggregate Maximum Bit Rate

ANDSF Access Network Discovery and Selection Function

ANR Automatic Neighbour Relation

ARP Allocation and Retention Priority

ARQ Automatic Repeat Request

AS Access Stratum

AUL Autonomous Uplink

BCCH Broadcast Control Channel

BCH Broadcast Channel

BL Bandwidth reduced Low complexity

BR-BCCH Bandwidth Reduced Broadcast Control Channel

BSR Buffer Status Report

C/I Carrier-to-Interference Power Ratio

CA Carrier Aggregation

CAZAC Constant Amplitude Zero Auto-Correlation

CBC Cell Broadcast Center

CC Component Carrier

CG Cell Group

CHO Conditional Handover

CIF Carrier Indicator Field

CIoT Cellular Internet of Things

CMAS Commercial Mobile Alert Service

CMC Connection Mobility Control

C-plane Control Plane

C-RNTI Cell RNTI

CoMP Coordinated Multi Point

CP Cyclic Prefix

CQI Channel Quality Indicator

CRC Cyclic Redundancy Check

CRE Cell Range Extension

CRS Cell-specific Reference Signal

CSA Common Subframe Allocation

CSG Closed Subscriber Group

CSI Channel State Information

CSI-IM CSI interference measurement

CSI-RS CSI reference signal

DAPS Dual Active Protocol Stack

DC Dual Connectivity

DCCH Dedicated Control Channel

DCN Dedicated Core Network

DeNB Donor eNB

DFTS DFT Spread OFDM

DL Downlink

DMTC Discovery Signal Measurement Timing Configuration

DRB Data Radio Bearer

DRS Discovery Reference Signal

DRX Discontinuous Reception

DTCH Dedicated Traffic Channel

DTX Discontinuous Transmission

DwPTS Downlink Pilot Time Slot

E-CID Enhanced Cell-ID (positioning method)

E-RAB E-UTRAN Radio Access Bearer

E-UTRA Evolved UTRA

E-UTRAN Evolved UTRAN

EAB Extended Access Barring

ECGI E-UTRAN Cell Global Identifier

ECM EPS Connection Management

EDT Early Data Transmission

EHC Ethernet Header Compression

eHRPD enhanced High Rate Packet Data

eIMTA Enhanced Interference Management and Traffic Adaptation

EMM EPS Mobility Management

eNB E-UTRAN NodeB

EPC Evolved Packet Core

EPDCCH Enhanced Physical Downlink Control Channel

EPS Evolved Packet System

ETWS Earthquake and Tsunami Warning System

FDD Frequency Division Duplex

FDM Frequency Division Multiplexing

G-RNTI Group RNTI

GBR Guaranteed Bit Rate

GERAN GSM EDGE Radio Access Network

GNSS Global Navigation Satellite System

GP Guard Period

GRE Generic Routing Encapsulation

GSM Global System for Mobile communication

GSO Geosynchronous Orbit

GUMMEI Globally Unique MME Identifier

GUTI Globally Unique Temporary Identifier

GWCN GateWay Core Network

GWUS Group Wake Up Signal

H-SFN Hyper System Frame Number

HARQ Hybrid ARQ

(H)eNB eNB or HeNB

HO Handover

HPLMN Home Public Land Mobile Network

HRPD High Rate Packet Data

HSDPA High Speed Downlink Packet Access

ICIC Inter-Cell Interference Coordination

IDC In-Device Coexistence

IP Internet Protocol

ISM Industrial, Scientific and Medical

KPAS Korean Public Alert System

L-GW Local Gateway

LAA Licensed-Assisted Access

LB Load Balancing

LBT Listen Before Talk

LCG Logical Channel Group

LCR Low Chip Rate

LCS LoCation Service

LEO Low Earth Orbit

LHN Local Home Network

LHN ID Local Home Network ID

LIPA Local IP Access

LMU Location Measurement Unit

LPPa LTE Positioning Protocol Annex

LTE Long Term Evolution

LWA LTE-WLAN Aggregation

LWAAP LTE-WLAN Aggregation Adaptation Protocol

LWIP LTE WLAN Radio Level Integration with IPsec Tunnel

LWIP-SeGW LWIP Security Gateway

MAC Medium Access Control

MBMS Multimedia Broadcast Multicast Service

MBR Maximum Bit Rate

MBSFN Multimedia Broadcast multicast service Single Frequency Network

MCCH Multicast Control Channel

MCE Multi-cell/multicast Coordination Entity

MCG Master Cell Group

MCH Multicast Channel

MCS Modulation and Coding Scheme

MDT Minimization of Drive Tests

MeNB Master eNB

MEO Medium Earth Orbit

MGW Media Gateway

MIB Master Information Block

MIMO Multiple Input Multiple Output

MME Mobility Management Entity

MMTEL Multimedia telephony

MO-EDT Mobile Originated Early Data Transmission

MPDCCH MTC Physical Downlink Control Channel

MSA MCH Subframe Allocation

MSI MCH Scheduling Information

MSP MCH Scheduling Period

MT-EDT Mobile Terminated Early Data Transmission

MTC Machine-Type Communications

MTCH Multicast Traffic Channel

MTSI Multimedia Telephony Service for IMS

N2 Reference point between the NG-RAN and the AMF

NACK Negative Acknowledgement

NAS Non-Access Stratum

NB-IoT Narrow Band Internet of Things

NCC Next Hop Chaining Counter

NCGI NR Cell Global Identifier

NCR Neighbour Cell Relation

NG-RAN NG Radio Access Network

NGSO Non-Geosynchronous Orbit

NH Next Hop key

NNSF NAS Node Selection Function

NPBCH Narrowband Physical Broadcast channel

NPDCCH Narrowband Physical Downlink Control channel

NPDSCH Narrowband Physical Downlink Shared channel

NPRACH Narrowband Physical Random Access channel

NPUSCH Narrowband Physical Uplink Shared channel

NPRS Narrowband Positioning Reference Signal

NPSS Narrowband Primary Synchronization Signal

NR NR Radio Access

NRT Neighbour Relation Table

NSSS Narrowband Secondary Synchronization Signal

NTN Non-Terrestrial Network

OFDM Orthogonal Frequency Division Multiplexing

OFDMA Orthogonal Frequency Division Multiple Access

OPI Offload Preference Indicator

OTDOA Observed Time Difference Of Arrival (positioning method)

