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TECHNICAL SPECIFICATION

5G;
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Equipment Identity Register Services;
Stage 3
(3GPP TS 29.511 version 15.0.0 Release 15)

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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x the first digit:

1 presented to TSG for information;

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document describes the stage 3 protocol and data model for the N5g-eir Service Based Interface between the 5G-EIR and its consumers over which the service to check the equipment identity as described in 3GPP TS 23.501 [2] is performed. It provides the stage 3 protocol definitions and message flows, and specifies the API for each service offered by the 5G-EIR.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

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; Stage 2".

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

[4]   3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[5]   3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[6]   3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

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

[8]   OpenAPI Initiative, "OpenAPI 3.0.0 Specification", https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md.

[9]   IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[10]   IETF RFC 7807: "Problem Details for HTTP APIs".

[11]   3GPP TS 33.501: "Security Architecture and Procedures for 5G System".

[12]   IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

[13]   3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

N5g-eir: Service-based interface exhibited by 5G-EIR

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

    5G-EIR   5G-Equipment Identity Register
    EIR   Equipment Identity Register
    PEI   Permanent Equipment Identifier

4 Overview

4.1 Introduction

N5g-eir is a Service-based interface exhibited by 5G-EIR (5G-Equipment Identity Register) which is an optional network function that supports the following functionality:

-   Check the status of Equipment's identity (e.g. to check that it has not been blacklisted).

The reference point N17 (see Fig 4-1 below) shows the interaction between the 5G-Equipment Identity Register 5G-EIR and the AMF (Access and Mobility Management Function) enabling the check of the status of the mobile equipment identity.
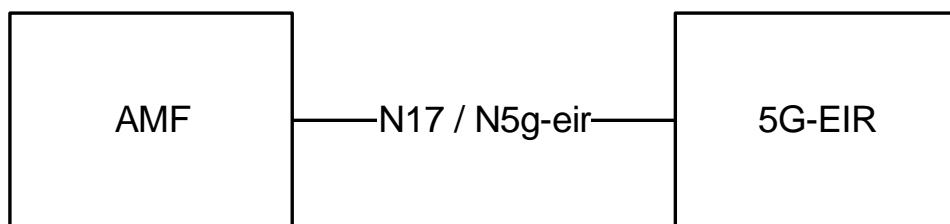
Figure 4-1: Reference Model – N5g-eir

During any procedure establishing a signalling connection with the UE the network may optionally perform an ME identity check with 5G-EIR via the N5g-eir_Equipment Identity Check Service exhibited by 5G-EIR.

5 Services offered by the 5G-EIR NF

5.1 Introduction

The following NF service is offered by the N5g-eir to check the ME whether it is black-listed or not:

-   N5g-eir_EquipmentIdentityCheck

Table 5.1-1: NF Services provided by 5G-EIR

Service Name	Description	Consumer
N5g-eir_EquipmentIdentityCheck	This service offered by the 5G-EIR allows the consumer to check the Permanent Equipment Identifier (PEI) and check whether the PEI is in the black list or not.	AMF

The N5g-eir_Equipment Identity Check service is specified in 3GPP TS 23.502 [3], subclause 4.2.2.2.2

5.2 N5g-eir_EquipmentIdentityCheck Service

5.2.1 Service Description

The N5g-eir_Equipment Identity Check service is provided by the 5G-EIR to check the Permanent Equipment Identifier (PEI) whether it is in the black list or not. The service can be consumed by AMF which initiates ME identity check by invoking the N5g-eirEquipmentIdentityCheckGet service operation (see clause 5.2.4.2. of 3GPP TS 23.502 [3]).

During the initial registration the Permanent Equipment Identifier is obtained from the UE. The AMF operator may check the PEI with an EIR.

5.2.2 Service Operations

5.2.2.1 Introduction

5.2.2.2 CheckEquipmentIdentity

5.2.2.2.1 General

The CheckEquipmentIdentity operation shall be used to check the PEI and determine whether the subscriber is allowed to use the equipment, in the following procedures:

- ME Identity check procedure (see subclause 4.7 of 3GPP TS 23.502 [3]);

