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Technical Specification

3rd Generation Partnership Project;

Technical Specification Group Services and System Aspects;

Telecommunication management;

Control and monitoring of Power, Energy and Environmental (PEE) parameters

Integration Reference Point (IRP);

Information Service (IS)

(Release 16)

** 

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# Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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

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# Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; as identified below:

28.304 Control and monitoring of Power, Energy and Environmental (PEE) parameters Integration Reference Point (IRP); Requirements

**28.305 Control and monitoring of Power, Energy and Environmental (PEE) parameters Integration Reference Point (IRP): Information Service (IS)**

28.306 Control and monitoring of Power, Energy and Environmental (PEE) parameters Integration Reference Point (IRP); Solution Set (SS) definitions

# 1 Scope

The present document specifies the control and monitoring of Power, Energy and Environmental (PEE) parameters Integration Reference Point (IRP) Information Service (IS).

It specifies the semantics and behaviour of operations, notifications and their parameters visible across Itf-N in a protocol and technology neutral way. It does not define their syntax and encoding.

# 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] ETSI ES 202 336-12 (V1.1.1) (2015-06): " Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (power, cooling and building environment systems used in telecommunication networks); Part 12: ICT equipment power, energy and environmental parameters monitoring information model".

[3] 3GPP TS 32.150: "Integration Reference Point (IRP) Concept and definitions".

[4] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[5] 3GPP TS 32.602: "Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP); Information Service (IS)".

[6] 3GPP TS 32.612: "Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP): Information Service (IS)".

[7] 3GPP TS 32.412: "Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Information Service (IS)".

[8] 3GPP TS 32.111-2: "Telecommunication management; Fault Management; Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)".

[9] 3GPP TS 28.304: "Control and monitoring of Power, Energy and Environmental (PEE) parameters Integration Reference Point (IRP); Requirements".

[10] ITU-T Recommendation X.733: "Information Technology – Open Systems Interconnection – Systems Management: Alarm Reporting Function".

# 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].

## 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].

CU Control Unit

DGU Digital Gathering Unit

NM-RMS Network Management layer RMS

PEE Power, Energy and Environmental

PEECMON PEE Control and Monitoring

RMS Remote Management Server

VSE Vendor-Specific Extension

VS-RMS Vendor Specific RMS

XCU XML enabled CU

# 4 System overview

## 4.1 System Context

The general definition of the System Context for the present IRP is found in 3GPP TS 32.150 [3], sub-clause 4.7.



Figure 4.1.1: System Context

# 5 Model

## 5.1 Model for solution 1

### 5.1.0 Introduction

NOTE: Void.

Due to the fact that existing CM, PM, and FM interface IRPs are applicable to solution 1, the model definition of this solution can refer to model definitions from Basic CM IRP (TS 32.602 [5]), Bulk CM IRP (TS 32.612 [6]), PM IRP (TS 32.412 [7]) and Alarm IRP (TS 32.111-2 [8]).

Use cases and requirement for Solution 1 are described in 28.304 [9].

### 5.1.1 Imported and associated information entities

#### 5.1.1.1 Imported information entities and local labels

None.

#### 5.1.1.2 Associated information entities and local labels

None.

### 5.1.2 Class diagrams

#### 5.1.2.1 Relationships

Due to the fact that existing CM, PM, and FM interface IRPs are applicable to solution 1, the model definition of this solution can refer to model definitions from Basic CM IRP (TS 32.602 [5]), Bulk CM IRP (TS 32.612 [6]), PM IRP (TS 32.412 [7]) and Alarm IRP (TS 32.111-2 [8]).

#### 5.1.2.2 Inheritance

Due to the fact that existing CM, PM, and FM interface IRPs are applicable to solution 1, the model definition of this solution can refer to model definitions from Basic CM IRP (TS 32.602 [5]), Bulk CM IRP (TS 32.612 [6]), PM IRP (TS 32.412 [7]) and Alarm IRP (TS 32.111-2 [8]).

### 5.1.3 Class definitions

Due to the fact that existing CM, PM, and FM interface IRPs are applicable to solution 1, the model definition of this solution can refer to model definitions from Basic CM IRP (TS 32.602 [5]), Bulk CM IRP (TS 32.612 [6]), PM IRP (TS 32.412 [7]) and Alarm IRP (TS 32.111-2 [8]).

