**3GPP TSG-SA3 Meeting #103-eS3-211988**

**e-meeting, 17 - 28 May 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **01** | **CR** |  | **rev** | **-** | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | Removal of ENs for draft-ietf-emu-rfc5448bis | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | S3 | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5G\_Ph1\_SEC | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-15 |
|  | *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:*** | | There exists an EN for draft-ietf-emu-rfc5448bis. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Remove the EN and add a note about the new EAP-AKA’ version in draft-ietf-emu-rfc5448bis. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | EN remains in the specification. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 6.1.3.1, F1. | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

\*\*\* Next 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 23.501: "System Architecture for the 5G System".

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

[4] IETF RFC 4303: "IP Encapsulating Security Payload (ESP)".

[5] 3GPP TS 33.310: "Network Domain Security (NDS); Authentication Framework (AF)".

[6] IETF RFC 4301: "Security Architecture for the Internet Protocol".

[7] 3GPP TS 22.261: "Service requirements for next generation new services and markets".

[8] 3GPP TS 23.502: "Procedures for the 5G System".

[9] 3GPP TS 33.102: "3G security; Security architecture".

[10] 3GPP TS 33.401: "3GPP System Architecture Evolution (SAE); Security architecture".

[11] 3GPP TS 33.402: "3GPP System Architecture Evolution (SAE); Security aspects of non-3GPP accesses".

[12] IETF RFC 5448: " Improved Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement (EAP-AKA')".

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

[14] 3GPP TS 35.215: " Specification of the 3GPP Confidentiality and Integrity Algorithms UEA2 & UIA2; Document 1: UEA2 and UIA2 specifications".

[15] NIST: "Advanced Encryption Standard (AES) (FIPS PUB 197)".

[16] NIST Special Publication 800-38A (2001): "Recommendation for Block Cipher Modes of Operation".

[17] NIST Special Publication 800-38B (2001): "Recommendation for Block Cipher Modes of Operation: The CMAC Mode for Authentication".

[18] 3GPP TS 35.221: " Specification of the 3GPP Confidentiality and Integrity Algorithms EEA3 & EIA3; Document 1: EEA3 and EIA3 specifications".

[19] 3GPP TS 23.003: "Numbering, addressing and identification".

[20] 3GPP TS 22.101: "Service aspects; Service principles".

[21] IETF RFC 4187: "Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement (EAP-AKA)".

[22] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[23] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

[24] 3GPP TS 33.117: "Catalogue of general security assurance requirements".

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

[26] Void

[27] IETF RFC 3748: "Extensible Authentication Protocol (EAP)".

[28] 3GPP TS 33.220: "Generic Authentication Architecture (GAA); Generic Bootstrapping Architecture (GBA)".

[29] SECG SEC 1: Recommended Elliptic Curve Cryptography, Version 2.0, 2009. Available <http://www.secg.org/sec1-v2.pdf>

[30] SECG SEC 2: Recommended Elliptic Curve Domain Parameters, Version 2.0, 2010. Available at <http://www.secg.org/sec2-v2.pdf>

[31] 3GPP TS 38.470: "NG-RAN; F1 General aspects and principles".

[32] 3GPP TS 38.472: "NG-RAN; F1 signalling transport".

[33] 3GPP TS 38.474: "NG-RAN; F1 data transport".

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

[35] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[36] 3GPP TS 35.217: "Specification of the 3GPP Confidentiality and Integrity Algorithms UEA2 & UIA2; Document 3: Implementors' test data".

[37] 3GPP TS 35.223: "Specification of the 3GPP Confidentiality and Integrity Algorithms EEA3 & EIA3; Document 3: Implementors' test data".

[38] IETF RFC 5216: "The EAP-TLS Authentication Protocol".

[39] IETF RFC 4346: "The Transport Layer Security (TLS) Protocol Version 1.1".

[40] IETF RFC 5246: "The Transport Layer Security (TLS) Protocol Version 1.2".

[41] 3GPP TS 38.460: "NG-RAN; E1 general aspects and principles".

[42] Void.

[43] IETF RFC 6749: "OAuth2.0 Authorization Framework".

[44] IETF RFC 7519: "JSON Web Token (JWT)".

[45] IETF RFC 7515: "JSON Web Signature (JWS)".

[46] IETF RFC 7748: "Elliptic Curves for Security".

[47] IETF RFC 7540: " Hypertext Transfer Protocol Version 2 (HTTP/2)".

[48] IETF RFC 5280: "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile".

[49] IETF RFC 6960: "X.509 Internet Public Key Infrastructure Online Certificate Status Protocol - OCSP".

[50] IETF RFC 6066: "Transport Layer Security (TLS) Extensions: Extension Definitions".

[51] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity; Stage 2".

[52] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description; Stage 2".

[53] 3GPP TS 33.122: "Security Aspects of Common API Framework for 3GPP Northbound APIs".

[54] 3GPP TS28.533: " Management and orchestration; Architecture framework".

[55] 3GPP TS28.531: "Management and orchestration of networks and network slicing; Provisioning".