5.2.2.2.2 Procedure using CheckEquipmentIdentity Operation

The NF Service Consumer (e.g. AMF) shall check the PEI by using the HTTP GET method as shown in Figure 5.2.2.2.2-1.
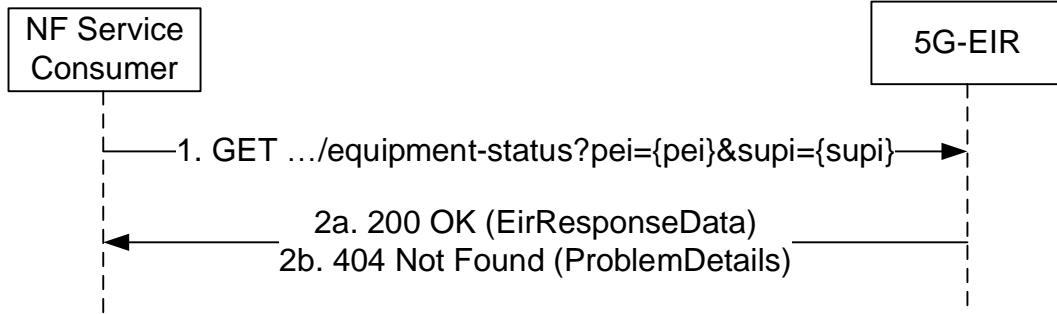
Figure 5.2.2.2.2-1: PEI status check by the NF Service Consumer

1. The NF Service Consumer (e.g. AMF) sends a GET request to the resource representing the PEI equipment Status. It shall include the PEI as a query parameter and, optionally, the SUPI may also be included.

2a. On success, "200 OK" with the message body containing the equipment status of the PEI.

2b. If the PEI is not known, "404 Not Found" with the message body containing a ProblemDetails object, with the "details" attribute set to "ERROR_EQUIPMENT_UNKNOWN". When receiving the response from the 5G-EIR, the NF Service Consumer (e.g. AMF) shall check the equipment Status and the detailed problem. Dependent upon the result, the NF Service Consume will decide its subsequent actions (e.g. sending a Registration Reject if the 5G-EIR indicates that the PEI is unknown or blacklisted).

The definition of the equipment-status resource is specified in subclause 6.1.3.

6 API Definitions

6.1 N5g-eir_EquipmentIdentityCheck Service API

6.1.1 API URI

URIs of this API shall have the following root:

{apiRoot}/{apiName}/{apiVersion}/

where the "apiName" shall be set to "n5g-eir-eic" and the "apiVersion" shall be set to "v1" for the current version of this specification.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, as defined in IETF RFC 7540 [7], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in subclause 5.3 of 3GPP TS 29.500 [4].

HTTP messages and bodies for the N5g-eir_EquipmentIdentityCheck Service shall comply with the OpenAPI [8] specification contained in Annex A.

6.1.2.2 HTTP standard headers

6.1.2.2.1 General

The usage of HTTP standard headers shall be supported as specified in subclause 5.2.2 of 3GPP TS 29.500 [4].

6.1.2.2.2 Content type

The following content types shall be supported:

- JSON, as defined in IETF RFC 8259 [9]. The use of the JSON format shall be signalled by the content type "application/json". See also subclause 5.4 of 3GPP TS 29.500 [4].

- The Problem Details JSON Object (IETF RFC 7807 [10]. The use of the Problem Details JSON object in a HTTP response body shall be signalled by the content type "application/problem+json".

6.1.2.3 HTTP custom headers

6.1.2.3.1 General

In this release of this specification, no custom headers specific to the N5g-eir_EquipmentIdentityCheck Service are defined. For 3GPP specific HTTP custom headers used across all service based interfaces, see clause 5.2.3 of 3GPP TS 29.500 [4].

6.1.3 Resources

6.1.3.1 Overview
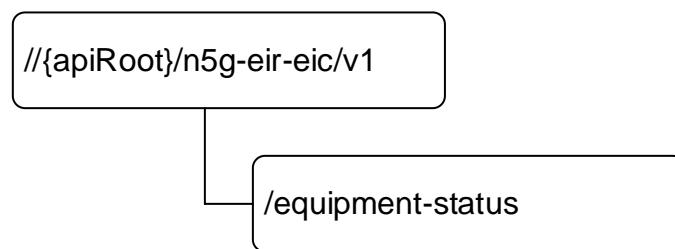
Figure 6.1.3.1-1: Resource URI structure of the n5g-eir-eic API

Table 6.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.1.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
equipmentStatus	…/equipment-status	GET	Retrieve the equipment status of the PEI

6.1.3.2 Resource: equipmentStatus

6.1.3.2.1 Description

This resource represents the equipmentStatus for a PEI.

6.1.3.2.2 Resource Definition

Resource URI: {apiRoot}/n5g-eir-eic/v1/equipment-status

This resource shall support the resource URI variables defined in table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See subclause 6.1.1

6.1.3.2.3 Resource Standard Methods

6.1.3.2.3.1 GET

This method shall support the URI query parameters specified in table 6.1.3.2.3.1-1.

Table 6.1.3.2.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description
pei	Pei	M	1	The PEI of the UE shall be included for equipment identify checking
supi	Supi	O	0..1	The SUPI of the UE

This method shall support the request data structures specified in table 6.1.3.2.3.1-2 and the response data structures and response codes specified in table 6.1.3.2.3.1-3.