### 5.1.4 Attribute definitions

NOTE: Void.

Attributes related to the control and monitoring of power, energy and environmental parameters in radio access networks are defined in IOC ManagedFunction – cf. 3GPP TS 28.622 [4].

### 5.1.5 Common notifications

No additional notifications compared to those applicable to IOC ManagedFunction – cf. 3GPP TS 28.622 [4].

## 5.2 Model for solution 2

### 5.2.0 Introduction

This clause introduces the set of classes (i.e. IOCs, SupportIOCs) that encapsulate information used by the CMON IRP for the control and monitoring of PEE parameters in radio access networks. The intent is to identify the information required for the CMONIRP implementation of its operations and notification emission. This clause provides the overview of all support object classes in UML. Subsequent clauses provide more detailed specification of various aspects of these support object classes.

### 5.2.1 Imported and associated information entities

#### 5.2.1.1 Imported information entities and local labels

There is no imported information entity.

#### 5.2.1.2 Associated information entities and local labels

There is no associated information entity.

### 5.2.2 Class diagrams

#### 5.2.2.1 Relationships



Figure 5.2.2.1.1: Information model for solution 2 - Relationships

#### 5.2.2.2 Inheritance

There is no inheritance defined.

### 5.2.3 Class definitions

#### 5.2.3.1 PEEMonitoredEntity

##### 5.2.3.1.1 Definition

This IOC represents the monitoring of a base station whose Power, Energy and Environmental (PEE) parameters are monitored. It can apply to a GERAN, UTRAN or E-UTRAN base station. It can apply to a base station with either a built-in sensor or an external sensor.

##### 5.2.3.1.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| mEId | M | M | - | M | - |

##### 5.2.3.1.3 Attribute constraints

None.

##### 5.2.3.1.4 Notifications

None.

##### 5.2.3.1.5 State diagram

None.

#### 5.2.3.2 PEEMEDescription

##### 5.2.3.2.1 Definition

This IOC provides a description of the monitored entity.

##### 5.2.3.2.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| siteIdentification | M | M | M | - | M |
| siteLatitude | CM | M | M | - | M |
| siteLongitude | CM | M | M | - | M |
| siteDescription | M | M | M | - | M |
| equipmentType | M | M | M | - | M |
| environmentType | M | M | M | - | M |
| powerInterface | M | M | M | - | M |
| xcuDguDescription | CM | M | M | - | M |
| sensorDescription | CM | M | M | - | M |
| vSRmsDescription | CM | M | M | - | M |

##### 5.2.3.2.3 Attribute constraints

|  |  |
| --- | --- |
| Name | Definition |
| xcuDguDescription | It shall be supported only in case of base stations with external sensors. |
| sensorDescription | It shall be supported only in case of base stations with external sensors. |
| vSRmsDescription | It shall be supported only in case of base stations with external sensors monitored via VS-RMS. |
| siteLatitude | It shall be supported only in case of UTRAN or E-UTRAN base stations. |
| siteLongitude | It shall be supported only in case of UTRAN or E-UTRAN base stations. |

##### 5.2.3.2.4 Notifications

None.

##### 5.2.3.2.5 State diagram

None.

#### 5.2.3.3 PEEMeasurementData

##### 5.2.3.3.1 Definition

This IOC represents the PEE measurements of the monitored entity.

##### 5.2.3.3.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| powerAverage | M | M | - | M | - |
| powerMin | M | M | - | M | - |
| powerMax | M | M | - | M | - |
| energyConsumption | M | M | - | M | - |
| temperatureAverage | M | M | - | M | - |
| temperatureMin | M | M | - | M | - |
| temperatureMax | M | M | - | M | - |
| voltageAverage | M | M | - | M | - |
| voltageMin | M | M | - | M | - |
| voltageMax | M | M | - | M | - |
| currentAverage | M | M | - | M | - |
| currentMin | M | M | - | M | - |
| currentMax | M | M | - | M | - |
| humidityAverage | M | M | - | M | - |
| humidityMin | M | M | - | M | - |
| humidityMax | M | M | - | M | - |
| collectionBeginTime | M | M | - | M | - |
| collectionEndTime | M | M | - | M | - |

##### 5.2.3.3.3 Attribute constraints

None.