[56] IETF RFC 4279 "Pre-Shared Key Ciphersuites for Transport Layer Security (TLS)".

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

[58] IETF RFC 6083: " Datagram Transport Layer Security (DTLS) for Stream Control Transmission Protocol (SCTP)".

[59] IETF RFC 7516: "JSON Web Encryption (JWE)".

[60] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3".

[61] IETF RFC 5705,"Keying Material Exporters for Transport Layer Security (TLS)".

[62] IETF RFC 5869 "HMAC-based Extract-and-Expand Key Derivation Function (HKDF)".

[63] NIST Special Publication 800-38D: "Recommendation for Block Cipher Modes of Operation: Galois Counter Mode (GCM) and GMAC".

[64] IETF RFC 6902: "JavaScript Object Notation (JSON) Patch".

[65] 3GPP TS 31.115: "Secured packet structure for (Universal) Subscriber Identity Module (U)SIM Toolkit applications.

[66] 3GPP TS 31.111: "Universal Subscriber Identity Module (USIM), Application Toolkit (USAT)".

[67] Internet draft draft-ietf-emu-rfc5448bis: "Improved Extensible Authentication Protocol Method for 3rd Generation Authentication and Key Agreement (EAP-AKA')".

[68] 3GPP TS 29.510: "5G System; Network function repository services".

[69] 3GPP TS 36.331: "Radio Resource Control (RRC); Protocol specification".

[70] 3GPP TS 29.505: "5G System; Usage of the Unified Data Repository services for Subscription Data; Stage 3".

[71] 3GPP TS 24.302: "Access to the 3GPP Evolved Packet Core (EPC) via non-3GPP access networks; Stage 3".

[72] IANA: "Transport Layer Security (TLS) Parameters".

[73] 3GP TS 29.573: "5G System; Public Land Mobile Network (PLMN) Interconnection". Stage 3".

[74] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3"

\*\*\* Next changes \*\*\*

#### 6.1.3.1 Authentication procedure for EAP-AKA'

EAP-AKA' is specified in RFC 5448 [12]. The 3GPP 5G profile for EAP-AKA' is specified in the normative Annex F.

The selection of using EAP-AKA' is described in sub-clause 6.1.2 of the present document.

Figure 6.1.3.1-1: Authentication procedure for EAP-AKA'

The authentication procedure for EAP-AKA' works as follows, cf. also Figure 6.1.3.1-1:

1. The UDM/ARPF shall first generate an authentication vector with Authentication Management Field (AMF) separation bit = 1 as defined in TS 33.102 [9]. The UDM/ARPF shall then compute CK' and IK' as per the normative Annex A and replace CK and IK by CK' and IK'.

2. The UDM shall subsequently send this transformed authentication vector AV' (RAND, AUTN, XRES, CK', IK') to the AUSF from which it received the Nudm\_UEAuthentication\_Get Request together with an indication that the AV' is to be used for EAP-AKA' using a Nudm\_UEAuthentication\_Get Response message.

NOTE: The exchange of a Nudm\_UEAuthentication\_Get Request message and an Nudm\_UEAuthentication\_Get Response message between the AUSF and the UDM/ARPF described in the preceding paragraph is the same as for trusted access using EAP-AKA' described in TS 33.402 [11], sub-clause 6.2, step 10, except for the input parameter to the key derivation, which is the value of <network name>. The "network name" is a concept from RFC 5448 [12]; it is carried in the AT\_KDF\_INPUT attribute in EAP-AKA'. The value of <network name> parameter is not defined in RFC 5448 [12], but rather in 3GPP specifications. For EPS, it is defined as " access network identity " in TS 24.302 [71], and for 5G, it is defined as "serving network name" in sub-clause 6.1.1.4 of the present document.

In case SUCI was included in the Nudm\_UEAuthentication\_Get Request, UDM will include the SUPI in the Nudm\_UEAuthentication\_Get Response.

The AUSF and the UE shall then proceed as described in RFC 5448 [12] until the AUSF is ready to send the EAP-Success.

3. The AUSF shall send the EAP-Request/AKA'-Challenge message to the SEAF in a Nausf\_UEAuthentication\_Authenticate Response message. 4. The SEAF shall transparently forward the EAP-Request/AKA'-Challenge message to the UE in a NAS message Authentication Request message. The ME shall forward the RAND and AUTN received in EAP-Request/AKA'-Challenge message to the USIM. This message shall include the ngKSI and ABBA parameter. In fact, SEAF shall include the ngKSI and ABBA parameter in all EAP-Authentication request message. ngKSI will be used by the UE and AMF to identify the partial native security context that is created if the authentication is successful. The SEAF shall set the ABBA parameter as defined in Annex A.7.1. During an EAP authentication, the value of the ngKSI and the ABBA parameter sent by the SEAF to the UE shall not be changed.

NOTE 1: The SEAF needs to understand that the authentication method used is an EAP method by evaluating the type of authentication method based on the Nausf\_UEAuthentication\_Authenticate Response message.