Table 6.1.3.2.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.2.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
EirResponseData	M	1	200 OK	Upon success, a response body containing the Equipment Status shall be returned
ProblemDetails	M	1	404 Not Found	The equipment identify checking has failed. The "cause" attribute shall be set to the following application error: - ERROR_EQUIPMENT_UNKNOWN See table 6.1.5.3-1 for the description of this error.

6.1.4   Data Model

6.1.4.1   General

This subclause specifies the application data model supported by the API.

Table 6.1.4.1-1 specifies the data types defined for the n5g-eir-eic service based interface protocol.

Table 6.1.4.1-1: n5g-eir-eic specific Data Types

Data type	Section defined	Description
EirResponseData	6.1.4.2.2	
EquipmentStatus	6.1.4.3.3	Equipment status of the PEI, this data type is string.

Table 6.1.6.1-2 specifies data types re-used by the N_{<NF>} service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the N_{<NF>} service based interface.

Table 6.1.4.1-2: 5g-eir-eic re-used Data Types

Data type	Reference	Comments
Pei	3GPP TS 29.571[6]	Data type representing the PEI of the UE.
Supi	3GPP TS 29.571 [6]	Data type representing the SUPI of the subscriber. pattern: "(imsi-[0-9]{5,15}|nai-.+)"
ProblemDetails	3GPP TS 29.571 [6]	Common data type for error responses

6.1.4.2   Structured data types

6.1.4.2.1   Introduction

This subclause defines the structures to be used in resource representations.

Allowed structures are: array, object.

6.1.4.2.2   Type: EirResponseData

Table 6.1.4.2.2-1: Definition of type EirResponseData

Attribute name	Data type	P	Cardinality	Description
status	EquipmentStatus	M	1	Status of the UE

6.1.4.3 Simple data types and enumerations

6.1.4.3.1 Introduction

This subclause defines simple data types and enumerations that can be referenced from data structures defined in the previous subclauses.

6.1.4.3.2 Simple data types

The simple data types defined in table 6.1.4.3.2-1 shall be supported.

Table 6.1.4.3.2-1: Simple data types

Type Name	Type Definition	Description
	<one simple data type, e.g. boolean, integer, null, number, string>	

6.1.4.3.3 Enumeration: EquipmentStatus

Table 6.1.4.3.3-1: Enumeration EquipStatus

Enumeration value	Description
"WHITELISTED"	Indicates the PEI is whitelisted
"BLACKLISTED"	Indicates the PEI is blacklisted
"GREYLISTED"	Indicates the PEI is greylisted

6.1.5 Error Handling

6.1.5.1 General

HTTP error handling shall be supported as specified in subclause 5.2.4 of 3GPP TS 29.500 [4].

6.1.5.2 Protocol Errors

The HTTP/2 protocol errors specified in clause 7 of IETF RFC 7540 [7] shall be supported. Errors due to malformed HTTP payload body and/or headers shall be conveyed with the appropriate HTTP 4xx status codes along with the ProblemDetails JSON body as specified in 3GPP TS 29.501 [5].

6.1.5.3 Application Errors

The common application errors defined in the Table 6.1.5.3-1 in 3GPP TS 29.501 [5] may also be used for the N5g-eir_EquipmentIdentityCheck service, and the following application errors listed in Table 6.1.5.3-1 are specific for the N5g-eir_EquipmentIdentityCheck service.

Table 6.1.5.3-1: Application errors

Application Error	HTTP status code	Description
ERROR_EQUIPMENT_UNKNOWN	404 Not Found	Indicate the mobile equipment is not known in the EIR.

6.1.6 Feature Negotiation

N/A

6.1.7 Security

6.1.7.1 General

The security mechanisms for service based interfaces are specified in clause 13 of 3GPP TS 33.501 [11].

Security Protection Edge Proxy (SEPP), as specified in 3GPP TS 33.501 [11], shall be used between service based interfaces across PLMNs. The NFs in a PLMN shall use the SEPP as a HTTP/2 proxy for the HTTP/2 messages that carry ":authority" pseudo header with a uri-host formatted as specified in subclause 6.1.4.3 of 3GPP TS 29.500 [4]

6.1.7.2   Transport Layer Security Protection of Messages

As specified in subclause 13.1 of 3GPP TS 33.501 [11], TLS shall be used for the security protection of messages at the transport layer for the N5g-eir service based interface if network security is not provided by other means.