P-GW PDN Gateway

P-RNTI Paging RNTI

PA Power Amplifier

PAPR Peak-to-Average Power Ratio

PBCH Physical Broadcast CHannel

PBR Prioritised Bit Rate

PCC Primary Component Carrier

PCCH Paging Control Channel

PCell Primary Cell

PCFICH Physical Control Format Indicator CHannel

PCH Paging Channel

PCI Physical Cell Identifier

PDCCH Physical Downlink Control CHannel

PDCP Packet Data Convergence Protocol

PDN Packet Data Network

PDSCH Physical Downlink Shared CHannel

PDU Protocol Data Unit

PHICH Physical Hybrid ARQ Indicator CHannel

PHY Physical layer

PLMN Public Land Mobile Network

PMCH Physical Multicast CHannel

PMK Pairwise Master Key

PPPP ProSe Per-Packet Priority

PPPR ProSe Per-Packet Reliability

PRACH Physical Random Access CHannel

PRB Physical Resource Block

ProSe Proximity based Services

PSBCH Physical Sidelink Broadcast CHannel

PSC Packet Scheduling

PSCCH Physical Sidelink Control CHannel

PSCell Primary SCell

PSDCH Physical Sidelink Discovery CHannel

PSK Pre-Shared Key

PSM Power Saving Mode

PSSCH Physical Sidelink Shared CHannel

pTAG Primary Timing Advance Group

PTW Paging Time Window

PUCCH Physical Uplink Control CHannel

PUR Preconfigured Uplink Resource

PUR-RNTI Preconfigured Uplink Resource RNTI

PUSCH Physical Uplink Shared CHannel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QCI QoS Class Identifier

QoE Quality of Experience

QoS Quality of Service

R-PDCCH Relay Physical Downlink Control CHannel

RA-RNTI Random Access RNTI

RAC Radio Admission Control

RACH Random Access Channel

RANAC RAN-based Notification Area code

RAT Radio Access Technology

RB Radio Bearer

RBC Radio Bearer Control

RCLWI RAN Controlled LTE-WLAN Interworking

RF Radio Frequency

RIBS Radio-interface based synchronization

RIM RAN Information Management

RLC Radio Link Control

RMTC RSSI Measurement Timing Configuration

RN Relay Node

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RNC Radio Network Controller

