**3GPP TSG-SA1 Meeting #95e *S1-2133110***

**Electronic Meeting, 23 August - 2 September 2021** *(revision of S1-213zzz)*

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **22.104** | **CR** | **0081** | **rev** | **-** | **Current version:** | **18.1.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | Introduction of Smart Energy Infrastructure Requirements |
|  |  |
| ***Source to WG:*** | Samsung, EUTC, China Telecom, ZTE, Vodafone |
| ***Source to TSG:*** | SA1 |
|  |  |
| ***Work item code:*** | SEI |  | ***Date:*** | 2021-8-17 |
|  |  |  |  |  |
| ***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)* |
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| ***Reason for change:*** | The Smart Energy Infrastructure feature captures the requirements identified by the study in TR 22.867. That study considered smart energy services, e.g. IEC standards, and their communication requirements including capacity, latency, availability, end-to-end QoS, resiliency / redundancy and security. Requirements were identified for operational manageability, e.g. the ability to configure and monitor the real (achieved and up to date) availability of communication services. Emerging smart grid use cases and their functional requirements were also identified, e.g. for on-demand power supply, distributed power supply systems, distribution automation, high accuracy power load measurement and control, meter automation and more.Communication KPIs and their service requirements for enabling micro-grids, DER and specifically distributed generation (DG) that require 5G wireless communication are also included. |
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| ***Summary of change:*** | New references are added.A few minor clean up changes are made to existing references (to remove curly double quotes, and add a period at the end of the reference.A new clause is added to 22.104 to capture smart energy requirements. |
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| ***Consequences if not approved:*** | The Smart Energy Infrastructure feature’s requirements will not be included in the normative standard. |
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| ***Clauses affected:*** | 2, 5.6.1, X (new), Y (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 22.261 CR 0547,TS 22.261 CR 0079  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | Requirements added to 22.104 for the SEI feature are specific to smart energy vertical service. Other requirements that are general to the 5G system that were identified as part of the FS\_5GSEI study are provided in a separate CRs to 22.261 and 22.104. |
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| ***This CR's revision history:*** |  |

---Start of the 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 TS 22.261: "Service requirements for the 5G system".

[3] IEC 61784-3: "Industrial communication networks – profiles – part 3: functional fieldbuses – general rules and profile definitions".

[4] BZKI, "Aspects of dependability assessment in ZDKI", June 2017.

[5] BZKI, "Requirement Profiles in ZDKI", 2017.

[6] IEC 61158: "Industrial communication networks – fieldbus specification", 2014.

[7] IEC 61907, "Communication network dependability engineering".

[8] Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson, Harlow, 13th Edition, 2017.

[9] Ernie Hayden, Michael Assante, and Tim Conway, "An Abbreviated History of Automation & Industrial Controls Systems and Cybersecurity", SANS Institute, <https://ics.sans.org/media/An-Abbreviated-History-of-Automation-and-ICS-Cybersecurity.pdf> {accessed: 2017-05-23}, 2014.

[10] IEC 61512 "Batch control - Part 1: Models and terminology".

[11] RESERVE project, Deliverable D1.3, ICT Requirements,
<http://www.re-serve.eu/files/reserve/Content/Deliverables/D1.3.pdf>, September 2017.

[12] RESERVE project, Deliverable D1.2, Energy System Requirements
<http://www.re-serve.eu/files/reserve/Content/Deliverables/D1.2.pdf>, September 2017.

[13] G. Garner, "Designing Last Mile Communications Infrastructures for Intelligent Utility Networks (Smart Grids)", IBM Australia Limited, 2010.

[14] B. Al-Omar, B., A. R. Al-Ali, R. Ahmed, and T. Landolsi, "Role of Information and Communication Technologies in the Smart Grid", Journal of Emerging Trends in Computing and Information Sciences, Vol. 3, pp. 707-716, 2015.

[15] H. Kagermann, W. Wahlster, and J. Helbig, "Recommendations for implementing the strategic initiative INDUSTRIE 4.0", Final report of the Industrie 4.0 working group, acatech – National Academy of Science and Engineering, Munich, April 2013.

[16] IEC 62443-3-2: "Security for industrial automation and control systems - Part 3-2: Security risk assessment and system design", in progress.

[17] IEC 62657-2: "Industrial communication networks - Wireless communication networks - Part 2: Coexistence management", 2017.

[18] IEC 62657-1: "Industrial communication networks – Wireless communication networks – Part 1: Wireless communication requirements and spectrum considerations".

[19] IEEE Std 802.1Q "Media Access Control (MAC) Bridges and Virtual Bridge Local Area Networks".

 NOTE: IEEE Std 802.1Qbv-2015 "Enhancements for Scheduled Traffic" has been included into IEEE Std 802.1Q-2018.

[20] IEEE, Use Cases IEC/IEEE 60802, 2018.

[21] "IEEE Standard for Local and metropolitan area networks--Timing and Synchronization for Time-Sensitive Applications in Bridged Local Area Networks--Corrigendum 1: Technical and Editorial Corrections," IEEE Std 802.1AS-2011/Cor 1-2013 (Corrigendum to IEEE Std 802.1AS-2011), pp. 1-128, Sept 2013.

[22] "IEEE Standard for Local and metropolitan area networks--Timing and Synchronization for Time-Sensitive Applications," IEEE Std 802.1AS-Rev/D7.3, pp. 1-502, August 2018.

[23] 3GPP TS 22.289: "Mobile Communication System for Railways".