##### 5.2.3.3.4 Notifications

None.

##### 5.2.3.3.5 State diagram

None.

#### 5.2.3.4 PEEAlarmInformation

##### 5.2.3.4.1 Definition

This IOC represents the alarm information of the monitored entity.

##### 5.2.3.4.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| alarmId | M | M | - | M | - |
| alarmTime | M | M | - | M | - |
| alarmType | M | M | - | M | - |
| perceivedSeverity | M | M | - | M | - |
| probableCause | M | M | - | M | - |
| additionaltext | O | M | - | M | - |

##### 5.2.3.4.3 Attribute constraints

None.

##### 5.2.3.4.4 Notifications

None.

##### 5.2.3.4.5 State diagram

None.

#### 5.2.3.5 PEEConfigInformation

##### 5.2.3.5.1 Definition

This IOC represents the PEE related configuration information of the monitored entity.

##### 5.2.3.5.2 Attributes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Support Qualifier | isReadable | isWritable | isInvariant | isNotifyable |
| powerMinThreshold | M | M | - | M | - |
| powerMaxThreshold | M | M | - | M | - |
| temperatureMinThreshold | M | M | - | M | - |
| temperatureMaxThreshold | M | M | - | M | - |
| voltageMinThreshold | M | M | - | M | - |
| voltageMaxThreshold | M | M | - | M | - |
| currentMinThreshold | M | M | - | M | - |
| currentMaxThreshold | M | M | - | M | - |
| humidityMinThreshold | M | M | - | M | - |
| humidityMaxThreshold | M | M | - | M | - |

##### 5.2.3.5.3 Attribute constraints

None.

##### 5.2.3.5.4 Notifications

None.

##### 5.2.3.5.5 State diagram

None.

#### 5.2.3.6 PEECMONIRP

##### 5.2.3.6.1 Definition

PEECMONIRP is the representation of the Power, Energy and Environmental (PEE) parameters management capabilities specified by the present document.

##### 5.2.3.6.2 Attributes

None.

##### 5.2.3.6.3 Attribute constraints

None.

##### 5.2.3.6.4 Notifications

None.

##### 5.2.3.6.5 State diagram

None.

### 5.2.4 Attribute definitions

#### 5.2.4.1 Attribute properties

| Attribute Name | Documentation and Allowed Values | Properties |
| --- | --- | --- |
| currentMinThreshold | It indicates the minimum current threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – Clauses 4.4.3.3, 4.4.3.4, Annex B | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| currentMaxThreshold | It indicates the maximum current threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – Clauses 4.4.3.3, 4.4.3.4, Annex B | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| environmentType | It indicates the type of environment of the monitored entity.  allowedValues: see ETSI ES 202 336-12 [2] – Clause 4.4.1. | type: <<enumeration>>  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| equipmentType | It indicates the type of equipment of the monitored entity.  allowedValues: see ETSI ES 202 336-12 [2] – Clause 4.4.1. | type: <<enumeration>>  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| humidityMinThreshold | It indicates the minimum humidity threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – clause 4.4.3.3, Annex B | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| humidityMaxThreshold | It indicates the maximum humidity threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – clause 4.4.3.3, Annex B | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| mEId | It identifies the monitored entity.  allowedValues: N/A | type: Integer  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| powerInterface | It indicates the type of power interface of the monitored entity.  allowedValues: see ETSI ES 202 336-12 [2] – Clause 4.4.1. | type: <<enumeration>>  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| powerMinThreshold | It indicates the minimum power threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – clauses 4.4.3.1, 4.4.3.4, Annex A | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| powerMaxThreshold | It indicates the maximum power threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – clauses 4.4.3.1, 4.4.3.4, Annex A | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| sensorDescription | It gives a description of the sensor.  allowedValues: N/A | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| siteDescription | It gives a description of the site of the monitored entity.  allowedValues: N/A | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| siteIdentification | It gives an identification of the site of the monitored entity.  allowedValues: N/A | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| siteLatitude | The latitude of the site location based on the World Geodetic System (1984 version) global reference frame (WGS 84).  Positive values correspond to north of 0 degrees latitude (northern hemisphere).  allowedValues: -90.0000 to +90.0000 | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| siteLongitude | The longitude of the site location based on the World Geodetic System (1984 version) global reference frame (WGS 84).  Positive values correspond to east of 0 degrees longitude.  allowedValues: -180.0000 to +180.0000 | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| temperatureMinThreshold | It indicates the minimum temperature threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – clause 4.4.3.4, Annex B | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| temperatureMaxThreshold | It indicates the maximum temperature threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – clause 4.4.3.4, Annex B | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| voltageMinThreshold | It indicates the minimum voltage threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – Clauses 4.4.3.3, 4.4.3.4, Annex B | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| voltageMaxThreshold | It indicates the maximum voltage threshold value to be used for raising alarms.  allowedValues: see ETSI ES 202 336-12 [2] – Clauses 4.4.3.3, 4.4.3.4, Annex B | type: Real  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: Null  isNullable: True |
| vSRmsDescription | It gives a description of the VS-RMS.  allowedValues: N/A | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |
| xcuDguDescription | It gives a description of the XCU/DGU.  allowedValues: N/A | type: String  multiplicity: 1  isOrdered: N/A  isUnique: N/A  defaultValue: False  isNullable: False |