RNL Radio Network Layer

RNTI Radio Network Temporary Identifier

ROHC Robust Header Compression

ROM Receive Only Mode

RRC Radio Resource Control

RRM Radio Resource Management

RTT Round Trip Time

RU Resource Unit

S-GW Serving Gateway

S-RSRP Sidelink Reference Signal Received Power

S1-MME S1 for the control plane

SAE System Architecture Evolution

SAP Service Access Point

SBCCH Sidelink Broadcast Control Channel

SC-FDMA Single Carrier – Frequency Division Multiple Access

SC-MCCH Single Cell Multicast Control Channel

SC-MTCH Single Cell Multicast Transport Channel

SC-N-RNTI Single Cell Notification RNTI

SC-PTM Single Cell Point To Multiploint

SC-RNTI Single Cell RNTI

SCC Secondary Component Carrier

SCell Secondary Cell

SCG Secondary Cell Group

SCH Synchronization Channel

SCTP Stream Control Transmission Protocol

SD-RSRP Sidelink Discovery Reference Signal Received Power

SDAP Service Data Adaptation Protocol

SDF Service Data Flow

SDMA Spatial Division Multiple Access

SDU Service Data Unit

SeGW Security Gateway

SeNB Secondary eNB

SFN System Frame Number

SI System Information

SI-RNTI System Information RNTI

S1-U S1 for the user plane

SIB System Information Block

SIPTO Selected IP Traffic Offload

SIPTO@LN Selected IP Traffic Offload at the Local Network

SL-BCH Sidelink Broadcast Channel

SL-DCH Sidelink Discovery Channel

SL-RNTI Sidelink RNTI

SL-SCH Sidelink Shared Channel

SPDCCH Short PDCCH

SPID Subscriber Profile ID for RAT/Frequency Priority

SPT Short Processing Time

SPUCCH Short PUCCH

SR Scheduling Request

SRB Signalling Radio Bearer

sTAG Secondary Timing Advance Group

STCH Sidelink Traffic Channel

SU Scheduling Unit

TA Tracking Area

TAC Tracking Area Code

TAG Timing Advance Group

TB Transport Block

TCP Transmission Control Protocol

TDD Time Division Duplex

TDM Time Division Multiplexing

TEID Tunnel Endpoint Identifier

TFT Traffic Flow Template

TM Transparent Mode

TMGI Temporary Mobile Group Identity

TNL Transport Network Layer

TTI Transmission Time Interval

U-plane User plane

UAC Unified Access Control

UDC Uplink Data Compression

UE User Equipment

UL Uplink

UM Unacknowledged Mode

UMTS Universal Mobile Telecommunication System

UpPTS Uplink Pilot Time Slot

UTRA Universal Terrestrial Radio Access

UTRAN Universal Terrestrial Radio Access Network

V2I Vehicle-to-Infrastructure

V2N Vehicle-to-Network

V2P Vehicle-to-Pedestrian

V2V Vehicle-to-Vehicle

V2X Vehicle-to-Everything

VRB Virtual Resource Block

WLAN Wireless Local Area Network

WT WLAN Termination

WUS Wake Up Signal

X2-C X2-Control plane

X2 GW X2 GateWay

X2-U X2-User plane

Xw-C Xw-Control plane

Xw-U Xw-User plane

End of changes

Next change

## 4.x Support of Non-Terrestrial Networks

E-UTRAN supports radio access over non-terrestrial networks for BL UEs, UEs in enhanced coverage and NB-IoT. Support for non-terrestrial networks encompasses platforms that provide radio access through Geosynchronous orbits (GSO), Non-Geosynchronous Orbit (NGSO), which includes Low-Earth Orbit (LEO) and Medium Earth Orbit (MEO) or High Altitude Platform Systems (HAPS).

Editor’s Note: the present section needs to be updated by RAN3.

Three types of service links are supported:

- Earth-fixed: provisioned by beam(s) continuously covering the same geographical areas all the time (e.g., the case of GSO satellites);

- Quasi-Earth-fixed: provisioned by beam(s) covering one geographic area for a limited period of time and a different geographic area during another period of time (e.g., the case of NGSO satellites generating steerable beams);

- Earth-moving: provisioned by beam(s) whose coverage area slides over the Earth surface (e.g., the case of NGSO satellites generating fixed or non-steerable beams).

With NGSO satellites, the eNB can provide either quasi-Earth-fixed cell coverage or Earth-moving cell coverage, while eNB operating with GSO satellites can provide Earth fixed cell coverage or quasi-Earth-fixed cell coverage.

End of changes

Next change

## 7.4 System Information

System information is divided into the *MasterInformationBlock* (MIB) and a number of *SystemInformationBlocks* (SIBs):

*- MasterInformationBlock* defines the most essential physical layer information of the cell required to receive further system information;

- *SystemInformationBlockPos* contains positioning assistance data;

- *SystemInformationBlockType1* and *SystemInformationBlockType1-BR* (for a BL UE or UE in enhanced coverage) contain information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information blocks;

- *SystemInformationBlockType2* contains common and shared channel information;

- *SystemInformationBlockType3* contains cell re-selection information, mainly related to the serving cell;

- *SystemInformationBlockType4* 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);

- *SystemInformationBlockType5* contains information about other E‑UTRA 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). It can also contain information about E-UTRA and NR idle/inactive measurements;

- *SystemInformationBlockType6* contains information about UTRA frequencies and 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);

- *SystemInformationBlockType7* contains information about GERAN frequencies relevant for cell re-selection (including cell re-selection parameters for each frequency);

- *SystemInformationBlockType8* contains information about CDMA2000 frequencies and CDMA2000 neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency as well as cell specific re-selection parameters);

- *SystemInformationBlockType9* contains a home eNB name (HNB name);

- *SystemInformationBlockType10* contains an ETWS primary notification;

- *SystemInformationBlockType11* contains an ETWS secondary notification;

- *SystemInformationBlockType12* contains a CMAS warning notification;

- *SystemInformationBlockType13* contains MBMS-related information;

- *SystemInformationBlockType14* contains information about Extended Access Barring for access control;

- *SystemInformationBlockType15* contains information related to mobility procedures for MBMS reception;

- *SystemInformationBlockType16* contains information related to GPS time and Coordinated Universal Time (UTC);

- *SystemInformationBlockType17* contains information relevant for traffic steering between E-UTRAN and WLAN;

- *SystemInformationBlockType18* contains information related to sidelink communication;

- *SystemInformationBlockType19* contains information related to sidelink discovery;

- *SystemInformationBlockType20* contains information related to SC-PTM;

- *SystemInformationBlockType21* contains information related to V2X sidelink communication;

- *SystemInformationBlockType24* contains information about NR frequencies and NR neighbouring cells relevant for cell re-selection (including cell re-selection parameters common for a frequency), which can also be used for NR idle/inactive measurements;

- *SystemInformationBlockType25* contains information about UAC parameters;

- *SystemInformationBlockType26* contains additional information related to V2X sidelink communication;

- *SystemInformationBlockType26a* contains information related to NR bands list which can be used for EN-DC operation with the serving cell;

- *SystemInformationBlockType27* contains assistance information for inter-RAT cell selection to NB-IoT;

- *SystemInformationBlockType28* contains information related to NR sidelink communication;

- *SystemInformationBlockType29* contains information related to common resource reservation.

- *SystemInformationBlockTypeXX* contains information required for accessing an NTN cell.

- *SystemInformationBlockTypeYY* contains assistance information for discontinuous coverage in NTN.

System information for NB-IoT is divided into the *MasterInformationBlock-NB* (MIB-NB) and a number of *SystemInformationBlocks-NB* (SIBs-NB):

- *MasterInformationBlock-NB* defines the most essential information of the cell required to receive further system information;

- *SystemInformationBlockType1-NB* contains information relevant when evaluating if a UE is allowed to access a cell and defines the scheduling of other system information blocks;

- *SystemInformationBlockType2-NB* contains common radio resource configuration information;

- *SystemInformationBlockType3-NB* contains cell re-selection information for intra-frequency, inter-frequency;

- *SystemInformationBlockType4-NB* contains neighboring cell related information relevant for intra-frequency cell re-selection;

- *SystemInformationBlockType5-NB* contains neighboring cell related information relevant for inter-frequency cell re-selection;

- *SystemInformationBlockType14-NB* contains information about access barring;

- *SystemInformationBlockType15-NB* contains information related to mobility procedures for MBMS reception;

- *SystemInformationBlockType16-NB* contains information related to GPS time and Coordinated Universal Time (UTC);

- *SystemInformationBlockType20-NB* contains information related to SC-PTM;

- *SystemInformationBlockType22-NB* contains common radio resource configuration information for paging and random access procedure on non-anchor carriers;

- *SystemInformationBlockType23-NB* contains common additional radio resource configuration information for random access procedure on anchor and non-anchor carriers;

- *SystemInformationBlockType27-NB* contains assistance information for inter-RAT cell selection to E-UTRAN and/or GERAN.

