



**Environmental Engineering (EE);
Powering of equipment in access network**

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Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI EN Approval Procedure (ENAP).

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
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Modal verbs terminology

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1 Scope

The present document describes the principles for powering of Telecommunications Equipment (TE) in access networks (both traditional copper based and Next Generation fibre and/or hybrid based) and contains requirements for the powering systems, laying down:

- the characteristics of the input and output interfaces of the power units; the recommendations for TE power protection, also regarding network integrity and public services availability requirements;
- the management data, necessary to guarantee the required availability of the network and provided public services and to ensure the maintenance of the TE power units.

The present document takes into account the innovative characteristics of fibre-based access network equipment and considers the intrinsic limitations of local power plants and power distribution when ICT equipment is installed inside telecom centre, local exchanges, street cabinets or inside buildings: it goes from "complete integration of the power plant in the TE" to "remote power feeding from a distant power plant".

The present document provides detailed information in annex A on the improved reliability of public electric power grid and on the improved reliability and availability of new fibre-based NGA network. It should be considered that, for street cabinet TE, the local power scenario is common, and, in that case, the main power supply availability characteristics are mainly based on electrical energy provider's performance.

The present document applies to the powering of all equipment of the access network (copper, fibre or radio networks) located inside or outside telecommunications centres or local exchanges, differentiating the applicable and sustainable power protection requirements. The access network is defined as the part of the telecommunications network, which comprises the network termination (passive or active) that is installed inside customer premises and the first exchange that can be also the broadband local exchange.

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 referenced document (including any amendments) applies.

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

- [1] [ETSI EN 300 132-1](#): "Environmental Engineering (EE); Power supply interface at the input to Information and Communication Technology (ICT) equipment; Part 1: Alternating Current (AC)".
- [2] [ETSI EN 300 132-2](#): "Environmental Engineering (EE); Power supply interface at the input of Information and Communication Technology (ICT) equipment; Part 2: -48 V Direct Current (DC)".
- [3] [IEC 62368-3](#): "Audio/video, information and communication technology equipment - Part 3: Safety aspects for DC power transfer through communication cables and ports".
- [4] [EN 60038](#): "CENELEC standard Voltages", (produced by CENELEC).
- [5] [EN 60664-1](#): "Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests", (produced by CENELEC).
- [6] [EN 50310](#): "Application of equipotential bonding and earthing in buildings with information technology equipment", (produced by CENELEC).

- [7] [ETSI EN 300 253](#): "Environmental Engineering (EE); Earthing and bonding of ICT equipment powered by -48 VDC in telecom and data centres".
- [8] [Recommendation ITU-T K.35](#): "Bonding configurations and earthing at remote electronic sites".
- [9] [Recommendation ITU-T K.45](#): "Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents".
- [10] [ETSI ES 203 215](#): "Environmental Engineering (EE); Measurement Methods and Limits for Power Consumption in Broadband Telecommunication Networks Equipment".
- [11] [ETSI EN 300 132-3](#): "Environmental Engineering (EE); Power supply interface at the input of Information and Communication Technology (ICT) equipment; Part 3: Up to 400 V Direct Current (DC)".
- [12] [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".
- [13] [ETSI TS 101 548-1](#): "Access, Terminals, Transmission and Multiplexing (ATTM); European Requirements for Reverse Powering of Remote Access Equipment; Part 1: Twisted pair networks".
- [14] [ETSI EN 301 605](#): "Environmental Engineering (EE); Earthing and bonding of 400 VDC data and telecom (ICT) equipment".
- [15] Void.
- [16] [HD 60364 series](#): "Low Voltage electrical installations", produced by CENELEC.
- [17] [ETSI ES 202 336-8](#): "Environmental Engineering (EE); Monitoring and Control Interface for Infrastructure Equipment (Power, Cooling and Building Environment Systems used in Telecommunication Networks); Part 8: Remote Power Feeding System control and monitoring information model".
- [18] [ETSI ES 203 408](#): "Environmental Engineering (EE); Colour and marking of DC cable and connecting devices".

