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Contents

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM), and is now submitted for the ETSI standards Membership Approval Procedure.

The present document is part 1 of a multi-part deliverable covering the External Common Power Supply (CPS) for Customer Premises Network and Access Equipment, as identified below:

ES 202 874-1: "Functional requirements";

TS 102 874-2: "Integrated Broadband Cable and Television Networks";

TS 102 874-3: "CPS Type 1 implementation details";

TS 102 874-4: "Part 4: CPS Type 2.b implementation details";

TS 102 874-5: "CPS Type 2.c implementation".

Introduction

The present document addresses the functional requirements and implementation and operational aspects of the External Common Power Supply (CPS) for Customer Premises Network and Access Equipment.

The multi-part deliverable represents a set of cohesive interwoven technical information that has jointly evolved to define solution of most efficient equipment, as defined below:

- ES 202 874-1 defines functional requirements for four different categories of CPS.
- TS 102 874-2 [i.1] defines detailed implementation and operational aspects for CPS Type 2.a.
- TS 102 874-3 [i.2] defines detailed implementation and operational aspects for CPS Type 1.
- TS 102 874-4 [i.3] defines detailed implementation and operational aspects for CPS Type 2.b.
- TS 102 874-5 [i.4]: defines detailed implementation and operational aspects for CPS Type 2.c.

The intended applications of these CPS categories are specified in the present document.

Table 1 summarises the structure of the present document.

Table 1

CPS category	Functional requirements	Implementation aspects
Type 1: 5V, 2A	ES 202 874-1	TS 102 874-3 [i.2]
Type 2.a: 12V, 1A		TS 102 874-2 [i.1]
Type 2.b: 12V, 2A		TS 102 874-4 [i.3]
Type 2.c: 12V, 5A		TS 102 874-5 [i.4]

The present document is describing functional requirements applicable to an external common power supply (CPS) converting and adapting AC mains to DC power for customer premises network equipment. Other methods for providing power to end devices are not in the scope of the document (e.g. Power Over Ethernet, power on USB, etc.).

The requirements were defined on the basis of HGI (Home Gateway Initiative) activity on the same subject contained in the public document HGI-RD015-R3 [i.5]. That is the result of collaborative efforts of HGI members that include Broadband Service Providers (BSPs), gateway manufacturers, and silicon vendors.

The present document is defining operating conditions, energy efficiency and ecodesign aspects for a number of categories of power supplies, depending on market applicability and power needs of the targeted Customer Premises Equipment (CPEs). Additional Technical Specifications will address the implementation aspects for each of the CPS categories here defined, including the choice of connectors.

The need for standardization activities in energy efficiency and ecodesign related to telecommunications is now widely seen. For example the European Union, in the "ICT 2009 Standardization Work Programme" [i.6] highlights this need. Enabling the use of standardized power supplies, or the development of a new Common Power Supply (CPS) for DSL modems, home gateways, optical network terminations is a key aspect of telecommunications standardization that will contribute to ecodesign.

The expected timeline for adoption of the present document is as follows:

- Initial, partial deployments prior to 2011 depending on availability of specific TSs.
- Universal deployments for customer premises equipment within service providers' networks (i.e. within those service providers mandating these requirements) starting from 2011.

1 Scope and Purpose

1.1 Scope

The present document specifies a universal solution for power supplies (named Common Power Supply and indicated with the acronym CPS) suitable for customer equipment used in the home networks, using energy provided by mains power in a range between 100 V and 240 V AC and 50 Hz to 60 Hz of frequency (apart tolerances). The topics addressed in the present document are as follows:

- applicability: definition of product categories included in the scope (home gateway, and various other devices installed in the home network);
- market scenarios and use cases for the use of the CPS in the home environment;
- functional requirements for electrical operating conditions of the CPS;
- functional requirements for energy efficiency of the CPS;
- functional requirements for connectors on the CPS and devices which it powers;
- functional requirements for eco-design of the CPS.

1.2 Applicability

Customer Network Gateway (CNG) Power Supply

Customer Network Gateways, also called Home gateways, currently use external power supplies ("bricks") that provide different ranges of output voltage and current.