- *SystemInformationBlockTypeXX-NB* contains information required for accessing an NTN cell.

- *SystemInformationBlockTypeYY-NB* contains assistance information for discontinuous coverage in NTN.

On MBMS-dedicated cell, only system information relevant for receiving MBMS service is broadcasted. *MasterInformationBlock-MBMS* (MIB-MBMS) and *SystemInformationBlockType1-MBMS* (SIB1-MBMS) are used instead of MIB and SIB1 respectively:

*- MasterInformationBlock-MBMS* defines the most essential physical layer information of the cell required to receive further system information on MBMS-dedicated cell;

*- SystemInformationBlockType1-MBMS* contains information relevant for receiving MBMS service and defines the scheduling of other system information blocks on MBMS-dedicated cell;

The MIB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH and BR-BCCH, and carried on DL-SCH. Except for BL UEs, UEs in enhanced coverage and NB-IoT UEs, all other SI messages than the MIB which are dynamically carried on DL-SCH, can be identified through the SI-RNTI (System Information RNTI). Both the MIB and *SystemInformationBlockType1* (*SystemInformationBlockType1-BR* for BL UEs and UEs in enhanced coverage) use a fixed schedule with a periodicity of 40 and 80 ms respectively. The scheduling of other SI messages is flexible and indicated by *SystemInformationBlockType1* (*SystemInformationBlockType1-BR* for BL UEs and UEs in enhanced coverage, and *SystemInformationBlockType1-NB* for NB-IoT). For NB-IoT, the MIB-NB is mapped on the BCCH and carried on BCH while all other SI messages are mapped on the BCCH and carried on DL-SCH. Both the MIB-NB and *SystemInformationBlockType1-NB* use a fixed schedule with a periodicity of 640 and 2560 ms respectively. The MIB-NB contains all information required to acquire SIB1-NB and SIB1-NB contains all information required to acquire other SI messages.

On MBMS-dedicated cell, the MIB-MBMS and SIB1-MBMSuse a fixed schedule with a periodicity of 160 ms. Additionally, SIB1-MBMS may be scheduled in additional non-MBSFN subframes indicated in MIB-MBMS.

For NB-IoT, in TDD mode, the MIB-TDD-NB is transmitted on the same NB-IoT carrier as NPSS/NSSS, *SystemInformationBlockType1-NB* can be transmitted on NB-IoT carrier other than the MIB-NB, and the SI messages can be transmitted on a NB-IoT carrier other than the MIB-NB. At most two NB-IoT carriers are used to transmit the MIB-NB, *SystemInformationBlockType1-NB* and the SI messages.

Except for NB-IoT, the eNB may schedule DL-SCH transmissions concerning logical channels other than BCCH or BR-BCCH in the same subframe as used for BCCH or BR-BCCH. The minimum UE capability restricts the BCCH or BR-BCCH mapped to DL-SCH e.g. regarding the maximum rate.

The Paging message is used to inform UEs in RRC\_IDLE and UEs in RRC\_CONNECTED about a system information change. For NB-IoT UEs, BL UEs, and UEs in CE, the UE is not required to detect SIB changes when in RRC\_CONNECTED, and the network may release the NB-IoT UE, BL UE or UE in CE to RRC\_IDLE if it wants the NB-IoT UE, BL UE or UE in CE to acquire changed SIB(s).

Except for NB-IoT, system information may also be provided to the UE by means of dedicated signalling e.g. upon handover.

End of changes

Next change

## 23.x Support for BL UEs, UEs in enhanced coverage and NB-IoT UEs over Non-Terrestrial Networks

### 23.x.1 General

Support for BL UEs, UEs in enhanced coverage and NB-IoT UEs over Non-Terrestrial Networks (see sub-clause 4.X) is only applicable to E-UTRA connected to EPC. UEs not supporting NTN may be barred from an NTN cell.

In NTN, only BL UEs, UEs in enhanced coverage and NB-IoT UEs with GNSS capability are supported in this release of the specification.

To accommodate long propagation delays in NTN, increased timer values and window sizes, or delayed starting times are supported for the physical layer and for higher layers.

### 23.x.2 Uplink synchronisation

For the serving cell, the network broadcast ephemeris information and common Timing Advance parameters for the UEs to autonomously perform Timing Advance and frequency shift pre-compensation.

UE acquires both its GNSS position as well as the satellite ephemeris before connecting to an NTN cell to ensure the UE is synchronized. Before performing random access, the UE shall autonomously pre-compensate the Timing Advance for the long propagation delay as well as the frequency doppler shift by considering the common Timing Advance, UE position and the satellite position through the satellite ephemeris.

In connected mode, the UE shall continuously update the Timing Advance and frequency pre-compensation, but the UE is not expected to perform GNSS acquisition. Timers ensure that the UE does not perform any transmissions due to outdated satellite ephemeris, common Timing Advance or GNSS position. In connected mode, upon outdated satellite ephemeris and common Timing Advance, the UE re-acquires the broadcasted parameters and upon outdated GNSS position the UE moves to idle mode.