2.2 Informative references

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- [i.1] ETSI EN 300 019-1-1: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-1: Classification of environmental conditions; Storage".
- [i.2] ETSI EN 300 019-1-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1: Classification of environmental conditions; Sub-part 3: Stationary use at weatherprotected locations".
- [i.3] ETSI EN 300 019-1-4: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1: Classification of environmental conditions; Sub-part 4: Stationary use at non-weatherprotected locations".

- [i.4] ETSI EN 300 019-1-8: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-8: Classification of environmental conditions; Stationary use at underground locations".
- [i.5] Void.
- [i.6] Void.
- [i.7] HD 60364-1: "Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions", (produced by CENELEC).
- [i.8] ETSI EN 302 999: "Safety; Remote Power Feeding Installations; Safety requirements for the erection and operation of information technology installations with remote power feeding".
- [i.9] ENISA: "Power Supply Dependencies in the Electronic Communications Sector Survey, analysis and recommendations for resilience against power supply failures", December 2013.
- [i.10] Council of European Energy Regulators (CEER): "[7TH CEER-ECRB Benchmarking report on the quality of electricity and gas supply](#)", Ref: C22-EQS-103-03.
- [i.11] [ARERA Annual report](#).
- [i.12] ETSI TS 103 553-1: "Environmental Engineering (EE); Innovative energy storage technology for stationary use; Part 1: Overview".
- [i.13] Void.
- [i.14] Void.
- [i.15] IEC EN 62368-3: "Audio/video, information and communication technology equipment - Part 3: Safety aspects for DC power transfer through communication cables and ports".
- [i.16] Recommendation ITU-T L.1001: "External universal power adapter solutions for stationary information and communication technology devices".
- [i.17] IEC EN 62368-1: "Audio/video, information and communication technology equipment - Part 1: Safety requirements".
- [i.18] [Directive \(EU\) 2022/2555](#) of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (NIS 2 Directive).
- [i.19] ETSI EN 303 215: "Environmental Engineering (EE); Measurement methods and limits for power consumption in broadband telecommunication networks equipment".
- [i.20] Void.
- [i.21] TR 62102: "Electrical safety - Classification of interfaces for equipment to be connected to information and communications technology networks", (produced by CENELEC).
- [i.22] Void.
- [i.23] Recommendation ITU-T L.1220 (2017-08): "Innovative energy storage technology for stationary use - Part 1: Overview of energy storage".
- [i.24] Void.
- [i.25] Recommendation ITU-T L.1202 (2015): "Methodologies for evaluating the performance of an up to 400 VDC power feeding system and its environmental impact".
- [i.26] Void.
- [i.27] Broadband Forum oneM2M TR-301: "Architecture and Requirements for Fiber to the Distribution Point".

- [i.28] [ETSI TS 103 553-2](#): "Environmental Engineering (EE); Innovative energy storage technology for stationary use; Part 2: Battery".
- [i.29] [ETSI TS 103 553-3](#): "Environmental Engineering (EE); Innovative energy storage technology for stationary use; Part 3: Supercapacitor".
- [i.30] ETSI ES 202 336-11: "Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (Power, Cooling and environment systems used in telecommunication networks); Part 11: Battery system with integrated control and monitoring information model".
- [i.31] Recommendation ITU-T I.112: "Vocabulary of terms for ISDNs".
- [i.32] Recommendation ITU-T L.1221: "Innovative energy storage technology for stationary use - Part 2: Battery".
- [i.33] Recommendation ITU-T L.1222: "Innovative energy storage technology for stationary use - Part 3: Supercapacitor technology".
- [i.34] [Recommendation ITU-T L.1200 \(May 2012\)](#): "Direct current power feeding interface up to 400 V at the input to telecommunication and ICT equipment".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

access gateway: gateway that interworks a significant number of analogue lines to a packet network and is located at the operator's premises

access network: part of a telecommunications network between the Network Termination/Access Gateway and the first switching unit

backfeeding or reverse powering: powering architecture that can supply power to access network units from the customer through its final distribution access copper pair

