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TECHNICAL SPECIFICATION

**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
LTE;
Control and monitoring of Power, Energy and Environmental (PEE) parameters Integration Reference Point (IRP);
Requirements
(3GPP TS 28.304 version 19.0.0 Release 19)**

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Foreword

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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 requirements for the control and monitoring of Power, Energy and Environmental (PEE) parameters in the following types of Radio Access Networks (RAN): GSM, UTRAN and E-UTRAN.

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 32.101: "Telecommunication management; Principles and high level requirements".

[3] 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".

[4] ETSI ES 202 336-1 (V1.1.2) (2008-09): " Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks) Part 1: Generic Interface".

[5] 3GPP TS 32.601: "Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP); Requirements".

[6] 3GPP TS 32.411: "Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Requirements".

[7] 3GPP TS 32.111-1: "Telecommunication management; Fault Management; Part 1: 3G fault management requirements".

[8] 3GPP TS 32.611: "Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP): Requirements".

[9] 3GPP TS 32.301: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP); Requirements".

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].

Remote Management Server: Application which controls and monitors power, energy and environmental parameters of Radio Access Networks.

Network Management layer Remote Management Server: Remote Management Server which operates at the NM layer.

Vendor-Specific Remote Management Server: Remote Management Server which operates at the DM layer.

XCU: Defined in ETSI ES 202 336-12 [3].

DGU: Defined in ETSI ES 202 336-12 [3].

NOTE: The concept of Remote Management Server is introduced in ETSI ES 202 336-12 [3] – Figure 1 (Principles of the monitoring of ICT equipment power, energy and environment parameters).

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	Data Gathering Unit
NM-RMS	Network Management layer RMS
PEE	Power, Energy and Environmental
RMS	Remote Management Server
VS-RMS	Vendor-Specific RMS
XCU	XML enabled CU

4 Concepts and background

4.1 General

With regard to the control and monitoring of their Power, Energy and Environmental (PEE) parameters, base stations can be of two different types:

either they have built-in sensors, which communicate with DM through Type-1 interface. In turn, DM communicates with the NM-RMS (see figure 4.1.1);

or they have external sensors, which communicate with the NM-RMS via:

- either XCU/DGU (see figure 4.1.1)

- or vendor-specific RMS (VS RMS) (see figure 4.1.1).

The NM-RMS collects PEE parameters from part or whole of the radio access network and may also control PEE related parameters through either DM(s) and/or XCU/DGU(s) and/or VS-RMS(s).

For this reason, it is beneficial to standardize the interface to control and monitor PEE parameters between the NM-RMS on the one hand and DM, XCU/DGU and VS-RMS on the other hand. This TS series specifies this Type-2 interface (see TS 32.101 [2]).