#### 5.2.4.2 Constraints

|  |  |  |
| --- | --- | --- |
| Name | Affected attribute(s) | Definition |
| inv\_TimerConstraints | ntfTimeTickTimer | The ntfTimeTickTimer is lower than or equal to ntfTimeTick. |

### 5.2.5 Common notifications

None.

# 6 Interface Definition

## 6.1 Interface definition for solution 1

### 6.1.1 Class diagram

None.

## 6.2 Interface definition for solution 2

### 6.2.1 Class diagram



Figure 6.2.1.1: Class diagram representing interfaces for solution 2

### 6.2.2 Generic rules

Rule 1: each operation with at least one input parameter supports a pre-condition valid\_input\_parameter which indicates that all input parameters shall be valid with regards to their information type. Additionally, each such operation supports an exception operation\_failed\_invalid\_input\_parameter which is raised when pre-condition valid\_input\_parameter is false. The exception has the same entry and exit state.

Rule 2: Each operation with at least one optional input parameter supports a set of pre-conditions supported\_optional\_input\_parameter\_yyy where "yyy" is the name of the optional input parameter and the  
pre-condition indicates that the operation supports the named optional input parameter. Additionally, each such operation supports an exception operation\_failed\_unsupported\_optional\_input\_parameter\_yyy which is raised when (a) the pre-condition supported\_optional\_input\_parameter\_yyy is false and (b) the named optional input parameter is carrying information. The exception has the same entry and exit state.

Rule 3: each operation shall support a generic exception operation\_failed\_internal\_problem which is raised when an internal problem occurs and that the operation cannot be completed. The exception has the same entry and exit state.

### 6.2.3 CMONOperations\_1 Interface (M)

#### 6.2.3.1 Operation readMEDescription (M)

##### 6.2.3.1.1 Definition

The IRPManager invokes this operation to read description data of the monitored entity.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-001  REQ-EECMON-CON-002  REQ-EECMON-CON-003 |  |

##### 6.2.3.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Qualifier | Matching Type | Comment |
| mEId | M | mEId of the PEEMonitoredEntity instance. | This parameter contains the identification of the monitored entity. |
| attributeNameList | O | List of attribute names (in PEEMEDescription). | This parameter contains the list of names of attributes of the monitored entity, from PEEMEDescription. If the list is not provided, name+value pairs for all attributes of the monitored entity shall be returned. |

##### 6.2.3.1.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Qualifier | Matching Information | Comment |
| mEId | M | mEId of the PEEMonitoredEntity instance. | This parameter contains the identification of the monitored entity. |
| attNameValueList | M | List of attribute name (in PEEMEDescription) and value pairs | This parameter contains a list of attribute name+value of the monitored entity. |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If allInformationReturned is true, status = OperationSucceeded.  If operation\_failed is true, status = OperationFailed. |

##### 6.2.3.1.4 Pre-condition

None.