The UEs may be configured to report Timing Advance at initial access or in connected mode. In connected mode triggered reporting of the Timing Advance is supported.

Editor’s note: FFS what to capture from RAN1 on how K offset or other new NTN RAN1 features function.

### 23.x.3 Support of discontinuous coverage

As a satellite moves on a specified orbit, for example in case of a NGSO satellite, the satellite beam(s) coverage area may move and cover different portions of a geographical area due to the orbital movement of the satellite. As a consequence, a UE located in the concerned geographical area may experience a situation of discontinuous coverage, due to e.g. a sparse satellites constellation deployment.

To enable the UE to save power during periods of no coverage, the network provides satellite mean ephemeris parameters to enable the UE to predict when coverage will be provided by upcoming satellites. Predicting out of coverage and in coverage using the satellite mean ephemeris is up to UE implementation. When out of coverage, the UE is not required to perform AS functions.

Editor’s Note: Agreement: Providing the start-time of (incoming) satellite’s coverage and end-time of serving satellite’s coverage is needed for Quasi-Earth Fixed satellites.

### 23.x.4 Mobility Management

#### 23.x.4.1 Mobility Management in ECM-IDLE

The principles described in clause 10.1.1 apply in NTN unless specified otherwise hereafter.

The network may broadcast more than one TAC per PLMN in a cell in order to reduce the signalling load at cell edge in NTN, in particular for Earth-moving cell coverage. The AS layer indicates all received TACs for the selected PLMN to the NAS layer. The network may update the UEs upon TAC removal. UEs may by up to UE implementation also check whether a TAC has been removed.

For quasi-Earth-fixed cells, timing information on when the cell is going to stop serving the area may be broadcast by the network. This may be used by the UE to start measurements on neighbour cells before the broadcast stop time of the serving cell, while the exact start of the measurements is up to UE implementation.

#### 23.x.4.2 Mobility Management in ECM-CONNECTED

Radio link failure and RRC connection re-establishment are supported in NTN. The principles described in clause 10.1.6 apply unless specified otherwise.

To enable mobility in NTN, the network provides target cell satellite ephemeris in the handover command.

Conditional handover is supported for BL UEs and UEs in enhanced coverage.

End of changes

# T1 Appendix: RAN2 agreements for the LTE\_NBIOT\_eMTC\_NTN WI

## T1.1 Support of Non continuous coverage

**RAN2#117-e Agreements:**

* RAN2 will use a new SIB to share the ephemeris information for Discontinuous Coverage with the UEs. Sharing the information using dedicated RRC signalling is FFS.
* While Out of Coverage in Discontinuous Coverage deployment (in Idle Mode or PSM mode) the UE is not required to perform any cell search and may deactivate its AS functions to optimize the power consumption. The remaining UE behaviour is left to UE implementation. FFS whether anything need to be specified for ASNAS interaction.
* For Discontinuous Coverage, ephemeris information of up to a maximum X satellites can be shared using the new SIB, where X is limited by the volume of information vs capacity of the SIB (X=4 is baseline). Increasing this maximum number by using dedicated RRC Signalling and by any further ephemeris optimization is FFS.
* RAN2 assumes that for Discontinuous Coverage, network can signal mean ephemeris parameters (for neighbours and potentially serving satellite for coverage prediction purpose), using the same (already introduced) ephemeris format. UE can always assume these are mean values and It is up to the network implementation to derive this mean value (and any trade-off between instantaneous and mean values if needed). FFS whether additional assumptions (like averaging time) need to be clarified, e.g. to have predictable performance.
* P3: For Prediction of discontinuous coverage, Information about satellite id, ephemeris type (FFS if two, three of four types) and epoch time will be provided with the ephemeris information. FFS if epoch time can be optional and be implicitly derived.

**RAN2#116bis-e Agreements:**

* The contents of the ephemeris / assistance info for non-continuous coverage: Confirm that we Reuse the satellite ephemeris orbital parameters, already agreed for UL pre-compensation, for multiple satellites (Ref L1 params from R1).

**RAN2#116-e Agreements:**

* Satellite Ephemeris Parameters (not same as for L1 pre-compensation, for the constellation, not just single satellite) is needed for the UE for predicting coverage discontinuity. Other info, e.g. beam info, elevation angle, reference location or corresponding is FFS.
* Providing the start-time of (incoming) satellite’s coverage and end-time of serving satellite’s coverage is needed for Quasi-Earth Fixed satellites.
* From RAN2 point of view, the existing power saving mechanisms e.g. DRX, PSM, eDRX, relaxed monitoring, and WUS can be reused in IoT-NTN. Minor enhancements in existing power saving mechanisms to support discontinuous coverage is FFS.

**RAN2#115-e Agreements:**

* RAN2 confirms that the following will be supported: discontinuous coverage without excessive UE power consumption and without excessive failures / recovery actions. It is expected that this need to be taken into account at least for Idle mode. The requirement is applicable for all reference scenarios (GEO, MEO and LEO).
* Sattelite assistance information will be used by the UE for predicting coverage discontinuity. The details of the assistance information is FFS. FFS whether any applicable agreements made in NR-NTN can be reused.
* The details of UEs actions when predicted to be out of coverage is FFS, e.g. stopping unnecessary cell search in the Idle mode, and FFS to what extent this need to be specified.
* It is FFS to what extent it need to be specified the details of UE’s prediction of discontinuous coverage and its ability to detect when it is back in coverage.
* RAN2 sends an LS to SA2 and CT1 (cc: RAN3) for the possible alignment work in their specification due to the support of discontinuous coverage.

