**3GPP TSG SA-WG2 Meeting #155  *S2-230xxxx***

**Athens, Greece, February 20 – 24, 2023 (*revision of*)**

|  |
| --- |
| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **23.501** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **18.0.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **X** | Core Network | **x** |

|  |
| --- |
|  |
| ***Title:***  | Support for restricted network slice location availability  |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | eNS\_ph3 |  | ***Date:*** | 2023-01-09 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | As concluded in TR23.700-41, S-NSSAI availability policies with the validity set to location information (e.g. a set of cells, or combination of cells and TAs), that are sent to the UE. The UE uses the policies and when the availability are not valid, the UE considers the S-NSSAI to be 1) not registered or 2) registered while no UP are allowed to be activated based on information in the received policy.Whether S-NSSAI validity policies is sent to the UE in the Configured NSSAI or separate is to be determined during normative phase.How the handover can be optimized to prevent the UE from leaving the slice service area (or entering into the slice service area) will be considered during normative phase based on RAN WG feedback.The AMF enforcement of the S-NSSAI availability policies e.g. when the UE does not support the policies will be described during normative phase based on AMF subscribing to AoI. |
|  |  |
| ***Summary of change:*** | Add the description on restricted network slice location availability as above. |
| ***--*** |  |
| ***Consequences if not approved:*** | Restricted network slice location availability is not supported. |
|  |  |
| ***Clauses affected:*** | 5.15.1, 5.15.x(new), 5.4.4a, 2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR’s revision history:*** |  |

##

## **FIRST CHANGE**

.

5.15.1 General

A Network Slice instance is defined within a PLMN or within an SNPN and shall include:

- the Core Network Control Plane and User Plane Network Functions, as described in clause 4.2,

and, in the serving PLMN, at least one of the following:

- the NG-RAN described in TS 38.300 [27];

- the N3IWF or TNGF functions to the non-3GPP Access Network described in clause 4.2.8.2 or the TWIF functions to the trusted WLAN in the case of support of N5CW devices described in clause 4.2.8.5;

- the W-AGF function to the Wireline Access Network described in clause 4.2.8.4.

The 5G System deployed in a PLMN shall always support the procedures, information and configurations specified to support Network Slice instance selection in the present document, TS 23.502 [3] and TS 23.503 [45].

Network slicing support for roaming is described in clause 5.15.6.

Network slices may differ for supported features and network functions optimisations, in which case such Network Slices may have e.g. different S-NSSAIs with different Slice/Service Types (see clause 5.15.2.1). The operator can deploy multiple Network Slices delivering exactly the same features but for different groups of UEs, e.g. as they deliver a different committed service and/or because they are dedicated to a customer, in which case such Network Slices may have e.g. different S-NSSAIs with the same Slice/Service Type but different Slice Differentiators (see clause 5.15.2.1).

The network may serve a single UE with one or more Network Slice instances simultaneously via a 5G-AN regardless of the access type(s) over which the UE is registered (i.e. 3GPP Access and/or N3GPP Access). The AMF instance serving the UE logically belongs to each of the Network Slice instances serving the UE, i.e. this AMF instance is common to the Network Slice instances serving a UE.

NOTE 1: Number of simultaneous connection of Network Slice instances per UE is limited by the number of S-NSSAIs in the Requested/Allowed NSSAI as described in clause 5.15.2.1.

NOTE 2: In this Release of the specification it is assumed that in any (home or visited) PLMN it is always possible to select an AMF that can serve any combination of S-NSSAIs that will be provided as an Allowed NSSAI.

The selection of the set of Network Slice instances for a UE is triggered by the first contacted AMF in a Registration procedure normally by interacting with the NSSF, and can lead to a change of AMF. This is further described in clause 5.15.5.

A PDU Session belongs to one and only one specific Network Slice instance per PLMN. Different Network Slice instances do not share a PDU Session, though different Network Slice instances may have slice-specific PDU Sessions using the same DNN.

During the Handover procedure the source AMF selects a target AMF by interacting with the NRF as specified in clause 6.3.5.

Network Slice-Specific Authentication and Authorization (NSSAA) enables Network Slice specific authentication as described in clause 5.15.10.

Network Slice Admission Control (NSAC) controls the number of registered UEs per network slice and the number of PDU Sessions per network slice as described in clause 5.15.11.

Support of subscription-based restrictions to simultaneous registration of network slices uses Network Slice Simultaneous Registration Group (NSSRG) information to enable control of which Network Slices that can be registered simultaneously by a UE as described in clause 5.15.12.