5. At receipt of the RAND and AUTN, the USIM shall verify the freshness of the AV' by checking whether AUTN can be accepted as described in TS 33.102 [9]. If so, the USIM computes a response RES. The USIM shall return RES, CK, IK to the ME. If the USIM computes a Kc (i.e. GPRS Kc) from CK and IK using conversion function c3 as described in TS 33.102 [9], and sends it to the ME, then the ME shall ignore such GPRS Kc and not store the GPRS Kc on USIM or in ME. The ME shall derive CK' and IK' according to Annex A.3.

If the verification of the AUTN fails on the USIM, then the USIM and ME shall proceed as described in sub-clause 6.1.3. 3.

6. The UE shall send the EAP-Response/AKA'-Challenge message to the SEAF in a NAS message Auth-Resp message.

7. The SEAF shall transparently forward the EAP-Response/AKA'-Challenge message to the AUSF in Nausf\_UEAuthentication\_Authenticate Request message.

8. The AUSF shall verify the message, and if the AUSF has successfully verified this message it shall continue as follows, otherwise it shall return an error to the SEAF. AUSF shall inform UDM about the authentication result (see sub-clause 6.1.4 of the present document for details on linking authentication confirmation).

9. The AUSF and the UE may exchange EAP-Request/AKA'-Notification and EAP-Response /AKA'-Notification messages via the SEAF. The SEAF shall transparently forward these messages.

NOTE 2: EAP Notifications as described in RFC 3748 [27] and EAP-AKA Notifications as described in RFC 4187 [21] can be used at any time in the EAP-AKA exchange. These notifications can be used e.g. for protected result indications or when the EAP server detects an error in the received EAP-AKA response.

10. The AUSF derives EMSK from CK’ and IK’ as described in RFC 5448[12] and Annex F. The AUSF uses the most significant 256 bits of EMSK as the KAUSF and then calculates KSEAF from KAUSF as described in clause A.6. The AUSF shall send an EAP Success message to the SEAF inside Nausf\_UEAuthentication\_Authenticate Response, which shall forward it transparently to the UE. Nausf\_UEAuthentication\_Authenticate Response message contains the KSEAF. If the AUSF received a SUCI from the SEAF when the authentication was initiated (see sub-clause 6.1.2 of the present document), then the AUSF shall also include the SUPI in the Nausf\_UEAuthentication\_Authenticate Response message.

NOTE 3: For lawful interception, the AUSF sending SUPI to SEAF is necessary but not sufficient. By including the SUPI as input parameter to the key derivation of KAMF from KSEAF, additional assurance on the correctness of SUPI is achieved by the serving network from both, home network and UE side.

11. The SEAF shall send the EAP Success message to the UE in the N1 message. This message shall also include the ngKSI and the ABBA parameter. The SEAF shall set the ABBA parameter as defined in Annex A.7.1.

NOTE 4: Step 11 could be NAS Security Mode Command or Authentication Result.

NOTE 5: The ABBA parameter is included to enable the bidding down protection of security features that may be introduced later.

The key received in the Nausf\_UEAuthentication\_Authenticate Response message shall become the anchor key, KSEAF in the sense of the key hierarchy in sub-clause 6.2 of the present document. The SEAF shall then derive the KAMF from the KSEAF, the ABBA parameter and the SUPI according to Annex A.7 and send it to the AMF. On receiving the EAP-Success message, the UE derives EMSK from CK’ and IK’ as described in RFC 5448 and Annex F. The ME uses the most significant 256 bits of the EMSK as the KAUSF and then calculates KSEAF in the same way as the AUSF. The UE shall derive the KAMF from the KSEAF, the ABBA parameter and the SUPI according to Annex A.7.

NOTE 6: As an implementation option, the UE creates the temporary security context as described in step 11 after receiving the EAP message that allows EMSK to be calculated. The UE turns this temporary security context into a partial security context when it receives the EAP Success. The UE removes the temporary security context if the EAP authentication fails.

The further steps taken by the AUSF upon receiving a successfully verified EAP-Response/AKA'-Challenge message are described in sub-clause 6.1.4 of the present document.

If the EAP-Response/AKA'-Challenge message is not successfully verified, the subsequent AUSF behaviour is determined according to the home network's policy.

If AUSF and SEAF determine that the authentication was successful, then the SEAF provides the ngKSI and the KAMF to the AMF.

\*\*\* Next changes \*\*\*

# F.1 Introduction

The present annex describes the 3GPP 5G profile for EAP-AKA' described in RFC 5448 [12], and RFC 4187 [21].

NOTE: . RFC 5448 [12] was specified for the needs of 4G and it does not take into account nor refer to 5G specifications. EAP-AKA’ identity handling, when it comes to 5G, is specified in the present Annex F. RFC 5448 [12] has been updated in draft-ietf-emu-rfc5448bis [67] to align with the 5G specifications and especially with Annex F. Otherwise draft-ietf-emu-rfc5448bis [67] is technically backwards compatible with RFC 5448 [12] . The present specification uses RFC 5448 [12] as the normative reference and in case of technical discrepancy, RFC 5448 [12] and the present specification take precedence over draft-ietf-emu-rfc5448bis [67].

\*\*\* End changes \*\*\*