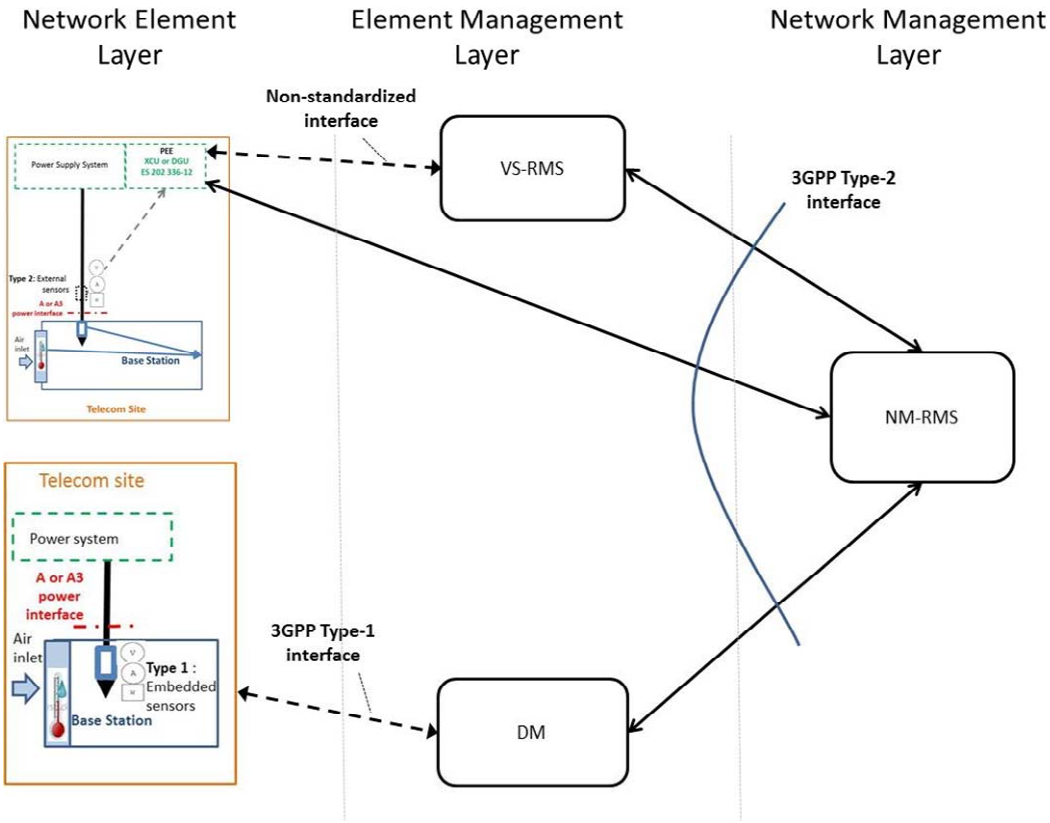

Figure 4.1.1: Overall architecture for the control and monitoring of PEE parameters

4.2 Architecture

The NM-RMS is a located in the NM layer (see also TS 32.101 [2]).

VS-RMS is located in the DM layer (see also TS 32.101 [2]).

XCU/DGU is located in the Network Element layer (see also TS 32.101 [2]).

Possible interfaces between all these entities are depicted in figure 4.1.1. The three possible scenarios for this IRP are depicted in figures 4.2.1, 4.2.2 and 4.2.3.

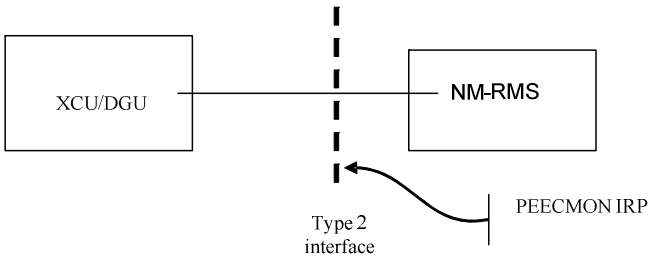

Figure 4.2.1: NM-RMS to XCU/DGU Type-2 interface

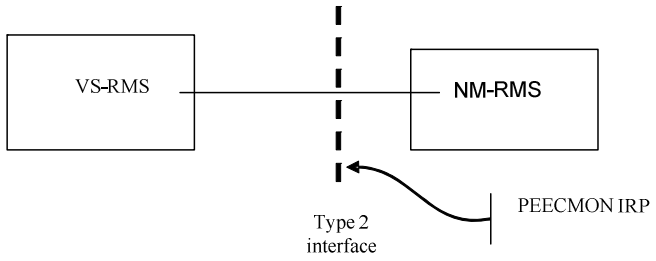

Figure 4.2.2: NM-RMS to VS-RMS Type-2 interface

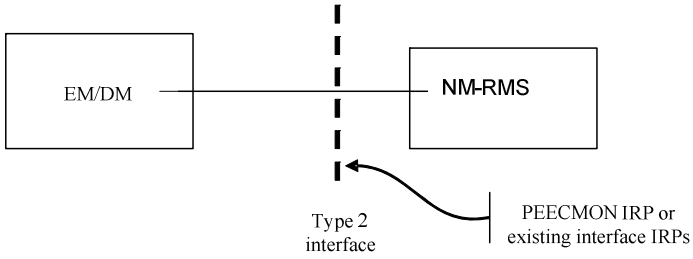

Figure 4.2.3: NM-RMS to EM/DM Type-2 interface

4.3 Functionality

Both DM, XCU/DGU and VS-RMS offer a capability allowing the NM-RMS to control and monitor PEE parameters of one or more base stations. This TS series specifies the information model exposed by the DM, XCU/DGU and VS-RMS to the NM-RMS, and the operations enabling the control and monitoring of PEE parameters from the NM-RMS.