Support of data rate limitation per Network Slice for a UE enables enforcement of Maximum Bit Rate per Network Slice for a UE as described in clause 5.15.13.

The selection of N3IWF supporting a set of slice(s) is described in clause 6.3.6.

The Support of restricted network slice location availability is described in clause 5.15.x.

## **More CHANGEs**

### 5.15.x Support for restricted network slice location availability

A network slice may be available only for a limited location which is not matching existing Tracking Areas boundaries that is known at the network based on operator policy.

The AMF, based on configuration, may be configured with validity area of service for an S-NSSAI. OAM may configure RRM policies for S-NSSAIs on a per cell basis as defined in TS 28.541 [xx], i.e. cells outside the Network Slice Area of Service while in a TA supporting the S-NSSAI may be allocated limited or no resources for the S-NSSAI.

For a supporting UE, the UE indicates its support for the temporary network slices optimization in the UE MM Core Network Capability as described in clause 5.4.4a in the Registration Request. The AMF, based on OAM configuration, may indicate to a supporting UE, may provide validity area of service for some S-NSSAIs in the Configured NSSAI in a Registration Accept or in a UE Configuration Update.

When a supporting UE has received validity area of service for an S-NSSAI, the UE shall only include the S-NSSAI in the Requested NSSAI or establish a PDU Session of the S-NSSAI when the UE location matches what is indicated in the validity area of service. The UE shall locally remove the S-NSSAI from the Allowed NSSAI or Partially Allowed NSSAI, if available and the UE shall also locally release any PDU sessions associated of the S-NSSAI when the UE location no longer matches what is indicated in the validity area of service, if available.

For a non-supporting UE, the UE enforces URSP rule as described in clause 6.6.2.3 of TS 23.503 [45] to only establish PDU sessions associated of the S-NSSAI when the UE location matches what is indicated in the validity area of service.

NOTE 1: Based on operator configuration in the PCF, each S-NSSAI can be associated with validity area of service, which can be used by the PCF to generate Location Criteria of the URSP rule. The Location Criteria of the URSP rule with the corresponding S-NSSAI is within validity area of service of such S-NSSAI. Then, the non-supporting UE will only establish PDU Sessions associated of the S-NSSAI when the UE location matches what is indicated in the validity area of service.

NOTE 2: Alternatively, the operator can reconfigure the TA boundaries to ensure the uniform support of S-NSSAIs in cells within the TA.

Editor’s note: RAN optimization on handover to prevent the UE from leaving the slice service area (or entering into the slice service area) or admission control will be considered based on RAN WG feedback

## **MORE CHANGES**

### 5.4.4a UE MM Core Network Capability handling

The UE MM Core Network Capability is split into the S1 UE network capability (mostly for E-UTRAN access related core network parameters) and the UE 5GMM Core Network Capability (mostly to include other UE capabilities related to 5GCN or interworking with EPS) as defined in TS 24.501 [47] and contains non radio-related capabilities, e.g. the NAS security algorithms, etc. The S1 UE network capability is transferred between all CN nodes at AMF to AMF, AMF to MME, MME to MME, and MME to AMF changes. The UE 5GMM Core Network Capability is transferred only at AMF to AMF changes.

In order to ensure that the UE MM Core Network Capability information stored in the AMF is up to date (e.g. to handle the situation when the USIM is moved into a different device while out of coverage, and the old device did not send the Detach message; and the cases of inter-RAT Registration Area Update), the UE shall send the UE MM Core Network Capability information to the AMF during the Initial Registration and Mobility Registration Update procedure within the NAS message.

The AMF shall store always the latest UE MM Core Network Capability received from the UE. Any UE MM Core Network Capability that an AMF receives from an old AMF/MME is replaced when the UE provides the UE MM Core Network Capability with Registration signalling.

If the UE's UE MM Core Network Capability information changes (in either CM-CONNECTED or in CM-IDLE state), the UE shall perform a Mobility Registration Update procedure when it next returns to NG-RAN coverage. See clause 4.2.2 of TS 23.502 [3].

The UE shall indicate in the UE 5GMM Core Network Capability if the UE supports:

- Attach in EPC with Request type "Handover" in PDN CONNECTIVITY Request message (clause 5.3.2.1 of TS 23.401 [26]).

- EPC NAS.

- SMS over NAS.

- LCS.

- 5G SRVCC from NG-RAN to UTRAN, as specified in TS 23.216 [88].