##### 6.2.3.1.5 Post-condition

allInformationReturned.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| allInformationReturned | For all attributes of the input parameter attributeNameList, their names and values are returned. All their values remain unchanged as the result of this operation. |

##### 6.2.3.1.6 Exception

|  |  |
| --- | --- |
| Assertion Name | Definition |
| operation\_failed | **Condition:** One of the input parameters is invalid or the post-condition is not true.  **Returned Information:** The output parameter status.  **Exit state:** Entry state. |

#### 6.2.3.2 Operation writeMEDescription (M)

##### 6.2.3.2.1 Definition

The IRPManager invokes this operation to modify description data of the monitored entity.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-007  REQ-EECMON-CON-008  REQ-EECMON-CON-009 |  |

##### 6.2.3.2.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Qualifier | Matching Type | Comment |
| mEId | M | mEId of the PEEMonitoredEntity instance. | This parameter contains the identification of the monitored entity. |
| attNameValueList | M | List of attribute name (in PEEMEDescription) and value pairs | This parameter contains the list of attribute name+value of the monitored entity, for attributes in PEEMEDescription. |

##### 6.2.3.2.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Qualifier | Matching Information | Comment |
| mEId | M | mEId of the PEEMonitoredEntity instance. | This parameter contains the identification of the monitored entity. |
| attNameValueList | M | List of attribute name (in PEEMEDescription) and value pairs | This parameter contains a list of attribute name+value of the modified attributes of the monitored entity after the operation has been achieved. |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If allInformationReturned is true, status = OperationSucceeded.  If operation\_failed is true, status = OperationFailed. |

##### 6.2.3.2.4 Pre-condition

None.

##### 6.2.3.2.5 Post-condition

allAttributesCorrectlyModified.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| allAttributesCorrectlyModified | All attributes of the input parameter attributeNameList have been correctly modified as requested by this operation. All their modified values are returned. |

##### 6.2.3.2.6 Exception

|  |  |
| --- | --- |
| Assertion Name | Definition |
| operation\_failed | **Condition:** One of the input parameters is invalid or the post-condition is not true.  **Returned Information:** The output parameter status.  **Exit state:** Entry state. |

### 6.2.4 CMONOperations\_2 Interface (M)

#### 6.2.4.1 Operation readMEConfiguration (M)

##### 6.2.4.1.1 Definition

The IRPManager invokes this operation to read threshold values on PEE parameters for one monitored entity.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-007  REQ-EECMON-CON-008  REQ-EECMON-CON-009 |  |

##### 6.2.4.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support  Qualifier | Information Type / Legal Values | Comment |
| mEId | M | PEEMonitoredEntity.mEId | This parameter contains the mEId of the PEEMonitoredEntity instance. |
| thresholdNameList | O | List of threshold names (in PEEMEConfiguration) | This parameter contains the list of threshold names for the monitored entity instances, where threshold name corresponds to an attribute name in PEEConfigInformation. If the list is not provided, name+value pairs for all thresholds of the monitored entity shall be returned. |

##### 6.2.4.1.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support Qualifier | Matching Information /  Information Type / Legal Values | Comment |
| mEId | M | PEEMonitoredEntity.mEId | This parameter contains the mEId of the PEEMonitoredEntity instance whose threshold(s) have been read. |
| thresholdNameValueList | M | List of threshold name and value pairs | This parameter contains the list of threshold name+value pairs set for the monitored entity instance, where threshold name corresponds to an attribute name in PEEConfigInformation. |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If allInformationReturned is true, status = OperationSucceeded.  If operation\_failed is true, status = OperationFailed. |

##### 6.2.4.1.4 Pre-condition

None.