This TS series describes two non-mutually exclusive solutions:

Solution 1: based on existing 3GPP Interface IRPs to support controlling and monitoring of PEE parameters of base stations with built-in sensors. This solution may be used for the interface between DM and NM-RMS.

Solution 2: describing simplified functionalities according to ETSI ES 202 336-1 [4] and ES 202 336-12 [3]. This solution may be used for the interfaces between XCU/DGU and NM-RMS, between VS-RMS and NM-RMS and between DM and NM-RMS.

Solution 1 is only applicable in case of scenario depicted in figure 4.2.3.

Solution 2 is applicable in case of all scenarios depicted by figures 4.2.1, 4.2.2 and 4.2.3.

5 Business level requirements

5.1 Requirements

NOTE 1: The next three business level requirements relate to the capability for the NM-RMS to initiate / stop the retrieval of power, energy and environmental parameters of selected base stations.

REQ-EECMON-CON-001: The DM shall support a capability allowing the NM-RMS to initiate / stop the retrieval of power, energy and environmental parameters of selected base stations.

REQ-EECMON-CON-002: The XCU/DGU shall support a capability allowing the NM-RMS to initiate / stop the retrieval of power, energy and environmental parameters of selected base stations.

REQ-EECMON-CON-003: The VS-RMS shall support a capability allowing the NM-RMS to initiate / stop the retrieval of power, energy and environmental parameters of selected base stations.

NOTE 2: The next three business level requirements relate to the capability for the NM-RMS to periodically receive power, energy and environmental parameters values for selected base stations.

REQ-EECMON-CON-004: The DM shall support a capability allowing the NM-RMS to periodically receive measured power, energy and environmental parameters values, for selected base stations from DM.

REQ-EECMON-CON-005: The XCU/DGU shall support a capability allowing the NM-RMS to periodically receive power, energy and environmental parameters values, for selected base stations from XCU/DGU.

REQ-EECMON-CON-006: The VS-RMS shall support a capability allowing the NM-RMS to periodically receive power, energy and environmental parameters values, for selected base stations from VS-RMS.

NOTE 3: The next three business level requirements relate to the capability for the NM-RMS to control some power, energy and environmental related parameters of selected base stations.

REQ-EECMON-CON-007: The DM shall support a capability allowing the NM-RMS to control power, energy and environmental related parameters of selected base stations via DM.

REQ-EECMON-CON-008: The XCU/DGU shall support a capability allowing the NM-RMS to control power, energy and environmental related parameters of selected base stations via XCU/DGU.

REQ-EECMON-CON-009: The VS-RMS shall support a capability allowing the NM-RMS to control power, energy and environmental related parameters of selected base stations via VS-RMS.

NOTE 4: The next three business level requirements relate to the capability for the NM-RMS to be notified in case of power, energy and environmental related alarms, for selected base stations, which can be detected by XCU/DGU or VS-RMS or DM. Examples of such alarms include: loss of connectivity between XCU/DGU or VS-RMS and external sensors, alarms internal to XCU/DGU or VS-RMS, power, energy and environmental parameters threshold crossing or reaching, etc.

REQ-EECMON-CON-010: The DM shall support a capability allowing the NM-RMS to be notified in case of power, energy and environmental related alarms being detected by DM, for selected base stations.

REQ-EECMON-CON-011: The XCU/DGU shall support a capability allowing the NM-RMS to be notified in case of power, energy and environmental related alarms being detected by XCU/DGU, for selected base stations.

REQ-EECMON-CON-012: The VS-RMS shall support a capability allowing the NM-RMS to be notified in case of power, energy and environmental related alarms being detected by VS-RMS, for selected base stations.

NOTE 5: The next three business level requirements relate to the capability for the NM-RMS to be notified in case of configuration changes, for selected base stations.

REQ-EECMON-CON-013: The DM shall support a capability allowing the NM-RMS to be notified in case of PEE related configuration changes being detected by DM, for selected base stations.

REQ-EECMON-CON-014: The XCU/DGU shall support a capability allowing the NM-RMS to be notified in case of PEE related configuration changes detected by XCU/DGU, for selected base stations.

REQ-EECMON-CON-015: The VS-RMS shall support a capability allowing the NM-RMS to be notified in case of PEE related configuration changes detected by VS-RMS, for selected base stations.