Furthermore, the connectors on the HG which attach to the power supply, and the corresponding connectors on the cable frequently differ, not only between HGs of different vendors, but also between different HG models from the same vendor. A suitable output voltage and current, along with connector type would have to be specified to create a truly "universal" solution applicable to all home gateways.

Home Network Infrastructure Devices (HNIDs) Power Supply

In addition to home gateways, other home network infrastructure devices (HNIDs) may use a power supply with similar features in terms of voltage and current, so that a common solution could be defined for both types of device.

These HNID devices may have a similar specification and distribution process, in other words they are managed and/or supplied by a common BSP. Therefore, the extension of the CPS solution defined for HGs to HNIDs has also been considered.

End Device Power Supply

Some end user devices use power supplies with similar characteristics to those of CNGs (e.g. some set top boxes, cordless phones and IP phones).

The requirements contained in the present document apply to all the above mentioned categories.

1.3 Requirements Notation

If the present document is implemented, the key words "MUST" and "SHALL" as well as "REQUIRED" are to be interpreted as indicating a mandatory aspect of the present document. The keywords indicating a certain level of significance of a particular requirement that are used throughout the present document are summarized below.

MUST: This word or the adjective "REQUIRED" means that the item is an absolute requirement of the present document.

MUST NOT: This phrase means that the item is an absolute prohibition of the present document.

SHOULD: This word or the adjective "RECOMMENDED" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.

SHOULD NOT: This phrase means that there may exist valid reasons in particular circumstances when the listed behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.

MAY: This word or the adjective "OPTIONAL" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.

2 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.

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

2.1 Normative references

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

[1] Home Gateway Initiative HGI-RD001-R2 (2008): "Technical Requirements: Residential Profile V1.0".

NOTE: Available at: http://www.homegatewayinitiative.org/publis/HGI_V1.01_Residential.pdf.

[2] Commission Regulation (EC) No 278/2009 of 6 April 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies.

[3] Energy Star®: "Program Requirements for Single Voltage External Ac-Dc and Ac-Ac Power Supplies - Eligibility Criteria (Version 2.0)".

[4] Public Law 110-140 (19 December 2007): "Energy Independence And Security Act Of 2007".

[5] United States Environmental Protection Agency (US EPA) (11 August 2004): "Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies".

[6] CENELEC EN 60950-1 (2006): " Information technology equipment - Safety - Part 1: General requirements".

[7] CENELEC EN 55022 (2006) and Amendment 1 (2007): " Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement".

[8] CENELEC EN 55024 (1998), Amendment 1 (2001) and Amendment 2 (2003): "Information technology equipment - Immunity characteristics - Limits and methods of measurement".

[9] IEEE 1413 (2010): "Standard Framework for Reliability Prediction of Hardware".

[10] 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".

[11] ETSI EN 300 019-1-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weather protected locations".

[12] ETSI EN 300 019-1-2: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-2: Classification of Environmental Conditions; Transportation".

[13] ITU-T Recommendation G.992.3: "Asymmetric digital subscriber line transceivers 2 (ADSL2)".

[14] ITU-T Recommendation K.21: "Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents".

[15] CISPR 22: "Information technology equipment - radio disturbance characteristics - limits and methods of measurement".

[16] CENELEC EN 61000-4-11: "Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests".

[17] CENELEC EN 61000-4-2: "Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test".

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

[19] CENELEC EN 61000-3-2: "Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)".

2.2 Informative references

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] ETSI TS 102 874-2: "Access, Terminals, Transmission and Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 2: Integrated Broadband Cable and Television Networks".

[i.2] ETSI TS 102 874-3: "Access, Terminals & Transmission, Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 3: CPS Type 1 implementation details".

[i.3] ETSI TS 102 874-4: "Access, Terminals & Transmission, Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 4: CPS Type 2.b implementation details".

[i.4] ETSI TS 102 874-5: "Access, Terminals & Transmission, Multiplexing (ATTM); External Common Power Supply for Customer Premises Network and Access Equipment; Part 5: CPS Type 2.c implementation".

[i.5] Home Gateway Initiative HGI-RD015-R3: "Energy Efficiency and Ecodesign requirements for a common power supply (CPS) for home gateway, home networking equipment and end devices".