##### 6.2.4.1.5 Post-condition

allInformationReturned.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| allInformationReturned | For all thresholds of the input parameter thresholdNameList, their names and values are returned. All their values remain unchanged as the result of this operation. |

##### 6.2.4.1.6 Exception

|  |  |
| --- | --- |
| Assertion Name | Definition |
| operation\_failed | **Condition:** One of the input parameters is invalid or the post-condition is not true.  **Returned Information:** The output parameter status.  **Exit state:** Entry state. |

#### 6.2.4.2 Operation writeMEConfiguration (M)

##### 6.2.4.2.1 Definition

The IRPManager invokes this operation to write threshold values on PEE parameters of one monitored entity.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-007  REQ-EECMON-CON-008  REQ-EECMON-CON-009 |  |

##### 6.2.4.2.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support  Qualifier | Information Type / Legal Values | Comment |
| mEId | M | List of <PEEMonitoredEntity.mEId> | This parameter contains the Id of PEEMonitoredEntity instance whose threshold(s) are to be written. |
| thresholdNameValueList | M | List of threshold name and value pairs | This parameter contains the list of threshold name+value pairs for the monitored entity instance, where threshold name corresponds to an attribute name in PEEConfigInformation.  Each threshold name+value pair defines the value of the monitored threshold. If the value is (a) crossed or (b) reached, a thresholdCrossing notification shall be emitted by the PEECMONIRP Agent. |

##### 6.2.4.2.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support Qualifier | Matching Information /  Information Type / Legal Values | Comment |
| mEId | M | PEEMonitoredEntity.mEId | This parameter contains the Id of the PEEMonitoredEntity instance whose threshold(s) have been written. |
| thresholdNameValueList | M | List of threshold name and value pairs | This parameter contains the list of threshold name+value pairs set for the monitored entity instance, where threshold name corresponds to an attribute name in PEEConfigInformation. |
| status | M | ENUM (OperationSucceeded, OperationFailed) | If allInformationReturned is true, status = OperationSucceeded.  If operation\_failed is true, status = OperationFailed. |

##### 6.2.4.2.4 Pre-condition

None.

##### 6.2.4.2.5 Post-condition

allThresholdsCorrectlyModified.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| allThresholdsCorrectlyModified | All thresholds of the input parameter thresholdNameValueList have been correctly modified as requested by this operation. All their values are returned. |

##### 6.2.4.2.6 Exception

|  |  |
| --- | --- |
| Assertion Name | Definition |
| operation\_failed | **Condition:** One of the input parameters is invalid or the post-condition is not true.  **Returned Information:** The output parameter status.  **Exit state:** Entry state. |

### 6.2.5 CMONOperations\_3 Interface (M)

#### 6.2.5.1 Operation createCMONPMJob (M)

##### 6.2.5.1.1 Definition

The IRPManager invokes this operation to create a PEE measurement job on one or more monitored entity(ies). The PEE measurement job starts immediately and run indefinitely until a stopCMONPMJob request is received by IRPAgent.

The way the address of the entity to which notifications containing measurement data are sent is provisioned, is not in the scope of this document.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-001  REQ-EECMON-CON-002  REQ-EECMON-CON-003 |  |

##### 6.2.5.1.2 Input parameters

| Parameter  Name | Support Qualifier | Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| mEIdList | M | List of <PEEMonitoredEntity.mEId> | This parameter contains the list of mEIds of PEEMonitoredEntity instances whose measurement(s) are to be collected. |
| measurementNameList | M | List of measurement names | This parameter contains the list of names of measurements to be collected. Each measurement name shall correspond to an attribute name of PEEMeasurementData. |
| granularityPeriod | M | A number of minutes. See Comment for legal values | It specifies the period between two successive measurements. The value can be 5 minutes, 15 minutes, 30 minutes, 1 hour, 12 hours and 24 hours.  The minimum granularity period is 5 minutes in most cases, but for some measurements it may only make sense to collect data in a larger granularity period.  It also specifies the period between two successive emissions of notifyMeasurementData notifications. |

##### 6.2.5.1.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support  Qualifier | Matching Information /  Information Type / Legal Values | Comment |
| jobId | M | Measurement job id | Unique identifier of the measurement job among all the existing measurement jobs in a PEECMONIRP Agent (located in XCU/DGU or in VS-RMS or in EM/DM). The uniqueness is guaranteed by the Operator. |
| status | M | ENUM (Success, Failure, PartialSuccess) | An operation may fail because of a specified (e.g. invalid granularity period, invalid measurement name) or unspecified reason. |

##### 6.2.5.1.4 Pre-condition

None.

##### 6.2.5.1.5 Post-condition

None.

##### 6.2.5.1.6 Exception

|  |  |
| --- | --- |
| Assertion Name | Definition |
| operation\_failed | **Condition:** One of the input parameters is invalid.  **Returned Information:** The output parameter status.  **Exit state:** Entry state. |

##### 6.2.5.1.7 Constraints

None.

