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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

Reference

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Environmental Engineering (EE).

The present document is part 12 of a multi-part deliverable covering monitoring and control interface for infrastructure equipment (power, cooling and building environment systems used in telecommunication networks), as identified below:

Part 1: "Generic Interface";

Part 2: "DC power system control and monitoring information model";

Part 3: "AC UPS power system control and monitoring information model";

Part 4: "AC distribution power system control and monitoring information model";

Part 5: "AC diesel back-up generator system control and monitoring information model";

Part 6: "Air Conditioning System control and monitoring information model";

Part 7: "Other utilities system control and monitoring information model";

Part 8: "Remote Power Feeding System control and monitoring information model";

Part 9: "Alternative Power Systems";

Part 10: "AC inverter power system control and monitoring information model";

Part 11: "Battery system with integrated control and monitoring information model";

Part 12: "ICT equipment power, energy and environmental parameters monitoring information model".

The goal of the present document is to define the measurement of electrical power and energy consumption of ICT equipment as well as environmental parameters (temperature, hygrometry) in order to improve energy monitoring and to correlate the power consumption to equipment operation activity (telecom traffic, computation, etc.). It is also to define the transfer protocol of this measurement data from site to network operation centre. Knowing power consumption gives the possibilities to reduce energy consumption of equipment and/or network. Granularity, measurement period and accuracies are defined to meet these targets. They may depend on equipment types and location in the different segments of a network (customer termination, access, core, data-center, etc.). In addition, these measurements can be used to improve engineering and operation including more accurate dimensioning of power systems, network evolution modelling and prevision, audit on field, etc.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document defines measurement and monitoring of power, energy and environmental parameters for ICT equipment in telecommunications or datacenter or customer premises.

It defines the power, energy and environmental parameters monitoring interface of ICT equipment based on generic ETSI ES 202 336-1 [1] interface so that correlations can be made with ICT equipment parameters (traffic, flowrate, number of connected lines, radio setting, QoS KPI, etc.) in the network management system.

Correlations of monitored data (power, energy consumption and environmental values) with the ICT equipment parameters and settings are not in the scope of the present document.

The monitoring interface covers:

- Internal power consumption measurement on the ICT equipment powered in DC and AC.
- Power consumption measurement external to the ICT equipment (if not implemented internally, e.g. legacy equipment).
- Energy metering based on power consumption measurement.
- Environmental parameters of the ICT equipment (e.g. temperature at air inlet of equipment).

The present document defines:

- The minimum set of exchanged information required at the interface, described in "natural language" in text tables including parameters such as precision, range, etc. and settings such as data acquisition periodicity, etc.
- The XML files with tags and variables corresponding to the data in the tables in complement to general rules defined in ETSI ES 202 336-1 [1] and ETSI ES 202 336-2 [4].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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The following referenced documents are necessary for the application of the present document.

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

[2] ETSI ES 202 336 (all parts): "Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks)".

[3] ETSI ETS 300 132-1: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac) derived from direct current (dc) sources".

[4] ETSI ES 202 336-2: "Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (Power, Cooling and environment systems used in telecommunication networks); Part 2: DC power system control and monitoring information model".

[5] ETSI ES 202 336-3: "Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks); Part 3: AC UPS power system control and monitoring information model".

[6] ETSI ES 202 336-10: "Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks); Part 10: AC inverter power system control and monitoring information model".

[7] ETSI EN 300 132-2: "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 2: Operated by -48 V direct current (dc)".

[8] ETSI ES 202 336-4: "Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks); Part 4: AC distribution power system control and monitoring information model".

[9] ETSI ES 202 336-6: "Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks); Part 6: Air Conditioning System control and monitoring information model".

[10] ETSI EN 300 019-2 (all subparts): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2: Specification of environmental tests".

[11] ETSI EN 300 019-1 (all subparts): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1: Classification of environmental conditions".

2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] IEEE 802.1 to 802.11: "IEEE Standard for Local & Metropolican Area Network".

[i.2] ISO/IEC 8879: "Information processing -- Text and office systems -- Standard Generalized Markup Language (SGML)".

[i.3] ETSI ES 203 215: "Environmental Engineering (EE); Measurement Methods and Limits for Power Consumption in Broadband Telecommunication Networks Equipment".

[i.4] ETSI ES 202 706: "Environmental Engineering (EE); Measurement method for power consumption and energy efficiency of wireless access network equipment".

