**3GPP TSG-RAN WG3 Meeting #115-e *R3-222290***

**21 Feb - 3 Mar 2022**

**Online**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.300** | **CR** | **NA** | **rev** | **-** | **Current version:** | **16.7.0** |  |
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| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)*** *on using this form: comprehensive instructions can be found at  <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:*** | NB-IoT/eMTC support for Non-Terrestrial Networks | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | ZTE, CATT, Samsung, MediaTek, Nokia, Nokia Shanghai Bell, Ericsson, Qualcomm Incorporated | | | | | | | | | |
| ***Source to TSG:*** | R3 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_NBIOT\_eMTC\_NTN | | | | |  | ***Date:*** | | | 2022-03-04 |
|  |  | | | |  | |  | | |  |
| ***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 NB-IoT/eMTC support for Non-Terrestrial Networks | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | NB-IoT/eMTC support for NTN reuses the NR NTN functionality as baseline, including the following aspects:  Introduction of specific NTN vocabulary and architecture;  Cell identity and TA corresponding to Earth-fixed geographical area;  Introduction of feeder link switch-over  Introduction of country-specific CN routing  Introduction of identification and restriction of satellite access  Introduction of O&M requirements | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | NB-IoT/eMTC for Non-Terrestrial Networks is not supported | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2 ; 3.1 ; 3.2 ; 4.x ; 23.x.5 ; 23.x.6 ; 23.x.7 ; 23.x.8 ; Annex X | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 36.410 CR 0028  TS 36.413 CR 1853  TS 36.423 CR 1665 | | |
| ***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:  Rev1: Add MediaTek as co-source, update the Clauses affected.  Rev2: Update the CR based on the agreements in RAN3#114bis-e, add the co-source companies.  Rev3: Update the cover page; Resubmission to RAN3#115-e.  Rev4: Changes introduced in RAN3#115-e: Capture the agreed TPs in R3-222564 and R3-222786. | | | | | | | | |

**>>> START OF CHANGE <<<**

# 2 References

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

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

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

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

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TR 25.913: "Requirements for Evolved UTRA (E-UTRA) and Evolved UTRAN (E-UTRAN)".

[3] 3GPP TS 36.201: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; General description".

[4] 3GPP TS 36.211:"Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation".

[5] 3GPP TS 36.212: "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding".

[6] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures".

[7] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements".

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

[9] 3GPP TS 36.302: "Evolved Universal Terrestrial Radio Access (E-UTRA); Services provided by the physical layer".

[10] Void

[11] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode".

[12] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities".

[13] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[14] 3GPP TS 36.322: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Link Control (RLC) protocol specification".

[15] 3GPP TS 36.323: "Evolved Universal Terrestrial Radio Access (E-UTRA); Packet Data Convergence Protocol (PDCP) specification".

[16] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification".

[17] 3GPP TS 23.401: "Technical Specification Group Services and System Aspects; GPRS enhancements for E-UTRAN access".

[18] 3GPP TR 24.801: "3GPP System Architecture Evolution (SAE); CT WG1 aspects".

[19] 3GPP TS 23.402: "3GPP System Architecture Evolution: Architecture Enhancements for non-3GPP accesses".

[20] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[21] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); "Requirements for support of radio resource management".

[22] 3GPP TS 33.401: "3GPP System Architecture Evolution: Security Architecture".

[23] 3GPP TS 23.272: "Circuit Switched Fallback in Evolved Packet System; Stage 2".

[24] Void.

[25] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

[26] 3GPP TS 23.003: "Numbering, addressing and identification".

[27] 3GPP TR 25.922: "Radio Resource Management Strategies".

[28] 3GPP TS 23.216: "Single Radio voice Call continuity (SRVCC); Stage 2".

[29] 3GPP TS 32.421: "Subscriber and equipment trace: Trace concepts and requirements".

[30] 3GPP TS 32.422: "Subscriber and equipment trace; Trace control and configuration management".

[31] 3GPP TS 32.423: "Subscriber and equipment trace: Trace data definition and management".

[32] Void.

[33] 3GPP TS 22.220: "Service Requirements for Home NodeBs and Home eNodeBs".