#### 6.2.5.2 Operation stopCMONPMJob (M)

##### 6.2.5.2.1 Definition

The IRPManager invokes this operation to stop an ongoing PEE measurement job on one or more monitored entity(ies). The PEE measurement job stops immediately.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-001  REQ-EECMON-CON-002  REQ-EECMON-CON-003 |  |

##### 6.2.5.2.2 Input parameters

| Parameter Name | Support Qualifier | Information Type / Legal Values | Comment |
| --- | --- | --- | --- |
| jobId | M | Measurement job id | Identifier of the measurement job among all the existing measurement jobs in a PEECMONIRP Agent (located in XCU/DGU or in VS-RMS or in EM/DM). |

##### 6.2.5.2.3 Output parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support  Qualifier | Matching Information /  Information Type / Legal Values | Comment |
| status | M | ENUM (Success, Failure, PartialSuccess) | An operation may fail because of a specified (e.g. unknown job, job cannot be stopped) or unspecified reason. |

##### 6.2.5.2.4 Pre-condition

None.

##### 6.2.5.2.5 Post-condition

cMONPMJobStopped.

|  |  |
| --- | --- |
| Assertion Name | Definition |
| cMONPMJobStopped | The PM job has been stopped. |

##### 6.2.5.2.6 Exception

|  |  |
| --- | --- |
| Assertion Name | Definition |
| operation\_failed | **Condition:** One of the input parameters is invalid or the post-condition is not true.  **Returned Information:** The output parameter status.  **Exit state:** Entry state. |

##### 6.2.5.2.7 Constraints

None.

### 6.2.6 CMONNotifications\_1 Interface (M)

#### 6.2.6.1 Notification notifyMeasurementData (M)

##### 6.2.6.1.1 Definition

The PEECMONIRP Agent notifies the PEECMONIRP Manager with measurement data.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-004  REQ-EECMON-CON-005  REQ-EECMON-CON-006 |  |

##### 6.2.6.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support  Qualifier | Information Type / Legal Values | Comment |
| notificationId | M |  | Unique identifier of the notification among all the notifications issued by the PEECMONIRP Agent (located in XCU/DGU or in VS-RMS or in EM/DM). |
| notificationHeader | M |  | This is the notification header to be inserted in each such notification. It includes a version indicator, the name, type and vendor name of the sending network node, and a time stamp indicating the time at which the notification is sent by PEECMONIRP Agent. |
| notificationType | M | “Measurement data” |  |
| jobId | M | Measurement job id | Unique identifier of the measurement job. |
| measHeader |  |  | This is the measurement result notification header to be inserted in each such notification. It includes a version indicator, the name, type and vendor name of the sending network node, and a time stamp ("collectionBeginTime").  The "collectionBeginTime" is a time stamp that refers to the start of the first measurement collection interval (granularity period) that is covered by the collected measurement results that are sent in this notification. |
| measData | M | Measurement data | It represents the sequence of zero or more measurement result items. It can be empty in case no measurement data can be provided. The individual "measData" elements can appear in any order.  Each "measData" element contains the mEId of the PEEMonitoredEntity instance, and the list of measurement results pertaining to that PEEMonitoredEntity instance ("measInfo").  Each “measInfo” is a pair of measurement name ("measName") and the corresponding result(s) ("measValues").  “measName” shall correspond to an attribute name in PEEMeasurementData.  "measValues" contains the list of measurement results for the resource being measured. |
| measFooter | M |  | The measurement result notification footer to be inserted in each notification. It includes a time stamp, which refers to the end of the overall measurement collection interval that is covered by the collected measurement results being sent in this notification. |

### 6.2.7 CMONNotifications\_2 Interface (M)

#### 6.2.7.1 Notification notifyAlarm (M)

##### 6.2.7.1.1 Definition

The PEECMONIRP Agent notifies the PEECMONIRP Manager of a new alarm.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-010  REQ-EECMON-CON-011  REQ-EECMON-CON-012 |  |