- Radio Capabilities Signalling optimisation (RACS).

- Network Slice-Specific Authentication and Authorization.

- Parameters in Supported Network Behaviour for 5G CIoT as described in clause 5.31.2.

- Receiving WUS Assistance Information (E-UTRA) see clause 5.4.9..

- Paging Subgrouping Support Indication (NR) see clause 5.4.12.

- CAG, see clause 5.30.3.3.

- Subscription-based restrictions to simultaneous registration of network slices (see clause 5.15.12).

- Support of NSAG (see clause 5.15.14).

- Minimization of Service Interruption (MINT), as described in clause 5.40.

- Equivalent SNPNs (see clause 5.30.2.11).

- Unavailability Period, as described in clause 5.4.1.4.

- Support for restricted network slice location availability (see clause 5.15.x)

If a UE operating two or more USIMs, supports and intends to use one or more Multi-USIM features (see clause 5.38) in a PLMN for a USIM, it shall indicate in the UE 5GMM Core Network Capability for this USIM in this PLMN that it supports these one or more Multi-USIM features with the following indications:

- Connection Release Supported.

- Paging Cause Indication for Voice Service Supported.

- Reject Paging Request Supported.

- Paging Restriction Supported.

Otherwise, the UE with the capabilities of Multi-USIM features but does not intend to use them shall not indicate support of these one or more Multi-USIM features.

A UE not operating two or more USIMs shall indicate the Multi-USIM features are not supported.

NOTE: It is not necessary for a UE operating two or more USIMs to use Multi-USIM features with all USIMs.

## **MORE CHANGES**

# 2 References

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

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

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

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

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

[2] 3GPP TS 22.261: "Service requirements for next generation new services and markets; Stage 1".

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

[4] 3GPP TS 23.203: "Policies and Charging control architecture; Stage 2".

[5] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS); Stage 2".

[6] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface: Stage 3".

[7] IETF RFC 7157: "IPv6 Multihoming without Network Address Translation".

[8] IETF RFC 4191: "Default Router Preferences and More-Specific Routes".

[9] IETF RFC 2131: "Dynamic Host Configuration Protocol".

[10] IETF RFC 4862: "IPv6 Stateless Address Autoconfiguration".

[11] ITU‑T Recommendation I.130: "Method for the characterization of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[12] ITU‑T Recommendation Q.65: "The unified functional methodology for the characterization of services and network capabilities".

[13] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS): Stage 3".

[14] IETF RFC 3736: "Stateless DHCP Service for IPv6".

[15] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[16] 3GPP TS 22.173: "IMS Multimedia Telephony Service and supplementary services; Stage 1".

[17] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station in idle mode".

[18] 3GPP TS 23.167: "3rd Generation Partnership Project; Technical Specification Group Services and Systems Aspects; IP Multimedia Subsystem (IMS) emergency sessions".

[19] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[20] IETF RFC 7542: "The Network Access Identifier".

[21] 3GPP TS 23.002: "Network Architecture".

[22] 3GPP TS 23.335: "User Data Convergence (UDC); Technical realization and information flows; Stage 2".

[23] 3GPP TS 23.221: "Architectural requirements".

[24] 3GPP TS 22.153: "Multimedia priority service".

[25] 3GPP TS 22.011: "Service Accessibility".

[26] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[27] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description".

[28] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol Specification".

[29] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[30] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[31] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity; Stage 2".

[32] 3GPP TS 23.214: "Architecture enhancements for control and user plane separation of EPC nodes; Stage 2".

[33] 3GPP TS 22.101: "3rd Generation Partnership Project; Technical Specification Group Services and Systems Aspects; Service aspects; Service principles".

[34] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[35] 3GPP TS 33.126: "Lawful Interception Requirements".

[36] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[37] 3GPP TS 22.280: "Mission Critical Services Common Requirements (MCCoRe); Stage 1".

[38] 3GPP TS 23.379: "Functional architecture and information flows to support Mission Critical Push To Talk (MCPTT); Stage 2".

[39] 3GPP TS 23.281: "Functional architecture and information flows to support Mission Critical Video (MCVideo); Stage 2".

[40] 3GPP TS 23.282: "Functional architecture and information flows to support Mission Critical Data (MCData); Stage 2".

[41] 3GPP TS 32.240: "Charging management; Charging architecture and principles".

[42] 3GPP TS 38.401: "NG-RAN Architecture description".

[43] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[44] IETF RFC 4960: "Stream Control Transmission Protocol".

[45] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System".