The protocol stack for the N5g-eir service based interface is shown on Figure 6.1.7.2-1.

```
┌─────────────────────┐
│    Application      │
├─────────────────────┤
│      HTTP/2         │
├ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┤
┊        TLS          ┊
├ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┤
│        TCP          │
├─────────────────────┤
│        IP           │
├─────────────────────┤
│        L2           │
└─────────────────────┘
```
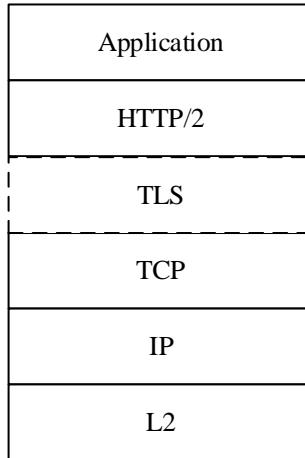
Figure 6.1.7.2-1: SBI Protocol Stack

The N5g-eir service based interface uses HTTP/2 protocol (see subclause 5.2) with JSON (see subclause 5.4) as the application layer serialization protocol. For the security protection at the transport layer, 5G-EIR NF shall support TLS and TLS shall be used within a PLMN if network security is not provided by other means, as specified in 3GPP TS 33.501 [11].

6.1.7.3   Authorization of 5G-EIR NF Service Access

As specified in subclause 13.4.1 of 3GPP TS 33.501 [11] OAuth 2.0 (see IETF RFC 6749 [12]) may be used for authorization of N5g-eir_EquipmentIdentityCheck service access. The 5G-EIR NF and the NRF (as defined in 3GPP TS 29.510 [13]) shall support the OAuth 2.0 authorization framework with "Client Credentials" grant type as specified in clause 4.4 of IETF RFC 6749 [12]. The NRF shall act as the Authorization Server providing the access tokens to the NF service consumers to access the service provided by the 5G-EIR. If the 5G-EIR NF receives an OAuth 2.0 authorization token in the "Authorization" HTTP request header field, the N5g-eir_EquipmentIdentityCheck service shall validate the access token, its expiry and its access scope before allowing access to the requested resource, as specified in clause 7 of IETF RFC 6749 [12].

Annex A (normative): OpenAPI specification

A.1   General

A.2   N5g-eir_EquipmentIdentityCheck Service API

```
openapi: 3.0.0
info:
  version: '1.R15.0.0'
  title: '5G-EIR Equipment Identity Check'
  description: '5G-EIR Equipment Identity Check Service'
paths:
  /equipment-status:
    get:
      summary: Retrieves the status of the UE
      operationId: GetEquipmentStatus
      tags:
        - Equipment Status (Document)
      parameters:
        - name: pei
          in: query
          description: PEI of the UE
          required: true
          schema:
            $ref: '#/components/schemas/Pei'
        - name: supi
          in: query
          description: SUPI of the UE
          required: false
          schema:
            $ref: '#/components/schemas/Supi'
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/EirResponseData'
        '404':
          description: PEI Not Found
          content:
            application/problem+json:
              schema:
                $ref: '#/components/schemas/ProblemDetails'
        default:
          description: Unexpected error
          content:
            application/problem+json:
              schema:
                $ref: '#/components/schemas/ProblemDetails'
components:
  schemas:
    EirResponseData:
      type: object
      required:
        - status
      properties:
        status:
          $ref: '#/components/schemas/EquipmentStatus'
    Pei:
      type: string
      pattern: "([0-9]{14})"
    Supi:
      type: string
      pattern: "(imsi-[0-9]{5,15}|nai-.+)"
    EquipmentStatus:
      type: string
      enum:
        - WHITELISTED
        - BLACKLISTED
        - GREYLISTED
    ProblemDetails:
```

```
          description: 'https://www.rfc-editor.org/rfc/rfc7807.txt'
          type: object
          required:
            - type
          properties:
            type:
              type: string
            title:
              type: string
            status:
              type: integer
            detail:
              type: string
            instance:
              type: string
externalDocs:
  description: Documentation
  url: 'http://www.3gpp.org/ftp/Specs/archive/29_series/29.511/'
```

Annex B (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-10	CT4#80	C4-175323				Initial Draft.	0.1.0
2017-10	CT4#80	C4-175396				At CT4#80 approved pCRs C4-175323, C4-175324, C4-175325, C4-175326 incorporated.	0.2.0
2017-12	CT4#81	C4-176439				At CT4#81 approved pCRs C4-176428, C4-176429 incorporated	0.3.0
2018-03	CT4#83	C4-182436				At CT4#83 approved pCRs C4-182368, C4-182369, C4-182384 incorporated.	0.4.0
2018-03	CT#79	CP-180032				Presented for information	1.0.0
2018-05	CT4#85	C4-184627				At CT4#85 approved pCRs C4-184475, C4-184476, C4-184628 incorporated.	1.1.0
2018-06	CT#81	CP-181106				Presented for approval	2.0.0
2018-06	CT#80					Approved in CT#80.	15.0.0

History

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V15.0.0	September 2018	Publication