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**Environmental Engineering (EE);**
**Power supply interface at the input of**
**Information and Communication Technology (ICT) equipment;**
**Part 2: -48 V Direct Current (DC)**

Reference
REN/EE-02109

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***ETSI***

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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.



The present document concerns the requirements for the interface between ICT equipment and its power supply, and includes requirements relating to its stability and measurement. Various other references and detailed measurement and test arrangements are contained in informative annexes.



The present document is part 2 of a multi-part deliverable covering Environmental Engineering (EE); Power supply interface at the input of Information and Communication Technology (ICT) equipment, as identified below:

Part 1: "Alternating Current (AC)";

**Part 2: "-48 V Direct Current (DC)";**

Part 3: "Up to 400 V Direct Current (DC)".

| **Proposed national transposition dates** | |
|---|---|
| Date of latest announcement of this EN (doa): | 3 months after ETSI publication |
| Date of latest publication of new National Standard or endorsement of this EN (dop/e): | 6 months after doa |
| Date of withdrawal of any conflicting National Standard (dow): | 6 months after doa |

# 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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# 1 Scope

The present document contains requirements and measurements methods for the physical interface "A" that is situated between the power supply system(s) and the power consuming ICT equipment.

The nominal voltage at power interface "A" of ICT equipment defined in the present document is DC voltage -48 V.

The DC power can be supplied by a DC output power system (e.g. based on AC rectifiers on grid or DC/DC converters on solar system, fuel cell, DC engine or fuel cell generator) and also directly supplied by a battery backup in this DC power system. The purpose of the present document is to be able to use a power supply system with the same characteristics for all ICT equipment defined in the area of application:

- to facilitate inter working of different types of load units;
- to facilitate the standardization of ICT equipment;
- to facilitate the installation, operation and maintenance in the same network of ICT equipment and systems from different origins.

The present document aims at providing electrical compatibility between the power supply equipment and the power consuming ICT equipment, between different system blocks and loads connected to the same power supply feeding the interface "A" (e.g. control/monitoring, cooling system, etc.).

The requirements are defined for:

- the power supply input of any type of ICT equipment installed at telecommunication centres that are connected to interface "A" powered by DC;
- any type of ICT equipment, installed in access networks and customers' premises, the DC interface "A" of which is also used by equipment requiring a DC supply source;
- any type of ICT equipment powered by DC, used in the fixed and mobile networks installed in different locations such as buildings, shelters, street cabinets, outdoor installations.



Disturbances on the power supply interface "A" relating to the continuous wave phenomena below 20 kHz are covered within the present document.



The present document does not cover safety requirements, they are covered by relevant safety standards.

The present document does not cover EMC requirements, they are covered by relevant EMC standards.

NOTE: Annex B gives guidance on -60 VDC supply systems.

# 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.

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

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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

[1] ETSI EN 300 253: "Environmental Engineering (EE); Earthing and bonding of ICT equipment powered by -48 VDC in telecom and data centres".

[2] Void.

[3] Void.

[4] Void.

[5] EN 61000-4-5: "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test" (produced by CENELEC).

[6] Void.

[7] EN 61000-4-29: "Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques -Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests" (produced by CENELEC).

## 2.2 Informative 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.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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] Recommendation ITU-T Q.551: "Transmission characteristics of digital exchanges".

[i.2] Recommendation ITU-T Q.552: "Transmission characteristics at 2-wire analogue interfaces of digital exchanges".

[i.3] Recommendation ITU-T Q.553: "Transmission characteristics at 4-wire analogue interfaces of digital exchanges".

[i.4] Recommendation ITU-T Q.554: "Transmission characteristics at digital interfaces of digital exchanges".



[i.5] ETSI TR 100 283: "Environmental Engineering (EE); Transient voltages at Interface "A" on telecommunications direct current (dc) power distributions".

[i.6] US Department of Defence MIL-STD-461E: "Requirements for the control of electromagnetic interference characteristics of subsystems and equipment".

[i.7] Void.

[i.8] Recommendation ITU-T O.41: "Psophometer for use on telephone-type circuits".