5.2 Actor roles

The function at the NM-RMS controlling and monitoring PEE parameters of base stations in the radio access network.

The function at the DM enabling to control and monitor PEE parameters of base stations with built-in sensors managed by the subject DM.

The function at the XCU/DGU enabling to control and monitor PEE parameters of base stations with external sensors managed by the subject XCU/DGU.

The function at the VS-RMS enabling to control and monitor PEE parameters of base stations with external sensors managed by the subject VS- RMS, via XCU/DGU.

5.3 Telecommunication resources

NM-RMS: The Network Management layer Remote Management Server controlling and monitoring PEE parameters of one or more base stations.

XCU/DGU: The XCU/DGU, offering local capabilities to monitor and control PEE parameters of one or more base station(s).

VS-RMS: The VS-RMS, offering capabilities to monitor and control PEE parameters of one or more base station(s).

5.4 High-level use cases

5.4.1 Use case: Managing the monitoring of PEE parameters

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The NM-RMS wants to monitor PEE parameters of base stations, some of which having built-in sensors, some others having external sensors.	
Actors and Roles	The function in the NM-RMS requesting PEE parameters via DM(s) and /or XCU/DGU(s) and/or VS-RMS(s).	
Telecom resources	NM-RMS, DM, XCU/DGU, VS-RMS.	
Assumptions	Connectivity exists between XCU/DGU, VS-RMS, DM and NM-RMS. Connectivity exists between base stations and XCU/DGU, VS-RMS and DM.	
Pre-conditions	XCU/DGU, VS-RMS, DM and NM-RMS are up and running.	
Begins when	The NM-RMS requests the XCU/DGU or VS-RMS or DM to collect values of certain PEE parameters of one or more base station(s) by sending an appropriate request message to the XCU/DGU or VS-RMS or DM.	
Step 1 (M)	The XCU/DGU or VS-RMS or DM receives the request message.	
Step 2 (M)	The XCU/DGU or VS-RMS or DM processes the request message, identifies the requested PEE parameters and retrieves the requested PEE parameters values from selected base stations.	
Step 3 (M)	Periodically, the XCU/DGU or VS-RMS or DM sends to the NM-RMS the requested PEE parameters values in a response message.	
Ends when	The NM-RMSC requests XCU/DGU or VS-RMS or DM to stop collecting values of certain PEE parameters of one or more base station(s) by sending an appropriate message to the XCU/DGU or VS-RMS or DM.	
Exceptions	The NM-RMS does not receive the requested PEE parameters values. Numerous failure reasons may be indicated.	
Post-conditions	The requested PEE parameters values have been returned.	
Traceability	Requirement **REQ-EECMON-CON-001**, **REQ-EECMON-CON-002**, **REQ-EECMON-CON-003**, **REQ-EECMON-CON-004**, **REQ-EECMON-CON-005**, **REQ-EECMON-CON-006** in clause 5.1.	

5.4.2 Use case: Controlling PEE related parameters

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The NM-RMS wants to control PEE related parameters of base stations, e.g. timers, thresholds, etc.	
Actors and Roles	The function in the NM-RMS controlling PEE related parameters via DM and/or XCU/DGU and/or VS-RMS.	
Telecom resources	NM-RMS, DM, XCU/DGU, VS-RMS.	
Assumptions	Connectivity exists between the DM, XCU/DGU, VS-RMS and the NM-RMS. Connectivity exists between base stations and XCU/DGU, VS-RMS, DM.	
Pre-conditions	XCU/DGU, VS-RMS, DM and NM-RMS are up and running.	
Begins when	The NM-RMS requests the XCU/DGU or VS-RMS or DM to set values of certain PEE related parameters of one or more base station(s) by sending an appropriate request message to the XCU/DGU or VS-RMS or DM.	
Step 1 (M)	The XCU/DGU or VS-RMS or DM receives the request message.	
Step 2 (M)	The XCU/DGU or VS-RMS or DM processes the request message, identifies the requested PEE related parameters and sets the PEE related parameters values of selected base stations.	
Step 3 (M)	The XCU/DGU or VS-RMS or DM sends back to the NM-RMS the actual PEE related parameters values in a response message.	
Ends when	The NM-RMS has received the actual PEE related parameters values.	
Exceptions	The XCU/DGU or VS-RMS or DM cannot set the PEE related parameters to values provided by the NM-RMS. Numerous failure reasons may be indicated.	
Post-conditions	The requested PEE related parameters values have been set on selected base stations.	
Traceability	Requirement **REQ-EECMON-CON-007**, **REQ-EECMON-CON-008**, **REQ-EECMON-CON-009** in clause 5.1.	