[34] 3GPP TS 22.268: "Public Warning System (PWS) Requirements".

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

[36] 3GPP TS 25.446: "MBMS synchronisation protocol (SYNC)".

[37] 3GPP TS 22.168: "Earthquake and Tsunami Warning System (ETWS) requirements; Stage 1".

[38] Void.

[39] Void.

[40] 3GPP TS 29.274: "Tunnelling Protocol for Control Plane (GTPv2-C); Stage 3".

[41] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".

[42] 3GPP TS 36.423: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 Application Protocol (X2AP)".

[43] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".

[44] 3GPP TS 36.443: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); M2 Application Protocol (M2AP)".

[45] 3GPP TS 36.444: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); M3 Application Protocol (M3AP)".

[46] 3GPP TS 36.420: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 general aspects and principles".

[47] 3GPP TS 29.281: "General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U)"

[48] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description"

[49] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs"

[50] 3GPP TR 36.816: "Evolved Universal Terrestrial Radio Access (E-UTRA); Study on signalling and procedure for interference avoidance for in-device coexistence".

[51] 3GPP TS 36.305: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Stage 2 functional specifications of User Equipment (UE) positioning in E-UTRAN".

[52] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[53] 3GPP TS 33.320: "Security of Home Node B (HNB) / Home evolved Node B (HeNB)".

[54] 3GPP TS 23.251: "Technical Specification Group Services and System Aspects; Network Sharing; Architecture and functional description".

[55] 3GPP TS 23.139: "3GPP system – fixed broadband access network interworking".

[56] 3GPP TS 23.007: "Technical Specification Group Core Network and Terminals; Restoration procedures".

[57] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[58] 3GPP TS 24.312: "Access Network Discovery and Selection Function (ANDSF) Management Object (MO)".

[59] 3GPP TR 36.842: "Study on Small Cell enhancements for E-UTRA and E-UTRAN; Higher layer aspects"

[60] 3GPP TR 36.932: "Scenarios and Requirements for Small Cell Enhancements for E-UTRA and E-UTRAN".

[61] 3GPP TS 36.425: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 interface user plane protocol".

[62] 3GPP TS 23.303: "Technical Specification Group Services and System Aspects; Proximity-based services (ProSe)"

[63] 3GPP TS 36.314: "Evolved Universal Terrestrial Radio Access (E-UTRA); Layer 2 - Measurements".

[64] 3GPP TR 36.889: "Study on Licensed-Assisted Access to Unlicensed Spectrum".

[65] IEEE 802.11, Part 11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications, IEEE Std.".

[66] 3GPP TS 36.360: "LTE-WLAN Aggregation Adaptation Protocol (LWAAP) specification".

[67] 3GPP TS 24.302: "Access to the 3GPP Evolved Packet Core (EPC) via non-3GPP access networks".

[68] 3GPP TS 36.361: "LTE/WLAN Radio Level Integration Using IPsec Tunnel (LWIP) encapsulation; Protocol specification".

[69] 3GPP TS 36.463: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN) and Wireless LAN (WLAN); Xw application protocol (XwAP)".

[70] 3GPP TS 33.402: "3GPP System Architecture Evolution (SAE); Security aspects of non-3GPP accesses".

[71] 3GPP TS 22.185: "Service requirements for V2X services; Stage 1".

[72] 3GPP TS 23.285: "Technical Specification Group Services and System Aspects; Architecture enhancements for V2X services".

[73] IETF RFC 7567 "IETF Recommendations Regarding Active Queue Management".

[74] 3GPP TS 26.114: "Technical Specification Group Services and System Aspects; IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[75] 3GPP TS 24.386: "User Equipment (UE) to V2X control function; protocol aspects; Stage 3".

[76] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity".

[77] 3GPP TS 23.280: "Common functional architecture to support mission critical services; Stage 2".

[78] 3GPP TS 36.355: " Evolved Universal Terrestrial Radio Access (E-UTRA);LTE Positioning Protocol (LPP)".

[79] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description, Stage 2".

[80] 3GPP TS 37.324: "NR; Service Data Protocol (SDAP) specification".

[81] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

[82] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[83] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[84] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[85] 3GPP TS 25.412: "UTRAN Iu interface signalling transport".