## T1.2 User plane impacts

**RAN2#117-e Agreements:**

* For eMTC use a reserved LCID for the TA report MAC CE.
* For eMTC, use a reserved LCID for the TA Report MAC CE.
* Regarding how to extend sr-ProhibitTimer in IoT NTN, attempt configurable offset.
* Use a reserved LCID for the MAC CE corresponding K\_Offset.
* For NB-IoT, use a reserved LCID for the TA Report MAC CE.
* On logical channel priority, put the UE-specific TA report MAC CE between “MAC control element for AUL confirmation” and “MAC control element for BSR, with exception of BSR included for padding”.
* During RA procedure for RRC re-establishment procedure, the UE should trigger TA report if an indication is broadcasted by the target cell’s SI. (aligned with NR NTN)
* During RA procedure for handover, the UE should trigger TA report if the target cell indicates this in the handover command. (aligned with NR NTN)
* Other than re-establishment (TA reporting controlled by target cell’s SI) and handover procedure (TA reporting controlled by HO command), TA reporting in connected mode is not controlled by enabling/disabling indication in SI. (aligned with NR NTN)
* RAN2 to clarify the previous agreement as: Upon reception of configuration or reconfiguration of TA reporting trigger event, if UE has not reported TA to current serving cell before (during this connection), the UE triggers a TA reporting. (can further check this during the implementation in the MAC CR). (aligned with NR NTN)
* Target cell can use delta configuration for the event configuration in handover command.
* Threshold-based TA-Trigger for TA value reporting will align with NR-NTN.
* Configuration of event triggered TA report will include TA offset threshold between current TA and the last successfully reported TA (similar to NR-NTN). FFS: The value of the TA offset threshold (consider possible to align with NR-NTN values).
* Extend RLC t-Reordering timer by adding values {ms2200, ms3200}.
* Do not add values between ms200 and ms1600 for extending RLC t-Reordering timer.
* Introduce a new discardTimer value ms2000 for eMTC over NTN. FFS whether to add ms3000.
* The two MAC CEs’ names are “Timing Advance Report MAC CE” and “Differential Koffset MAC CE”.
* Adopt the following field description for the “Timing Advance Report MAC CE”:

- R: Reserved bit, set to 0;

- Timing Advance: The Timing Advance field indicates the least integer number of subframes greater than or equal to the Timing Advance value (see TS 36.211 [7] section 8.1). The length of the field is 14 bits.

* Adopt the following field description for the “Differential Koffset MAC CE”:

- R: Reserved bit, set to 0;

- Differential Koffset: This field contains the differential Koffset. The length of the field is 6 bits.

**RAN2#116bis-e Agreements:**

* Do not mandate Msg3 or Msg5 to include TA report MAC CE, and whether it can be included depends on the TB size of Msg3 or Msg5.
* Reuse NR NTN’s TA reporting trigger event in IoT NTN, i.e., a TA offset threshold between current TA and the last successfully reported TA is used for event-triggered TA reporting. FFS for location used for TA reporting purpose.
* Introduce a new MAC CE for provision of UE specific K\_offset and the size is fixed to 1 byte. FFS on the MAC CE’s name.
* (Following NR NTN) Neither of the following options are supported “TA information requested by network”, “Periodical reporting of TA information”
* (Following NR NTN) Upon reception of configuration or reconfiguration of TA reporting trigger event, if UE has not reported TA before, the UE triggers a TA reporting. FFS whether we need different behaviour for different re-configurations e.g. Handover.
* On the RAR window’s start offset for the case of NB-IoT 41ms offset: The RA window start offset defined as sum (current offset, UE-eNB RTT) is applied to the case of NB-IoT 41ms offset.

**RAN2#116-e Agreements:**

* The estimate of UE-eNB RTT is equal to the sum of UE’s TA and K\_mac, where the UE’s TA is given by T\_TA=(N\_TA+N\_(TA,UE-specific) 〖+N〗\_(TA,common) 〖+N〗\_(TA,offset) )×T\_s, and K\_mac value is broadcasted by network.
* RAN2 confirm that the start of mac-ContentionResolutionTimer is delayed by UE-eNB RTT in IoT NTN.
* Any enhancements on (N)PRACH resource selection in IoT NTN will not be pursued in Rel-17.
* An offset equal to UE-eNB RTT is added to the formula used for calculating the (UL) HARQ RTT timer in IoT NTN.
* Support UE-specific TA reporting using MAC CE in Msg3/Msg5 for IoT NTN.
* For IoT NTN, UE specific TA reporting during RACH procedure (MSG3/MSG5) in RRC IDLE is enabled/disabled by SI, similar with NR NTN.
* Support TA reporting in RRC connected mode in IoT NTN.
* UE-specific TA report uses MAC CE.
* Support event-triggered for TA reporting in connected mode. Wait for NR NTN agreements for other triggers.
* On how to extend RLC t-Reordering in IoT NTN, wait for NR NTN agreements and see if they can be reused.
* Don’t change the L2 buffer requirement for IoT NTN (assume the network may need to limit the bit rate in order to not exceed L2 buffer).
* The PDCP discardTimer should be extended to support eMTC over NTN.
* If PDCP discardTimer is agreed to be extended to support eMTC over NTN, how to extend the timer value can wait for the conclusion for RLC t-reordering timer.
* The ra window start offset is defined as sum (current offset, UE-eNB RTT) and current offset is defined in TS36.321 (FFS if applicable to NB-IoT 41ms offset)