NOTE: ETSI ES 202 706 is revision of the ETSI TS 102 706.

[i.5] ETSI ES 201 554: "Environmental Engineering (EE); Measurement method for Energy efficiency of Mobile Core network and Radio Access Control equipment".

[i.6] ETSI ES 203 184: "Environmental Engineering (EE); Measurement Methods for Power Consumption in Transport Telecommunication Networks Equipment".

[i.7] ETSI ES 203 136: "Environmental Engineering (EE); Measurement methods for energy efficiency of router and switch equipment".

[i.8] ETSI EN 301 575: "Environmental Engineering (EE); Measurement method for energy consumption of Customer Premises Equipment (CPE)".

[i.9] ETSI ES 203 237: "Environmental Engineering (EE); Green Abstraction Layer (GAL); Power management capabilities of the future energy telecommunication fixed network nodes".

[i.10] ETSI ES 203 228: "Environmental Engineering (EE); Assessment of Mobile Network Energy Efficiency".

[i.11] Recommendation ITU-T M.3000 serie: "TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits Telecommunications management network".

[i.12] Recommendation ITU-T M.3010 (Series M): "TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits Telecommunications management network - Principles for a telecommunications management network".

[i.13] ETSI TS 132 101 (V12.0.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Principles and high level requirements (3GPP TS 32.101 version 12.0.0 Release 12)".

[i.14] ETSI EN 302 099: "Environmental Engineering (EE); Powering of equipment in access network".

[i.15] ETSI EN 300 132-3-1: "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 3: Operated by rectified current source, alternating current source or direct current source up to 400 V; Sub-part 1: Direct current source up to 400 V".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

NOTE: Terms referring to energy interface, equipment and distribution are described in power distribution standards ETSI ETS 300 132-1 [3], ETSI EN 300 132-3-1 [i.15], ETSI EN 300 132-2 [7] for ac and dc interface A and A3 and ETSI EN 302 099 [i.14] for access network equipment powering.

AC distribution power system: device or system that distribute AC voltage or convert DC voltage to AC voltage and provides electrical power without interruption in the event that commercial power drops to an unacceptable voltage level

alarm: any information signalling abnormal state, i.e. different to specified normal state of hardware, software, environment condition (temperature, humidity, etc.)

NOTE: The alarm signal should be understood by itself by an operator and should always have at least one severity qualification or codification (colour, level, etc.). alarm message structure are defined in ETSI ES 202 336-1 [1].

EXAMPLE: Rectifier failure, battery low voltage, etc.

board: electronic part of an equipment (e.g. a blade server)

cabinet: closed enclosure including several shelves or racks

Control Unit (CU): integrated unit in an equipment to monitor and control this equipment through sensors and actuators

Data Gathering Unit (DGU): functional unit used for several functions:

- collect serial, digital, and analog data from several equipment;
- option to send (output) serial or digital commands;
- forward/receive information to/from the Local/Remote Management Application via agreed protocols;
- mediation between interfaces and protocols.

NOTE: This function may be integrated as part of specific equipment.

DC back-up system: device or system that provides electrical power without interruption in the event that commercial power drops to an unacceptable voltage level

DC distribution power system: device or system to distribute DC voltage

Ethernet: LAN protocol

NOTE: Equivalent to IEEE 802.1 to 802.11 [i.1].

event: any information signalling a change of state which is not an alarm: e.g. battery test, change of state of battery charge

NOTE: The event signal should be understood by itself by an operator It should be transmitted in a formatted structure with text message and other fields like for alarm. An event can be coded as an alarm with severity "0".

eXtensible Mark-up Language (XML): application profile or restricted form of SGML

NOTE: By construction, XML documents are conforming SGML the Standard Generalized Markup Language (ISO/IEC 8879 [i.2]) documents. XML is designed to describe data and focus on what data is. XML should be discerned from the well known Hypertext Transfer Mark-up Language (HTML) which was designed to display data and to focus on how data looks.

infrastructure equipment: power, cooling and building environment systems used in telecommunications centres and Access Networks locations

EXAMPLE: Cabinets, shelters, underground locations, etc.

module: closed unit including electronic boards forming part of a larger system (e.g. sub-unit of a base station in a cabinet or separated)

rack: sub part of the cabinet including ICT equipment rest

shelf: level in a cabinet

Warning: low severity alarm

World Wide Web Consortium (W3C): consortium founded in October 1994 to develop common interoperable protocols and promote World Wide Web

NOTE: See http://www.w3c.org.

