**3GPP TSG-SA3 Meeting #123 S3-252863**

**Goteborg, Sweden, 25 – 29 August 2025**

**Source: Xiaomi**

**Title: Addressing ENs in AIoT authentication procedure**

**Document for: Approval**

**Agenda item: 4.1.1**

**Spec: 3GPP TS 33.369**

**Version: 0.2.0**

**Work Item: AmbientIoT-SEC**

**Comments**

It is proposed to address the following ENs in the AIoT authentication procedure.

Editor’s Note: Whether ADM or AIOTF generates RANDAIOT\_n is FFS.

To reduce the interaction between the AIOTF and ADM, it is proposed that AIOTF generate RANDAIOT\_n for authentication. Otherwise, one additional round of messages is necessary for transmitting the RANDAIOT\_n, i.e. one message from the AIOTF to ADM for requesting the generation of RANDAIOT\_n, and one message from the ADM to AIOTF for providing the RANDAIOT\_n.

Editor’s Note: Whether replay attack is possible is FFS.

Editor’s Note: Whether RANDAIOT\_d is required for inventory procedure is FFS.

Since the Inventory request is not protected, the replay attack can always be launched. However, the device authentication is determined by verifying the RES, which is generated at least by using RANDAIOT\_n included in the Inventory request. If the verification of RES fails, the replay attack can be detected by the network side. Therefore, the attacker cannot manipulate the AIoT system by launching a replay attack during the inventory procedure.

During the authentication procedure, each peer entity should provide a random number to ensure freshness. Therefore, it is proposed to include RANDAIOT\_d in the inventory response and use it as one of the input parameters for generating the RES. With RANDAIOT\_d and RANDAIOT\_n, the security of authentication can be further enhanced.

Editor’s Note: How RESAIOT is derived and whether it is derived from KAIoT or intermediate key is FFS.

Editor’s note: The impact of interaction between AIOTF and ADM is FFS. If the authentication is expected to be run more often than normal UE, (e.g., during each inventory procedure), the analysis of load of ADM is FFS.

Considering the storage limitation of AIoT device, it is proposed that the KAIOTF is refreshed during each inventory + command procedure. In this case, the AIoT device do not need to store the security context, which can meet the requirement from RAN. The KAIOTF can be generated by the ADM from KAIOT and provided to the AIOTF to protect the command message. Regarding the load of ADM, it can be left to the implementation of the private network.

Considering the security functionality of AIOTF and ADM, and the primary authentication procedure in SNPN (clause I.2.2.2.2 of TS 33.501), it is proposed that ADM calculate XRES by using the KAIoT and determine the authentication result by verifying RES. Therefore, the security functionality of AIOT system will be:

* The ADM is responsible for the authentication and credential management.
* The AIOTF is responsible for the communication protection.

Editor’s note: How to perform the mutual authentication for command procedure will be specified.

To save the calculation resources and transmission resources of AIoT device, the implicit authentication method can be used for mutual authentication. By verifying the security of command request message, the AIoT device can implicitly determine the authentication result to the network.

\* \* \* First Change \* \* \* \*

### 5.2.2 Authentication procedure

The authentication procedure is aligned with inventory procedure and command procedure in 6.2.2 and 6.2.3 of TS 23.369[2].



Figure 5.2.1-1: Authentication procedure

0. Step 1-6 of clause 6.2.2 Procedure for Inventory or clause 6.2.3 Procedure for command in TS 23.369 [2] is performed.

1. AIOTF shall generate RANDAIOT\_n.

2. AIOTF shall send inventory request message including RANDAIOT\_n to NG-RAN.

Editor’s Note: The inclusion of RANDAIOT\_n in Paging Request and the size of RANDAIOT\_n needs RAN confirmation.

3. NG-RAN shall send the paging request message including RANDAIOT\_n to the AIoT device.

4. Upon receiving the paging request message, AIoT device shall generate RANDAIOT\_d and derive RESAIOT using KAIoT, RANDAIOT\_d and RANDAIOT\_n for network authenticating AIoT Device.

Editor’s Note: Where the authentication credentials are processed in AIOT device is FFS.

5. AIoT device sends D2R message to the NG-RAN, including RESAIOT and RANDAIOT\_d from device.

Editor’s Note: The security requirements of generating RANDAIOT\_d are FFS.

6. NG-RAN sends Inventory report message to AIOTF, including the RESAIOT and RANDAIOT\_d.

7. AIOTF sends device identifier, RANDAIOT\_d, RANDAIOT\_n, and RESAIOT to ADM.

8. ADM derives XRESAIOT using the same method as in AIoT device and compares XRESAIOT with RESAIOT.

Editor’s Note: Where the authentication credential is processed in AIOT device is FFS.

9. ADM sends authentication result to AIOTF.

After receiving the authentication result response, the steps 12-14 in clause 6.2.2 for inventory procedure or the step 8-11 of clause 6.2.3 for command procedure in TS 23.369 [2] continues.

For command case, the network is implicitly authenticated by the device via the successful verification of the MAC calculated using the KAIOTF and included in the command request as described in clause 5.2.3.

Editor’s note: How and where to derive keys is FFS.

\* \* \* Second Change \* \* \* \*

Annex X (normative):   
Key derivation functions

# X.1 RESAIOT and XRESAIOT derivation function

When deriving a RESAIOT and XRESAIOT from KAIOT, the following parameters shall be used to form the input S to the KDF:

- FC =TBD,

- P0 = RANDAIOT\_n,

- L0 = length of RANDAIOT\_n (i.e. 0x00 0x10),

- P1 = RANDAIOT\_d.

- L1 = length of RANDAIOT\_d (i.e. 0x00 0x10),

The input key KEY shall be KAIOT.

\* \* \* End of Changes \* \* \* \*