NOTE: Access network units may be ONU, ONT or remote DSL units.

centralized powering: remote powering in which the remote feeding source is located in a telecommunications centre

cluster powering: remote powering of a cluster of equipment (1 to n items of equipment), in which the remote feeding source is located outside a telecommunications centre

electric energy provider: provider of electrical energy from the public grid (mains)

ES1, ES2, ES3: See IEC EN 62368-1 [i.17].

interface A: -48 VDC power interface at input of Telecom/ICT equipment with voltage range and other electrical specifications defined in ETSI EN 300 132-2 [2]

interface A1: up to 400 VAC rms power interface at input of Telecom/ICT equipment with voltage range and other electrical specifications defined in ETSI EN 300 132-1 [1]

interface A3: up to 400 VDC power interface at input of Telecom/ICT equipment with voltage range, and other electrical specifications defined in ETSI EN 300 132-3 [11]

Local Power Unit (LPU): power supply equipment whose function is to supply a telecommunication equipment situated at the same location

NOTE: It is generally locally connected to the mains and provides DC or AC voltage output to feed telecommunication equipment.

local powering: powering principle of a telecommunications equipment by a (dedicated) power unit implemented in the same location

network termination: functional group on the network side of a user-network interface

NOTE: Source: Recommendation ITU-T I.112 [i.31].

primary circuit: See IEC EN 62368-1 [i.17].

protective device selectivity: coordination of the operating characteristics of two or more protective devices to ensure faulty equipment is safely disconnected with no or limited impact on other parts of the system

PS1, PS2, PS3: See IEC EN 62368-1 [i.17].

Remote Feeding Telecommunication (RFT) circuit: secondary circuit within the equipment, intended to supply or receive DC power via a telecommunication network at voltages equal to or exceeding the limits for TNV circuits, and on which overvoltages from telecommunication networks are possible

Remote Power Receiver (RPR): unit receiving remote DC from RPU through power lines and converting it to input power interface of a TE or a radio unit

NOTE: The RPR may be an external unit with an adapted power interface (e.g. -48 VDC) or an integrated function of a telecommunications equipment.

Remote Power Unit (RPU): unit, powered by the grid or by a DC power system delivering -48 VDC or up to 400 VDC, which supplies remote DC on power lines to distant Telecommunication Equipment (TE) e.g. radio unit or RPR

Remote Powering (RP): power feeding of a telecommunications equipment by a remote power circuit

NOTE: Such a circuit consists of a remote power unit, distribution wiring, and fed receivers.

RFT-C circuit: RFT circuit which is so designed and protected that under normal operating conditions and single fault conditions the currents in the circuit do not exceed defined values

RFT-V circuit: RFT circuit which is so designed and protected that under normal operating conditions and single fault conditions the voltages are limited and the accessible area of contact is limited

secondary circuit: See IEC EN 62368-1 [i.17].

SELV circuit: See IEC EN 62368-1 [i.17].

TN-C: See HD 60364-1 [i.7].

TN-S: See HD 60364-1 [i.7].

TNV circuit: See EN 62368-1 [i.24].

TT: See HD 60364-1 [i.7].

3.2 Symbols

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

$I_1, I_2, I_3, I_4, I_5, I_6$	power interface
L-	Power line of negative potential polarity
L+	Power line of positive potential polarity
S	Signal
S/P _{filter}	Filter separating signal S and power P

3.3 Abbreviations

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

A _{bat}	Autonomy of a battery
AC	Alternating Current
AN	Access Node
ANU	Access Network Unit
B	Battery
CB	Circuit Breaker
CO	Central Office
CPE	Customer's Premises Equipment
DC	Direct Current
DC/DC	Direct Current/Direct Current

NOTE: DC/DC are used in general in expression such as DC/DC converter or DC/DC conversion.

DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Module
EC _{bat}	Energy Capacity of a battery
EMC	ElectroMagnetic Compatibility
FTTB	Fibre To The Building
FTTC	Fibre To The Curb
FTTCab	Fibre To The Cabinet
FTTdp	Fibre To The distribution point
FTTH	Fibre To The Home
HD	Harmonization Document
HTA	Home Terminal Adaptor
ICT	Information & Communication Technology
IEC	International Electrical Committee
ISDN	Integrated Services Digital Network
IT	Information Technology
ITU-T	International Telecommunication Union - Telecommunication standardization sector
LED	Light Emitting Diode
LPU	Local Power Unit
LV	Low Voltage
MDF	Main Distribution Frame
MP	Mid-Point
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NGA	Next Generation Access
ONT	Optical Network Termination
ONU	Optical Network Unit
P	Power

NOTE: Indices can be used associated with P as P_{indice} in some clauses to clarify which power P is used in formula.

PD	Powered Device
PM	Powering Method
POTS	Plain Old Telephone Service
PSE	Power Sourcing Equipment
PSTN	Public Switched Telephone Network
PSU	Power Supply Unit
R	Rectifier
RFT	Remote Feeding Telecommunication
RFT-C	Remote Feeding Telecommunication-Current
RFT-V	Remote Feeding Telecommunication-Voltage
RP	Remote Power
RPR	Remote Power Receiver
RPU	Remote Power Unit
SAIDI	System Average Interruption Duration Index

SAIFI	System Average Interruption Frequency Index
SELV	Safety Extra Low Voltage
TC	Telecommunication Centre
TE	Telecom Equipment
TLC	TeLecommuniCation
TNV	Telecommunication Network Voltage
UPS	Uninterruptible Power Supply
VRLA	Valve Regulated Lead Acid

4 Introduction

4.1 General

Innovative fibre-based and hybrid-based NGA network TE has changed the traditional powering paradigm.

The present document proposes the viable measures to comply with the integrity, availability and uninterrupted telephone/VoIP provision that the European Directive defines for public networks [i.18].

It describes different configurations of powering the TE and the impacts on networks and services continuity and reliability:

- Local power supply for TE (e.g. street cabinet, active network termination, etc.).
- Remote Feeding to TE from central office through copper access pair.
- Cluster Power supply feeding power for a cluster of TE.
- Remote power feeding to TE from centre or cluster power through a power cable.
- Back feeding or Reverse Powering architecture that can supply power to Access Network Units such as ONU or ONT or remote DSL unit from the customer premises through its final distribution access copper pair.

The present document provides information on powering equipment, power strategy, local powering, remote powering, power management, safety. EMC and environmental requirements.

5 Powering configurations

5.0 General

Next Generation Access (NGA) networks induce changes in the powering model and in the need of local back-up, when compared to traditional access networks centre where the back-up is obtained by battery alone or with back-up generator source (Diesel, fuel cell).

Both fixed and mobile NGA networks, usually, require local powering of access network active equipment that are installed outside Central Offices and closer to the end user's premises, Typical NGA scenarios are fiber-based FTTH, hybrid FTTC/FTTCab, FTTdp and FTTB architectures.

The new local powering scenario of fibre-based or hybrid fibre/copper NGA networks of a public Telecom networks and services provider, shall include back-up measures in order to ensure to comply with continuity, availability and reliability requirements defined by European Directive [i.18]. But for FTTB, FTTC/FTTCab, FTTdp with the increasing deployment of a great number of distributed active small cabinets, that can be installed inside buildings (FTTB) or in the street (FTTC, FTTCab), the basic power supply backup autonomy has to be optimized, due to a large number of small active cabinets to be installed at optimized costs and dimensions. Only when it is required for some service offers, a long back-up autonomy is obtained by local battery extension or alternatively by remote powering solution proposed to avoid local energy storage.