[86] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[87] Void

[88] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[89] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[90] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access".

[91] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[92] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[93] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services ".

[x] 3GPP TS 36.410: “Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 general aspects and principles”.

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

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

Editor’s Note: where indicated, related definitions of the present section may need to be aligned with NR NTN stage 2 CR or provided by the relevant 3GPP WGs.

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**: [RAN2]

**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.

**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.

**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.

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

**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-terrestrial network**: An E-UTRAN consisting of eNBs, which provide non-terrestrial LTE access to UEs by means of an NTN payload embarked on space-borne NTN vehicle and an NTN Gateway.

**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.

**NTN payload:** a network node, embarked on board a satellite, 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.

**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**: [RAN2]

**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**: [RAN2]

**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

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

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

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

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

NTN Non-Terrestrial Network

NR NR Radio Access

NRT Neighbour Relation Table

NSSS Narrowband Secondary Synchronization Signal

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

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

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

**>>> NEXT CHANGE <<**

## 4.x Non-Terrestrial Networks

[RAN2 - TP]

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



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

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

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

- A eNB may serve multiple NTN payloads;

- An NTN payload may be served by multiple eNBs.

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

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

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

- A Mapped Cell ID as specified in subclause 23.x.5.

**>>> NEXT CHANGE <<**

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

[RAN2 - TP]

### 23.x.5 Switch over

#### 23.x.5.1 Definitions

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

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

#### 23.x.5.2 Assumptions

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

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

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

#### 23.x.5.3 Procedures

The NTN Control function determines the point in time when the feeder link switch over between two eNBs is performed. For BL UEs and UEs in enhanced coverage, the transfer of the affected UE(s)’ context between the two eNBs at feeder link switch over is performed by means of either S1 based or X2 based handover, and it depends on the eNBs’ implementation and configuration information provided to the eNBs by the NTN Control function.

### 23.x.6 Signalling

The Cell Identity, as defined in TS 36.413 [25] and TS 36.423 [42], 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 eNB to the Core Network as part of the User Location Information, or as E-UTRAN CGI in the related S1AP messages;

- The Cell Identity used for Paging Optimization in S1 interface;

- The Cell Identity used for PWS.

For a BL UE or a UE in enhanced coverage, the Cell Identity included within the target identification of the handover messages allows identifying the correct target cell.

The mapping between Cell Identities and geographical areas is configured in the RAN and Core Network.

For a BL UE or a UE in enhanced coverage, the eNB is responsible for constructing the Mapped Cell ID based on the UE location info received from the UE. The mapping may be pre-configured (e.g., up to operator’s policy) or up to implementation.

NOTE: As described in TS 23.401 [17], the User Location Information may enable the MME to determine whether the UE is allowed to operate at its present location. Pre-configuration of special mapped cell identifiers may be used to indicate areas outside the serving PLMN’s country.

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

### 23.x.7 MME(Re-)Selection by eNB

The eNB implements the NAS Node Selection Function specified in TS 36.410 [x].

For a RRC\_CONNECTED UE, when the eNB is configured to ensure that the BL UE or the UE in enhanced coverage is using an MME that serves the country in which the UE is located. If the eNB detects that a BL UE or a UE in enhanced coverage is in a different country to that served by the serving MME, it should perform an S1 handover to change to an appropriate MME or initiate anUE Context Release Request procedure towards the serving MME (in which case the MME may decide to de-register the UE)..

### 23.x.8 O&M Requirements

The NTN related parameters shall be provided by O&M to the eNB providing non-terrestrial access, as specified in TS 38.300 [79].

**>>> NEXT CHANGE <<**

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

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



Figure X-1: NTN based E-UTRAN

The eNB depicted in Figure X-1 may be subdivided into non-NTN infrastructure eNB 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 vehicle, providing a structure, power, commanding, telemetry, attitude control for the satellite and possibly an appropriate thermal environment, radiation shielding.

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

The NTN control function controls the spaceborne 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 eNB functions of the eNB.

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

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

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

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

- The Cell identifier (S1 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 (S1 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/eNBs;

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

**>>> END OF CHANGE <<<**