[i.9] IEC 60050-601: "International Electrotechnical Vocabulary. Chapter 601: Generation, transmission and distribution of electricity - General" (Area 826 "Electrical installations", section 826-11 "Voltages and currents").

[i.10] EN 60269-1: "Low-voltage fuses - Part 1: General requirements" (produced by CENELEC).

[i.11] EN 60934: "Circuit-breakers for equipment (CBE)" (produced by CENELEC).

[i.12] IEC 60050-351: 2013: "International Electrotechnical Vocabulary. Part 351: Control technology".

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

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

**abnormal service voltage range:** range of steady state voltage over which the equipment will not be expected to maintain normal service but will survive undamaged

**customer premises:** location which is the sole responsibility of the customer

**DC power return conductor:** 0 V power supply conductor

NOTE: Also called "battery return".

**fully equipped equipment:** configuration that corresponds to the maximum power consumption measured at -48 VDC with the equipment in operating conditions (e.g. not in standby mode)

NOTE: When there are several fully equipped configurations because of different combinations of possible boards, the configuration with the boards that gives the highest power consumption should be considered.

**ICT equipment:** device, in the telecommunication network infrastructure, that provides an ICT service

**interface "A":** terminals at which the power supply is connected to the system block

NOTE 1: See also figure 1 and annex A.

NOTE 2: This is a functional definition and not an exact depiction of the physical location.



**malfunction:** termination of the normal service

**maximum steady state input current ($I_m$):** maximum steady state input current, stated by the manufacturer, for a fully equipped equipment under test connected to interface "A" at nominal voltage

**nominal voltage:** value of the voltage by which the electrical installation or part of the electrical installation is designated and identified



NOTE: As defined in IEC 60050-601 [i.9].

**normal service:** service mode where ICT equipment operates within its specification which includes a defined restart time after malfunction or full interruption

**normal service voltage range:** range of steady state voltages over which the equipment will maintain normal service

**power supply:** power source to which ICT equipment is intended to be connected

**service voltage:** value of the voltage under normal conditions, at a given instant and a given point of the system

NOTE: As defined in IEC 60050-601 [i.9].

**steady-state:** state of a system at which all state and output variables remain constant in time while all input variables are constant

NOTE: This is definition 351-45-10 in IEC 60050-351:2013 [i.12].

**system block:** functional group of equipment depending for its operation and performance on its connection to the same power supply

NOTE: A system block may consist of equipment or a functional group of equipment. Different examples of configurations at interface "A" are given in annex A.

**telecommunication centre:** location where ICT equipment is installed and which is the sole responsibility of the operator

## 3.2 Symbols

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

| | |
|---|---|
| $I_t$ | instantaneous inrush current |
| $I_m$ | maximum steady state input current |
| L | inductance of inductive element of LISN |
| R | resistance of resistive element of LISN |
| t | time |
| $U_{pso,eff}$ | effective psophometric voltage |
| $U_{rms}$ | RMS voltage |
| $Z_c$ | capacitive impedance of immunity measurement circuit |
| $Z_m$ | resistive impedance of immunity measurement circuit |
| µs | microsecond |

## 3.3 Abbreviations

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

| | |
|---|---|
| AC | Alternating Current |
| DC | Direct Current |

NOTE: Also when used as a suffix to units of measurement.

| | |
|---|---|
| EMC | ElectroMagnetic Compatibility |
| ESR | Equivalent Series Resistance |
| EUT | Equipment Under Test |
| HOD | High-Ohmic Distributions |
| ICT | Information and Communication Technology |
| IL | Insertion Loss |
| LISN | Line Impedance Stabilization Network |
| LOD | Low-Ohmic Distributions |
| RF | Radio Frequency |
| rms | root mean square |
| TR | Technical Report |
| VDC | Voltage Direct Current |

NOTE: Also when used as a suffix to units of measurement.



# 4 Requirements

## 4.0 Power interface "A"

The power supply interface, interface "A" of figure 1, is a physical point to which all the requirements are related.

This point is situated between the power supply system(s) and the power consuming ICT equipment.