XCU: CU enabled to communicate using XML interface as defined in the present document

xDSL: global designation of the digital subscriber line (DSL) technologies

3.2 Symbols

For the purposes of the present document, the following symbols apply:

E	electric energy
I	electric current
P	electric power
T	temperature
U	electric voltage or difference of potential

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

µC	Microcontroler
AC	Alternating Current
ADC	Analog Digital Conversion or Converter
ADSL	Asynchronous Digital Subscriber Line
BB	Broad-Band
BBU	Base-Band Unit
BS	Base Station
CU	Control Unit of an equipment
DC	Direct Current
DGU	Data Gathering Unit
DSLAM	Digital Subscriber Line Access Multiplexer
EEPROM	Electricaly Erasable Programmable Read Only Memory
EMAN	Energy Manager (abbreviation of IETF specification)
E-UTRAN	Extended UTRAN
FAN	Fixed Access Network
HTML	Hypertext Transfer Make-up Language
HTTP	HyperText Transfer Protocol
ICT	Information and Communication Technology
IETF	Internet Engineering Task Force
IP	Internet Protocol
KPI	Key Performance Indicator
LAN	Local Array Network
MSAN	Multiservice Access Network
NE	Network Element
NMS	Network Management System
OA	Operational Amplifier
OLT	Opitcal Line Termination
ONT	Optical Network Termination
ONU	Optical Network Unit
OSS	Operations Support System
PEE	Power, Energy, Environmental parameters
PF	Power Factor
PSU	Power Supply Unit
RMA	Remote Management Application
RMS	Root Mean Square
RRU	Remote Radio Unit
SGML	Standard Generalized Markup Language
TCP	Transmission Control Protocol for IP
TMN	Telecom Management Network

NOTE: As defined in Recommendation ITU-T M.3000 series [i.11].

UPS	Un-interruptible Power Supply
UTRAN	Extended Terrestrial Radio Access Network
W3C	World Wide Web Consortium
XCU	XML enabled CU
XML	eXtensible Mark-up Language (see W3C)

4 ICT power, energy and environmental parameters monitoring system

4.1 General description

The basic principles of power, energy and environment parameters measurements of ICT equipment and their transfer to the network management systems (NMS) are shown in figure 1.

The following measuring device are used: wattmeter or energy meter (W, Wh) and/or Voltage (V) and/or current meter (A). Voltage or current shall be recorded for monitoring when used to assess the power and energy consumption. Temperature shall also be measured and recorded.

NOTE 1: The energy consumption can be calculated from power measurement over a period of time.

NOTE 2: Humidity should be measured at the level of room or air conditioning, not at equipment level.

In the preferred implementation, power and energy measurements shall be taken down-stream of power supply interface A or A3 as defined in ETSI ETS 300 132-1 [3], ETSI EN 300 132-2 [7] and ETSI EN 300 132-3-1 [i.15] and inside the ICT equipment (type 1 measurement).

Otherwise e.g. on legacy equipment, power and energy measurements can be taken upstream of interface A outside the ICT equipment (type 2 measurement).

The electrical measurement sensors shall be located the closest as possible of the power electrical interface (A or A3) and the thermal environment sensors shall be placed in the air flow of the air inlet of the equipment or shelter.

For interoperability, measurement values are transmitted directly using ETSI ES 202 336-1 [1] and the present document's protocol, or indirectly through the TMN protocol over the NMS.

NOTE 3: The Network Management System (NMS) is the functional entity from which the network operator monitors and controls the system at centralized level and manage operational and maintenance activities, it is using a TMN protocol not defined in the present document. The operation and Maintenance functions are based on the principles of the Telecommunication Management Network (TMN) of Recommendation ITU-T M.3010 [i.12] introduced by Recommendation ITU-T M.3000 series [i.11].

NOTE 4: The measurements done using this standard can be used as inputs for enabling:

- assessment of Power Consumption in Broadband Telecommunication Networks Equipment [i.3] Transport Telecommunication Networks Equipment [i.6], Customer Premises Equipment (CPE) [i.8];
- assessment of Energy efficiency of wireless access network equipement [i.4], Core network equipment [i.5], router and switch equipment [i.7], Mobile Network [i.10];
- Power management capabilities of the future energy telecommunication fixed network nodes with Green Abstraction Layer (GAL) [i.9].