[24] IEEE P802.1CS: "IEEE Draft Standard for Local and metropolitan area networks - Link-local Registration Protocol".

[25] IEEE P802.1Qdd: "IEEE Draft Standard for Local and Metropolitan Area Networks--Bridges and Bridged Networks -- Amendment: Resource Allocation Protocol (RAP)".

[26] IEC/IEEE 60802: "Time-Sensitive Networking Profile for Industrial Automation".

[27] 3GPP TS 22.263: "Service requirements for Video, Imaging and Audio for Professional Applications (VIAPA)".

[aa] 61850-90-3-2016 – IEC/IEEE International Standard - Communication Networks and Systems for Power Utility automation – Part 90-3: Precision time protocol profile for power utility.

[bb] IEEE Std C37.238-2011, IEEE Standard Profile for Use of IEEE Std 1588™ Precision Time Protocol in Power System Applications.

[cc] IEC 61850-90-5:2012, Use of IEC 61850 to transmit Synchrophasors information according to IEEE C37.118.

[dd] IEEE Std C37.118.2-2011, IEEE Standard for Synchrophasor Data Transfer for Power Systems.

---Next Change---

### 5.6.1 Clock synchronisation service level requirements

The 5G system shall support a mechanism to process and transmit IEEE 1588v2 / Precision Time Protocol messages to support 3rd-party applications which use this protocol.

The 5G system shall support a mechanism to synchronise the user-specific time clock of UEs with a global clock.

The 5G system shall support a mechanism to synchronize the user-specific time clock of UEs with a working clock.

The 5G system shall support two types of synchronization clocks, the global time domain and the working clock domains.

The 5G system shall support networks with up to 128 working clock domains (with different synchronization domain identifiers / domain numbers), including for UEs connected through the 5G network.

NOTE 1: The domain number (synchronization domain identifier) is defined with one octet in IEEE 802.1AS [22].

The 5G system shall be able to support up to four simultaneous synchronization domains on a UE.

NOTE 1A: The four synchronization domains are used, for example, as two synchronization domains for global time and two working clock domains. One pair of global time and working clock is used as redundant synchronization domains for zero failover time.

The synchronicity budget for the 5G system within the global time domain shall not exceed 900 ns.

NOTE 2: The global time domain requires in general a precision of 1 µs between the sync master and any device of the clock domain. Some use cases require only a precision of ≤ 100 µs for the global time domain if a working clock domain with precision of ≤ 1 µs is available.

NOTE 3: (void)

The synchronicity budget for the 5G system within a working clock domain shall not exceed 900 ns.

NOTE 4: The working clock domains require a precision of ≤ 1 µs between the sync master and any device of the clock domain.

NOTE 5: Different working clock domains are independent and can have different precision.

NOTE 6: The synchronicity budget for the 5G system is also applicable when the flow of clock synchronization messages traverses the air interface twice.

The 5G system shall provide a media-dependent interface for one or multiple IEEE 802.1AS sync domains [22].

The 5G system shall provide an interface to the 5G sync domain which can be used by applications to derive their working clock domain or global time domain (Reference Clock Model).

The 5G system shall provide an interface at the UE to determine and to configure the precision and time scale of the working clock domain.

The 5G system shall be able to support arbitrary placement of sync master functionality and sync device functionality in integrated 5G / non-3GPP TSN networks.

The 5G system shall be able to support clock synchronization through the 5G network if the sync master and the sync devices are served by different UEs. (Flow of clock synchronization messages is in either direction, UL and DL.)

The 5G system shall provide a suitable means to support the management of the merging and separation of working clock domains, that is interoperable with the corresponding mechanisms of TSN and IEEE 802.1AS.

The 5G System should support the IEC 61850-9-3 [aa] profile and IEEE Std C37.238-2017 [bb].

5G system should support at least one of the two profiles for synchrophasor communications: IEC 61850-90-5:2012 [cc], or IEEE Std C37.118.2-2011 [dd].

The 5G system should support the IEEE 802.1Q QoS profile as defined IEC 61850-90-5 [cc].

---Next Change---

# X Recovery of infrastructure for electrical distribution

## X.1 Description

The robustness of the infrastructure for electrical power distribution may depend upon the possibility to operate telecommunication networks even during an energy system incident, in which electricity cannot be delivered to some network operator facilities. Through coordination between the network operator and the energy system operator, increases in the ability to recover the energy system operation can be achieved.

X.2 RequirementsSubject to regulatory requirements and operator policy, the 5G system shall support a mechanism by which an MNO can identify the uninterruptable power supply status of the MNO's infrastructure, specifying which physical regions would be affected in terms of physical topology.

NOTE1: This information can facilitate energy system recovery operations.

Subject to regulatory requirements, the 5G system shall support a mechanism by which a third party can communicate the energy system recovery status in terms of location and time table to the MNO.

NOTE2: This information can facilitate MNO operations to facilitate energy system recovery.

---Next Change---

# Y Protection of infrastructure for electrical transmission

## Y.1 Description

Transmission infrastructure is a key component of the energy system. Communication enables protection of this infrastructure. The algorithms involved depend on certain constraints must be met.

## Y.2 Requirements

The 5G system shall support an end-to-end latency of less than 5ms or 10ms, as requested by the UE initiating the communication.

The 5G system shall support communication channel symmetry in terms of latency (latency from UE1 to UE2, and latency from UE2 to UE1), with the max asymmetry < 2ms.

---End of the Change---