**RAN2#115-e Agreements:**

* Start of ra-ResponseWindow is delayed by an offset. Postpone discussion on the offset value until further agreements regarding RACH are made in RAN1.
* If the start of the RA Response window is accurately compensated by UE-eNB RTT and no extension of repetition is required, there is no need to extend the ra-ResponseWindowSize for IoT NTN.
* Start of mac-ContentionResolutionTimer is delayed by an offset, (assumed equal to UE-eNB RTT). This can be revisited if RAN1 decides something that requires to change this.
* If the start of mac-ContentionResolutionTimer is accurately compensated by UE-eNB RTT and no extension of repetition is required, there is no need to extend the mac-ContentionResolutionTimer for IoT NTN.
* From RAN2 perspective, for UE with UE-specific pre-compensation as a baseline it is up to eNB implementation to ensure sufficient time on UE side for the Msg3 transmission for IoT NTN.
* RAN2 assumes that TA information (FFS what) reporting by the UE on network enabling will be needed in IoT NTN. Expect RAN1 need to progress on this, and can maybe reuse NR NTN progress. FFS in which message this is provided.
* UE-eNB RTT is taken into account when calculating the (UL) HARQ RTT timer.
* RAN2 assumes that sr-ProhibitTimer need to be extended. Postpone treatment of sr-ProhibitTimer values until the NR NTN details have been decided.
* From RAN2’s perspective, delayed start of pur-ResponseWindowTimer with UE-eNB RTT can be supported. This can be revised if RAN1 finds issues to support PUR that are not small.
* pur-ResponseWindowSize is not extended for IoT NTN.
* SPS is supported without modification for IoT NTN.
* RAN2 confirm the SI agreement that the value range of the RLC t-Reordering timer will be extended to support IoT NTN.
* Do not extend the PDCP discardTimer for NB-IoT over NTN.
* FFS whether to extend the PDCP discardTimer for eMTC over NTN.
* Do not extend PDCP t-Reordering for IoT NTN.

## T1.3 Control plane impacts – Tracking Area and Mobility related

**RAN2#117-e Agreements:**

* All parameters needed to access the target cell are included in RRCReconfiguration message for handover.
* For simplicity, the whole SIBXX structure is included in RRCReconfiguration message for handover.
* SIBXX is included outside mobilityControlInfo, similarly to other dedicated SIB.

**RAN2#116bis-e Agreements:**

* It is up to the UE implementation whether or when to check SIB1 for TAC removal (for R17). Mobile UEs may need to check. No additional mechanism is needed. Can capture in a NOTE in Stage-2.

**RAN2#116-e Agreements:**

* The AS layer indicates to NAS layer all of the received TACs for the selected PLMN.
* For quasi-earth fixed cell, UE should start measurements on neighbour cells before the broadcast stop time of the serving cell, i.e the time when the serving cell stops covering the current area, and the exact time to start measurements (inter and intra-frequency) is up to UE implementation. FFS to what extent this need to be covered in the TS.
* Location-assisted cell reselection (e.g. as for NR NTN) is not supported for IoT NTN in rel 17.
* The use of hard TAC or soft TAC is up to network implementation in earth-fixed and earth-moving cells.
* Relaxed monitoring further enhancements are not considered for IoT NTN in rel-17.

**RAN2#115-e Agreements:**

* Cell selection / reselection procedures for NB-IoT and LTE-M in TN is the baseline in NB-IoT/LTE-M NTN.
* RAN2 assumes that Satellite assistance information, e.g. for cell selection reselection, for serving cell is provided to UE.
* Wait for the progress in RAN1 before discussion on whether satellite assistance information is broadcast in a separate information block.
* The timing information on when a cell is going to stop serving the area is broadcast at least for the quasi-earth fixed case. FFS details.
* The network may broadcast more than one TAC per PLMN in a cell, which is up to network implementation.
* The UE determines the Tracking Area based on the broadcast information (the use of other information is not excluded).
* When the network stops broadcasting a TAC, the UE needs to know it. FFS how this is done.
* UE does not do TAU if one of the currently broadcasted TAC belongs to UE’s registration area.
* Rel-16 LTE CHO mechanism is supported for LTE-M devices in IoT NTN. FFS which CE Mode(s) to apply
* No procedural update is required to support connected mode mobility for LTE-M.
* Rel-16 RLF / connection re-establishment mechanisms are supported in IoT NTN assuming that minor adjustments to UE specific timers and constants would be sufficient.
* FFS if Satellite assistance information for neighbour cell(s) is provided to UE for cell selection/reselection (justification would be needed).
* The value range for parameter t304 is not extended with larger values.
* Send an LS to RAN4 to inform that RRM impacts for supporting CHO should be taken into consideration.
* Postpone the discussion on whether specific timers and constants for RLF and RRC connection re-establishment procedures require extended value range and/or new behaviour till next meeting.
* System information update notification procedure is not used to inform TAC updates, at least for TAC additions (FFS removals)