##### 6.2.7.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support  Qualifier | Information Type / Legal Values | Comment |
| notificationId | M |  | Unique identifier of the notification among all the notifications issued by the PEECMONIRP Agent (located in XCU/DGU or in VS-RMS or in EM/DM). |
| notificationHeader | M |  | This is the notification header to be inserted in each such notification. It includes a version indicator, the name, type and vendor name of the sending network node, and a time stamp indicating the time at which the notification is sent by PEECMONIRP Agent. |
| notificationType | M | “Alarm notification” |  |
| alarmId | M |  | Unique alarm id among alarm ids generated by the PEECMONIRP Agent. |
| alarmTime | M | All values indicating valid time. | It indicates the date and time when the alarm is raised by the alarmed PEEMonitoredEntity instance. |
| alarmType | M |  | See Event Types in TS 32.111-2 [8] – Annex A. |
| perceivedSeverity | M |  | Critical, Major, Minor, Warning, Indeterminate, Cleared: see [10]. |
| probableCause | M |  | See Probable Causes in TS 32.111-2 [8] – Annex B. |
| additionalText | O | N/A | It can carry semantics that is outside the scope of this IRP specification. It may provide the identification of the site from which the alarm has been originated. It may contain further information on the alarm. |

### 6.2.8 CMONNotifications\_3 Interface (M)

#### 6.2.8.1 Notification notifyConfigurationChange (M)

##### 6.2.8.1.1 Definition

The PEECMONIRP Agent notifies the PEECMONIRP Manager of a change of configuration.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-013  REQ-EECMON-CON-014  REQ-EECMON-CON-015 |  |

##### 6.2.8.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support  Qualifier | Information Type / Legal Values | Comment |
| notificationId | M |  | Unique identifier of the notification among all the notifications issued by the PEECMONIRP Agent (located in XCU/DGU or in VS-RMS or in EM/DM). |
| notificationHeader | M |  | This is the notification header to be inserted in each such notification. It includes a version indicator, the name, type and vendor name of the sending network node, and a time stamp indicating the time at which the notification is sent by PEECMONIRP Agent. |
| notificationType | M | “Configuration Change notification” |  |
| mEId | M | mEId of the PEEMonitoredEntity instance. | This parameter contains the identification of the monitored entity. |
| attNameValueList | M | List of attribute name (in PEEMEDescription) and value pairs | This parameter contains a list of attribute name+value pairs of the monitored entity, for which a value change happened. |

### 6.2.9 CMONNotifications\_4 Interface (M)

#### 6.2.9.1 Notification notifyThresholdCrossingOrReaching (M)

##### 6.2.9.1.1 Definition

The PEECMONIRP Agent notifies the PEECMONIRP Manager of a threshold crossing.

|  |  |  |
| --- | --- | --- |
| Referenced TS | Requirement label | Comment |
| 3GPP TS 28.304 [9] | REQ-EECMON-CON-013  REQ-EECMON-CON-014  REQ-EECMON-CON-015 |  |

##### 6.2.9.1.2 Input parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter  Name | Support  Qualifier | Information Type / Legal Values | Comment |
| notificationId | M |  | Unique identifier of the notification among all the notifications issued by the PEECMONIRP Agent (located in XCU/DGU or in VS-RMS or in EM/DM). |
| notificationHeader | M |  | This is the notification header to be inserted in each such notification. It includes a version indicator, the name, type and vendor name of the sending network node, and a time stamp indicating the time at which the notification is sent by PEECMONIRP Agent. |
| notificationType | M | “Threshold crossing or reaching notification” |  |
| mEId | M | mEId of the PEEMonitoredEntity instance. | This parameter contains the identification of the monitored entity. |
| thresholdInfo | M |  | It indicates crossed threshold information such as:  • The name of the threshold (corresponding to an attribute of PEEConfigInformation) whose value has crossed a threshold,  • The threshold value,  • The observed value that have crossed or reached the threshold value. |

Annex A (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2018-03 | SA#79 |  |  |  |  | Upgrade to change control version | 15.0.0 |
| 2018-12 | SA#82 | SP-181039 | 0001 | 1 | F | Include information about referencers to CM, PM and FM IRPs | 15.1.0 |
| 2020-07 | - | - | - | - | - | Update to Rel-16 version (MCC) | **16.0.0** |