5.4.3 Use case: Supervising PEE related alarms

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The NM-RMS wants to supervise PEE related alarms of base stations.	
Actors and Roles	The function in the NM-RMS supervising PEE related alarms via DM and/or XCU/DGU and/or VS-RMS.	
Telecom resources	NM-RMS, DM, XCU/DGU, VS-RMS.	
Assumptions	Connectivity exists between the DM, XCU/DGU, VS-RMS and the NM-RMS. Connectivity exists between base stations and XCU/DGU, VS-RMS, DM.	
Pre-conditions	XCU/DGU, VS-RMS, DM and NM-RMS are up and running.	
Begins when	An alarm related to a PEE parameter occurs on a base station being supervised by the NM-RMS.	
Step 1 (M)	In case this alarm relates to a base station with external sensor, or relates to XCU/DGU or VS-RMS, or relates to the connectivity between the external sensor and XCU/DGU or VS-RMS, XCU/DGU or VS-RMS sends the corresponding alarm notification to NM-RMS. In case this alarm relates to a base station with built-in sensor, DM sends the corresponding alarm notification to NM-RMS.	
Ends when	NM-RMS receives the alarm notification from XCU/DGU or VS-RMS or DM.	
Exceptions	Information conveyed in the alarm notification received by NM-RMS from XCU/DGU or VS-RMS or DM cannot be treated by NM-RMS.	
Post-conditions	NM-RMS has received the alarm notification from XCU/DGU or VS-RMS or DM.	
Traceability	Requirement **REQ-EECMON-CON-010**, **REQ-EECMON-CON-011**, **REQ-EECMON-CON-012**, in clause 5.1.	

5.4.4 Use case: Monitoring PEE related configuration changes

Use case stage	Evolution/Specification	<<Uses>> Related use
Goal	The NM-RMS wants to monitor PEE configuration changes such as e.g. new base station, new XCU/DGU.	
Actors and Roles	The function in the NM-RMS monitoring PEE related alarms via DM and/or XCU/DGU and/or VS-RMS.	
Telecom resources	NM-RMS, DM, XCU/DGU, VS-RMS.	
Assumptions	Connectivity exists between the DM, XCU/DGU, VS-RMS and the NM-RMS. Connectivity exists between base stations and XCU/DGU, VS-RMS, DM.	
Pre-conditions	XCU/DGU, VS-RMS, DM and NM-RMS are up and running.	
Begins when	A PEE related configuration change occurs, related to a base station in scope of the NM-RMS.	
Step 1 (M)	In case this configuration change is detected on a base station with external sensor, or relates to XCU/DGU or VS-RMS, XCU/DGU or VS-RMS sends the corresponding configuration change notification to NM-RMS. In case this PEE related configuration change relates to a base station with built-in sensor, DM sends the corresponding configuration change notification to NM-RMS.	
Ends when	NM-RMS receives the configuration change notification from XCU/DGU or VS-RMS or DM.	
Exceptions	Information conveyed in the configuration change notification received by NM-RMS from XCU/DGU or VS-RMS or DM cannot be treated by NM-RMS.	
Post-conditions	NM-RMS has received the configuration change notification from XCU/DGU or VS-RMS or DM.	
Traceability	Requirement **REQ-EECMON-CON-013**, **REQ-EECMON-CON-014**, **REQ-EECMON-CON-015** in clause 5.1.	

6 Specification level requirements

6.1 Requirements

6.1.1 Requirements for solution 1

REQ-PEECMON-OPT1-FUN-001: for configuration management purposes, requirements from either 3GPP TS 32.601 [5] clause 4, or from 3GPP TS 32.611 [8] clause 4.3, shall apply.

REQ-PEECMON-OPT1-FUN-002: for performance management purposes, requirements from 3GPP TS 32.411 [6] – clauses 4 and 5 - shall apply.