An example of a configuration in which interface "A" is identified is given in annex A.

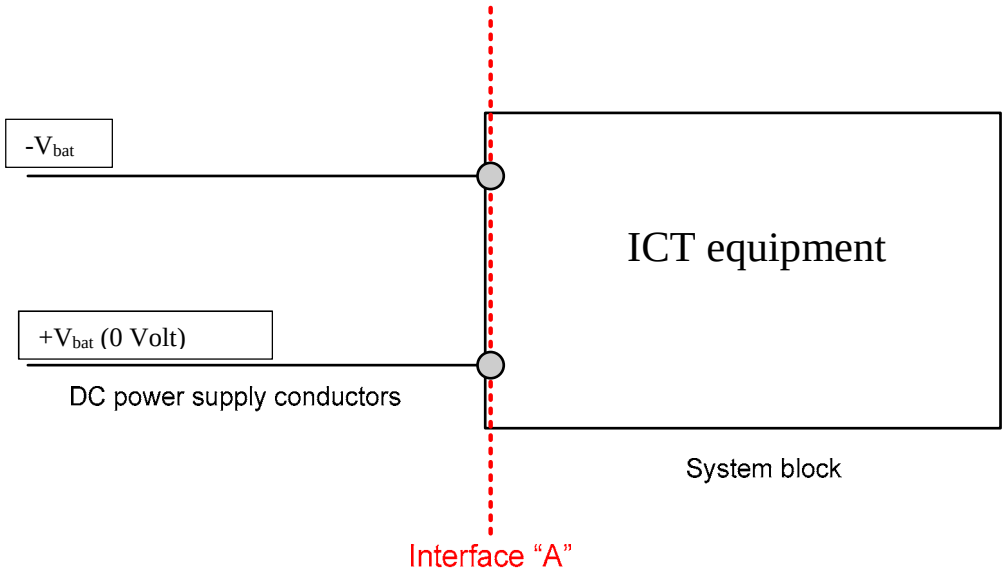


**Figure 1: Identification of interface "A"**

## 4.1 Nominal voltage

The nominal voltage at interface "A" shall be -48 VDC with positive conductor connected to earth as defined in ETSI EN 300 253 [1].

NOTE 1: The positive conductor, also called DC return, can be (see ETSI EN 300 253 [1]):

- Isolated DC return: this is a DC power system in which the DC power return conductor has a single point connection to the bonding network. Equipment intended for this power distribution has a floating DC power at the power input terminal.
- Common DC return: this is a DC power system in which the return conductor is connected to the bonding network at many points. Equipment intended for this power distribution can have the DC return earthed at the power input terminal.

NOTE 2: In most cases the nominal voltage of interface "A" is based on a 24 cells lead-acid battery. Use of other technologies, such as Lithium-ion batteries, are increasing and are compatible with the requirements of the present document

## 4.2 Normal service voltage range at interface "A"

The normal service voltage range for the -48 VDC nominal supply at interface "A" shall be from -40,5 VDC to -57,0 VDC.

NOTE 1: The maximum voltage is based on a 0,3 V drop in the distribution loop and a battery voltage of 2,35 V/cell plus 0,5 % for regulation.

There shall be no degradation of service performance when ICT equipment is operating at voltages within the normal service voltage range including voltage variation inside the normal voltage range.

This requirement shall be verified by applying at interface "A" a voltage step test with specification and parameters defined in table 1. The testing and measurement techniques are described in EN 61000-4-29 [7].

The test shall apply to equipment with single and multiple power supply "A" interface inputs.