[46] 3GPP TS 23.041: "Public Warning System".

[47] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[48] 3GPP TS 24.502: "Access to the 5G System (5GS) via non-3GPP access networks; Stage 3".

[49] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[50] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[51] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[52] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode".

[53] Void.

[54] IETF RFC 4861: "Neighbor Discovery for IP version 6 (IPv6)".

[55] 3GPP TS 23.271: "Functional stage 2 description of Location Services (LCS)".

[56] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[57] IETF RFC 4555: "IKEv2 Mobility and Multihoming Protocol (MOBIKE)".

[58] 3GPP TS 29.510: "5G System: Network function repository services; Stage 3".

[59] 3GPP TS 29.502: "5G System: Session Management Services: Stage 3".

[60] IETF RFC 7296: "Internet Key Exchange Protocol Version 2 (IKEv2) ".

[61] 3GPP TS 23.380: "IMS Restoration Procedures".

[62] 3GPP TS 24.229: "IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3".

[63] 3GPP TS 23.292: "IP Multimedia Subsystem (IMS) centralized services; Stage 2".

[64] 3GPP TS 23.222: "Functional architecture and information flows to support Common API Framework for 3GPP Northbound APIs".

[65] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane Nodes; Stage 3".

[66] 3GPP TS 32.421: "Telecommunication management; Subscriber and equipment trace; Trace concepts and requirements".

[67] 3GPP TS 32.290: "5G system; Services, operations and procedures of charging using Service Based Interface (SBI)".

[68] 3GPP TS 32.255: "5G Data connectivity domain charging; Stage 2".

[69] 3GPP TS 38.306: "NR; User Equipment -UE) radio access capabilities".

[70] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access -E-UTRA); User Equipment -UE) radio access capabilities".

[71] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[72] 3GPP TS 23.285: "Architecture enhancements for V2X services".

[73] IETF RFC 2865: "Remote Authentication Dial In User Service (RADIUS)".

[74] IETF RFC 3162: "RADIUS and IPv6".

[75] 3GPP TS 29.281: "General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U)".

[76] 3GPP TS 26.238: "Uplink streaming".

[77] 3GPP TR 26.939: "Guidelines on the Framework for Live Uplink Streaming (FLUS)".

[78] International Telecommunication Union (ITU), Standardization Bureau (TSB): "Operational Bulletin No. 1156"; http://handle.itu.int/11.1002/pub/810cad63-en (retrieved October 5, 2018).

[79] 3GPP TS 28.533: "Management and orchestration; Architecture framework".

[80] 3GPP TS 24.250: "Protocol for Reliable Data Service; Stage 3".

[81] IETF RFC 8684: "TCP Extensions for Multipath Operation with Multiple Addresses".

[82] IETF RFC 8803: "0-RTT TCP Convert Protocol".

[83] IEEE Std 802.1CB-2017: "IEEE Standard for Local and metropolitan area networks-Frame Replication and Elimination for Reliability".

[84] 3GPP TS 23.316: "Wireless and wireline convergence access support for the 5G System (5GS)".

[85] WiFi Alliance Technical Committee, Hotspot 2.0 Technical Task Group: "Hotspot 2.0 (Release 2) Technical Specification".

[86] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[87] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[88] 3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC); Stage 2".

[89] CableLabs DOCSIS MULPI: "Data-Over-Cable Service Interface Specifications DOCSIS 3.1, MAC and Upper Layer Protocols Interface Specification".

[90] BBF TR-124 issue 5: "Functional Requirements for Broadband Residential Gateway Devices".

[91] BBF TR-101 issue 2: "Migration to Ethernet-Based Broadband Aggregation".

[92] BBF TR-178 issue 1: "Multi-service Broadband Network Architecture and Nodal Requirements".

[93] BBF TR-456 issue 2: "AGF Functional Requirements".

[94] BBF WT-457: "FMIF Functional Requirements".

Editor's note: The reference to BBF WT-457 will be revised when finalized by BBF.

[95] IEEE Std 802.1Qcc-2018: "IEEE Standard for Local and metropolitan area networks - Bridges and Bridged Networks - Amendment: Stream Reservation Protocol (SRP) Enhancements and Performance Improvements".

[96] Void.

[97] IEEE Std 802.1AB-2016: "IEEE Standard for Local and metropolitan area networks -- Station and Media Access Control Connectivity Discovery".

[98] IEEE Std 802.1Q-2018: "IEEE Standard for Local and metropolitan area networks--Bridges and Bridged Networks".