## T1.5 Control plane – Other

**RAN2#117-e Agreements:**

* A new bit, e.g. *cellBarred-NTN*, is introduced in SIB1 to bar NTN UEs from accessing a NTN cell. FFS whether to consider MIB instead of SIB1 for NB-IoT. NTN UE ignores the legacy bit.
* SIBXX is an essential SIB, i.e. the UE shall consider the cell barred if it is unable to acquire the SIB when scheduled.
* UE shall acquire the NTN specific SIB before accessing the cell, regardless of the state of UL sync validity timer.
* RAN2 assumes Upon recovery from loss of precomp synch while TAT has not expired, UE resumes UL operation, no RACH is needed.
* When the UE tunes away, it is assumed that the UE may not receive DL dedicated transmissions, actions in the DL can be left to UE implementation.
* There is some support for enhancements for long data transmissions, which could be Rel-18.
* Introduce a guard timer TXXXX for SIBXX acquisition in connected mode. At TXXX expiry, UE triggers RLF (if it can be shown in Q2 that UE will loose RLM when UE tunes away, it can be discussed to skip this timer)
* Introduce a presence indicator in addition to the 2 bit LSB EARFCN in the NB-IoT MIB (eMTC - all aspects FFS)
* Upon timer expiry (or UE tune away), UE stops all UL transmissions, flushes all HARQ buffers and maintains all UL resources.
* The UL synchronisation validity timer is maintained in RRC.
* Modified Proposal 4: SIBXX acquisition is captured in 5.2.2. UE actions upon ul-SyncValidityTimer expiry are described in a new section in 5.3.3, which will refer to 5.2.2 for SIBXX (re)acquisition
* t-service is moved to SIB3.
* UE shall perform neighbour cell measurement of higher priority inter-frequency or inter-RAT frequencies regardless of the remaining serving time.
* Do not capture UE behaviour w.r.t to registration update in multiple tracking areas case in TS 36.304 section 5.4.
* Unless RAN1 updates the RRC parameters spreadsheet otherwise, align the value range of the ephemeris position state vectors with the number of signalling bits.
* Unless RAN1 updates the RRC parameters spreadsheet otherwise, align the value range of the ephemeris velocity state vectors with the number of signalling bits.
* cellBarred-NTN is signalled in SIB1 for NB-IoT.
* P1: No further enhancement on cell reselection priority is needed in IoT-NTN.
* P2: RAN2 will follow the RAN1 agreement that UE will report the remaining GNSS validity duration to the network. FFS: value range (not clear if the values of RAN1 agreement can be used). FFS which message.

**RAN2#116bis-e Agreements:**

* Keep the current representation of positionX, Y and Z parameters and add an Editor’s note to check the exact signalling
* Keep the current representation of velocityX, Y and Z parameters and add an Editor’s note to check with RAN1.
* Change the description of the actual value of parameter semiMajorAxis to: 6500000 + IE value \* (43000000 – 6500000) \* 2-33
* For all ephemeris parameters, simplify the representation of the formulas.
* TA common parameters, UL synchronisation validity duration and ephemeris epoch time are signalled in the NTN specific SIB (SIBXX).
* K\_offset and K\_mac parameters are signalled in the NTN specific SIB (SIBXX).
* UL (N)PRACH, (N)PUSCH and PUCCH transmission segment duration parameters are signalled in SIB2. (N)PUSCH and PUCCH transmission segment duration parameters are also signalled in dedicated signaling.
* Configuration of UL transmission segment for PUSCH for sub-PRB allocation is only signalled in dedicated signalling.
* In NB-IoT, the list of TACs broadcast in the cell is per PLMN.
* The maximum number of TACs that can be broadcast in a cell in IOT NTN is 12, the same as NR NTN.
* ta-Report-r17 is signaled in radioResourceConfigCommon.
* We will have the barring bit to prevent terrestrial UEs to use NTN. FFS if we define a new barring bit for NTN UEs barring.
* When SI used for UL synch (pre-compensation) is no longer valid, the UE autonomously tunes away and re-aquires the required SI, and then comes back. FFS whether anything additional is needed.
* UE acquires the NTN specific SIB before accessing the cell.
* UE need to have a valid GNSS fix before going to connected. RAN2 assumes that the UE may need to re-aquire the GNSS fix right before establishing the connection (regardless if previously valid or not), if needed to avoid interruption during the connection.
* When the GNSS fix becomes outdated in RRC\_CONNECTED mode, the UE goes to IDLE mode.
* Assume that eMTC can follow whatever is agreed for NR NTN
* For NB-IoT, assume that the location info need to be protected, also coarse location info, as has been stated by SA3. FFS if location can be reported by NAS, can ask CT1/SA2. Can also ask SA3 to confirm their view on coarse location information. Keep R3/SA2 informed.
* IoT-NTN support is indicated by single per UE capability indication. This capability indication comprises of all RAN1 features needed for IoT-NTN and the following control plane and user plane functionalities of RAN2.- TA Pre-compensation, RAR Window adjustments and MAC contention resolution Timer adjustments.- Timer adjustments for PDCP/RLC/MAC for NTN operation.- Acquisition of new SIB for IoT-NTN access- GNSS Support.
* TA Reporting is optional for IoT-NTN UE with separate capability indication from UE
* Capability bit signalling is not needed for support of cell reselection based on timer functionality. UE not having this capability will follow legacy cell reselection behaviour.

**RAN2#116-e Agreements:**

* The serving cell ephemeris information (used for L1 pre-compensation) is signalled in a new SIB, which is NTN specific.
* Update to serving cell ephemeris information does not affect the system information value tag and does not trigger System information modification procedure. How to trigger re-read of this information is FFS. FFS if the UE shall reacquire the new SIB when SI update is triggered.
* Updates to serving cell ephemeris information are not bound to the BCCH modification period.
* The timing information on when a serving cell is going to stop serving the area is broadcast in the same SIB as the ephemeris information.
* Broadcast of the timing information on when a serving cell is going to stop serving the area is only applicable to quasi earth fixed cell (not to moving cell).
* No enhancement to R16 RLF and RRC connection Re-establishment procedures are introduced in R17. (this does not include handling of UL synchronisation loss which is FFS and does not include non continuous coverage).
* No extension to timers and constants is required for RLF and RRC connection Re-establishment.
* No need to extend the 10 s delay for actions upon reception of RRCConnectionRelease in NB-IoT.
* It is feasible to use the legacy barring bit to block legacy UEs, and it is possible to have a new bit that assumes the functionality of the old bit. It is FFS if it is needed to use the barring bit or whether other mechanism can be assumed (new band etc).
* No enhancement to R16 CHO are introduced in R17.

**RAN2#115-e Agreements:**

None