**Table 1**

| Test level of Normal service voltage step variation | Voltage step duration | Basic standard for testing | Rise and fall time of voltage step | Performance criteria |
|---|---|---|---|---|
| From -40,5 V to -57,0 VDC and back to -40,5 VDC (see figure 2a) | 0,1 s | EN 61000-4-29 [7] | Between 1 µs and 50 µs on 100 Ω resistive load (see basic standard for test generator) | No degradation in the service performance during and after the test |
| From -57,0 V to -40,5 VDC and back to -57 VDC (see figure 2b) | 0,1 s | | | |

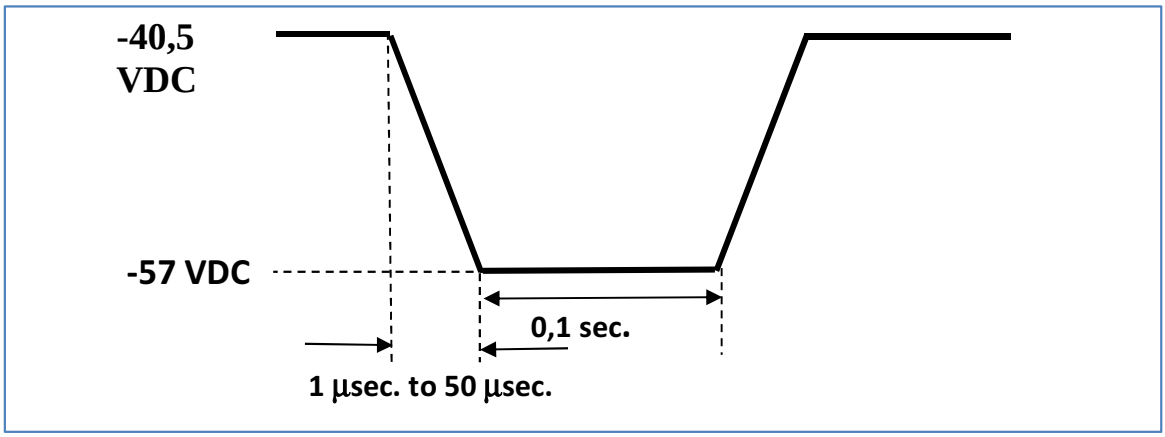


**Figure 2a**



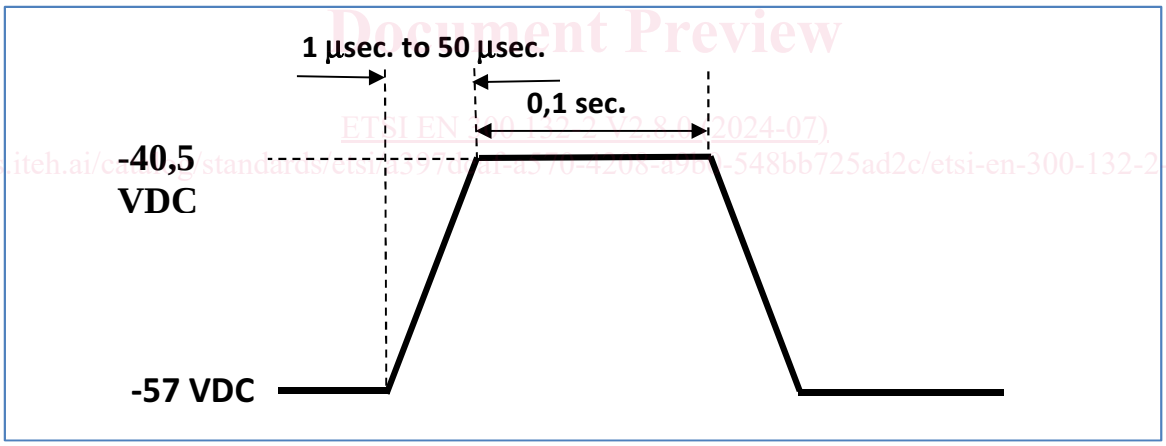




**Figure 2b**

In the case of ICT equipment with power supply input redundancy (e.g. Input 1 and Input 2), this test shall be performed:

- with Inputs 1 and 2 powered simultaneously and applying the test in table 1 on both inputs simultaneously;
- with Inputs 1 and 2 powered simultaneously and applying the test in table 1 on one input (either Input 1 or 2);
- with either Input 1 or 2 powered and no power on the other power input and applying the test in table 1 on the powered input.

NOTE 2: The minimum voltage is based on the voltage drop in the distribution network and a battery cell end of discharge voltage.