[99] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[100] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

[101] 3GPP TS 29.274: "Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3".

[102] 3GPP TS 23.632: "User Data Interworking, Coexistence and Migration; stage 2".

[103] 3GPP TS 29.563: "5G System (5GS); HSS services for interworking with UDM; Stage 3".

[104] IEEE Std 802.1AS-2020: "IEEE Standard for Local and metropolitan area networks--Timing and Synchronization for Time-Sensitive Applications".

[105] 3GPP TS 22.104: "Service requirements for cyber-physical control applications in vertical domains".

[106] IEEE Std 802.11-2012: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[107] IEEE Std 1588-2008: "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems".

[108] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[109] 3GPP TS 24.193: "Access Traffic Steering, Switching and Splitting; Stage 3".

[110] 3GPP TS 24.526: "User Equipment (UE) policies for 5G System (5GS); Stage 3".

[111] 3GPP TS 22.186: "Enhancement of 3GPP support for V2X scenarios; Stage 1".

[112] 3GPP TR 38.824: "Study on physical layer enhancements for NR ultra-reliable and low latency case (URLLC)".

[113] IEEE: "Guidelines for Use of Extended Unique Identifier (EUI), Organizationally Unique Identifier (OUI), and Company ID (CID)", https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/tutorials/eui.pdf.

[114] 3GPP TS 32.256: "Charging Management; 5G connection and mobility domain charging; Stage 2".

[115] 3GPP TS 33.210: "Network Domain Security (NDS); IP network layer security".

[116] 3GPP TS 38.415: "PDU Session User Plane Protocol".

[117] 3GPP TS 24.535: "Device-side Time-Sensitive Networking (TSN) Translator (DS-TT) to network-side TSN Translator (NW-TT) protocol aspects; Stage 3".

[118] 3GPP TS 32.274: "Charging Management; Short Message Service (SMS) charging".

[119] 3GPP TS 23.008: "Organization of subscriber data".

[120] 3GPP TS 38.314: "NR; Layer 2 measurements".

[121] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[122] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[123] 3GPP TS 32.254: "Charging management; Exposure function Northbound Application Program Interfaces (APIs) charging".

[124] 3GPP TS 33.535: "Authentication and Key Management for Applications based on 3GPP credentials in the 5G System (5GS)".

[125] 3GPP TS 38.410: "NG-RAN; NG general aspects and principles".

[126] IEEE Std 1588: "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems", Edition 2019.

[127] ST 2059-2:2015: "SMPTE Standard - SMPTE Profile for Use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications".

[128] 3GPP TS 23.304: "Proximity based Services (ProSe) in the 5G System (5GS)".

[129] 3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services".

[130] 3GPP TS 23.548: "5G System Enhancements for Edge Computing; Stage 2".

[131] IEEE Std 802.3: "Ethernet".

[132] 3GPP TS 29.561: "5G System; Interworking between 5G Network and external Data Networks; Stage 3".

[133] 3GPP TS 29.513: "Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".

[134] 3GPP TS 23.558: "Architecture for enabling Edge Applications (EA)".

[135] 3GPP TS 26.501: "5G Media Streaming (5GMS); General description and architecture".

[136] 3GPP TS 23.256: "Support of Uncrewed Aerial Systems (UAS) connectivity, identification and tracking; Stage 2".

[137] GSMA NG.116: "Generic Network Slice Template".

[138] IETF RFC 3948: "UDP Encapsulation of IPsec ESP Packets".

[139] 3GPP TS 24.539: "5G System (5GS); Network to TSN translator (TT) protocol aspects; Stage 3".

[140] 3GPP TS 33.220: "Generic Authentication Architecture (GAA); Generic bootstrapping architecture".

[141] 3GPP TS 33.223: "Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (GBA) Push function".

[142] 3GPP TS 23.540: "Technical realization of Service Based Short Message Service; Stage 2".

[143] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[144] 3GPP TS 29.525: "5G System; UE Policy Control Service; Stage 3".

[145] 3GPP TS 29.505: "5G System; Usage of the Unified Data Repository Services for Subscription Data; Stage 3".

[146] IEEE Std P802.1Qdj-d0.3: "IEEE Draft Standard for Local and metropolitan area networks - Bridges and Bridged Networks - Amendment XX: Configuration Enhancements for Time-Sensitive Networking".

[147] 3GPP TS 23.700‑05: "Study on architecture enhancements for vehicle-mounted relays".

[xx] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM)".

## **END of CHANGES**