REQ-PEECMON-OPT1-FUN-003: for fault management purposes, requirements from 3GPP TS 32.111-1 [7] – clauses 4 and 5 - shall apply.

6.1.2 Requirements for solution 2

REQ-PEECMON-OPT2-FUN-001: The IRPAgent shall support a capability allowing the IRPManager to initiate / stop the retrieval of power, energy and environmental parameters of selected base stations.

REQ-PEECMON-OPT2-FUN-002: The IRPAgent shall support a capability allowing the IRPManager to periodically receive measured power, energy and environmental parameters values, for selected base stations.

REQ-PEECMON-OPT2-FUN-003: The IRPAgent shall support a capability allowing the IRPManager to be notified in case of power, energy and environmental parameters related alarms, for selected base stations.

REQ-PEECMON-OPT2-FUN-004: The IRPAgent shall support a capability allowing the IRPManager to be notified in case of power, energy and environmental parameters related configuration changes being detected by the IRPAgent, for selected base stations.

6.2 Actor roles

6.2.1 Actor roles for solution 1

IRPManager at the NM-RMS, controlling and monitoring PEE parameters of base stations in the radio access network.

IRPAgent at the DM, enabling to control and monitor PEE parameters of base stations with built-in sensors managed by the subject DM.

6.2.2 Actor roles for solution 2

IRPManager at the NM-RMS, controlling and monitoring PEE parameters of base stations in the radio access network.

IRPAgent at the DM, enabling to control and monitor PEE parameters of base stations with built-in sensors managed by the subject DM.

IRPAgent at the XCU/DGU, enabling to control and monitor PEE parameters of base stations with external sensors managed by the subject XCU/DGU.

IRPAgent at the VS- RMS, enabling to control and monitor PEE parameters of base stations with external sensors managed by the subject VS- RMS, via XCU/DGU.

6.3 Telecommunication resources

6.3.1 Telecommunication resources for solution 1

NM-RMS: The Network Management layer Remote Management Server controlling and monitoring PEE parameters of one or more base stations.

6.3.2 Telecommunication resources for solution 2

All telecommunication resources, as defined in clause 5.3.

6.4 Use cases

6.4.1 Use cases for solution 1

6.4.1.1 Use case: Initiating PEE performance management job

IRPManager initiates a PM job by sending appropriate request to IRPAgent, in compliance with PM IRP – cf. 3GPP TS 32.411 [6]. This use case corresponds to the high-level use case "Managing the monitoring of PEE parameters" (cf. clause 5.4.1 of the present document).

6.4.1.2 Use case: Controlling PEE related threshold

IRPManager sends appropriate request to IRPAgent, in compliance with PM IRP – cf. 3GPP TS 32.411 [6]. This use case corresponds to the high-level use case "Controlling PEE related parameters" (cf. clause 5.4.2 of the present document).

6.4.1.3 Use case: Supervising PEE related alarms

In case of PEE related alarms, IRPAgent emits alarm notifications to inform IRPManager, in compliance with Alarm IRP – cf. 3GPP TS 32.111-1 [7]. This use case corresponds to the high-level use case "Supervising PEE related alarms" (cf. clause 5.4.3 of the present document).

6.4.1.4 Use case: Monitoring PEE related configuration changes

In case of PEE related configuration changes, IRPAgent emits configuration change notifications to inform IRPManager, in compliance with Notification IRP – cf. 3GPP TS 32.301 [2]. This use case corresponds to the high-level use case "Monitoring PEE related configuration changes" (cf. clause 5.4.4 of the present document).

6.4.2 Use cases for solution 2

See use cases in clause 5.4.

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2018-03	SA#79	SP-180071				Presented for approval	2.0.0
2018-03	SA#79					Upgrade to change control version	15.0.0
2020-07	-	-	-	-	-	Update to Rel-16 version (MCC)	16.0.0
2022-03	-	-	-	-	-	Update to Rel-17 version (MCC)	17.0.0
2024-04	-	-	-	-	-	Update to Rel-18 version (MCC)	18.0.0
2025-09	SA#109	-	-	-	-	Update to Rel-19 version (MCC)	19.0.0

History

Document history		
V19.0.0	October 2025	Publication