[i.6] European Commission: "ICT 2009 Standardization Work Programme".

NOTE: Available at: http://ec.europa.eu/enterprise/sectors/ict/files/wp2009_en.pdf.

3 Definitions and abbreviations

3.1 Definitions

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

Customer Network (CN): in-house network composed by home gateway, end devices, network segments (physical wired or wireless connections between customer network elements), home network infrastructure devices such as network adapters (performing a L1/L2 conversion between different network segments) and nodes (network adapters with L3 routing capabilities)

NOTE: Also called Home Network (HN) or Customer Premises Network (CPN).

Customer Network Gateway (CNG): gateway between the HN and the Access Network able to perform networking functions from physical connection to bridging and routing capabilities, but also possibly implementing functions related to the service support

NOTE: Also called Home Gateway (HG) or Small Business Gateway (SBG).

Customer Network Device (CND): physical device enabling service(s) usage

NOTE 1: Also called End Device (ED).

NOTE 2: EDs can be dedicated to the internet, conversational and audio-video services. But they could be also Consumer Electronics equipment and other devices which may have nothing to do with these premium services (e.g. services performing a content sharing within a HN, typically between a PC and a music system, through the HG).

3.2 Abbreviations

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

AC Alternating Current
ADSL Asymmetric Digital Subscriber Line
BSP Broadband Service Provider
CE Comission Européenne

NOTE: "CE" is the European symbol for products’ compliance to safety and EMC directives QLN Quiet Line Noise.

CND Customer Network Device
CNG Customer Network Gateway
CPE Customer Premises Equipment
CPN Customer Premises Network
CPS Common Power Supply
DC Direct Current
DSL Digital Subscriber Line
ED End Device
EMC ElectroMagnetic Compatibility
EuP Energy-using products
HG Home Gateway
HGI Home Gateway Initiative
HNID Home Network Infrastructure Device
ITU-T International Telecommunication Union - Telecommunication standardisation sector
LAN Local Area Network
MTBF Mean Time Between Failures
NAS Network Attached Storage
NT Network Termination
PLT PowerLines Technologies
PSU Power Supply Unit
PVC PolyVinyl Chloride

QLN	Quiet Line Noise
SDO	Standards Development Organization
VDSL	Very high speed Digital Subscriber Line
WAN	Wide Area Network

4 Market scenarios and use cases

4.1 The state of the art

4.1.1 Market situation

As mentioned, a number of different categories of devices can be already present in the customer environment or can be installed as part of the service offer proposed by the single service provider; all of them need an external power supply. There can be:

- home and business gateways;
- set top boxes;
- fixed IP telephones or analogue phones with specific features such as displays;
- fixed cordless telephones;
- PDAs/tablet PCs/smart terminals devoted to specific service usage;
- HNIDs such as bridges between different technologies, hubs and switches, wireless repeaters or additional (to the HG one) access points.

An analysis of commonly deployed power supplies shows that there are two basic categories of power supplies adopted, with relatively small differences in output voltage and current across a wide number of devices.

- Lower voltage power supplies:
  - commonly, these devices have a fixed output voltage between 3,3 V and 6 V (in some rare cases 7,5 V) and a maximum output current below 0,5 A (typically, when a battery is to be charged on the product);
  - as above, but with maximum output current between 1 A and 2 A.
- Higher voltage power supplies:
  - commonly, these power supplies have a fixed output voltage between 12 V and 15 V and a maximum output current below 0,5 A (typically, when a battery is to be charged on the product);
  - as above, but with maximum output current between 1 A and 2 A maximum.

There are a large number of different power supplies on the market but with small differences in the output current and voltage. A pre-analysis performed by Telecom Italia labs considered a total of 33 devices, all included in the two listed categories, all of which turned out to have a unique power supply.

- In regard to choice of materials, current devices typically do not meet ecodesign best practice in the following aspects:
  - PVC (PolyVinyl Chloride) is commonly used for cable construction. Alternatives with lower environmental impact are possible;
  - recycled plastics are not commonly used;
  - lack of design features allowing easily disassembling the product at the end of its life in order to separate electronics from plastic parts.

4.1.2 Power supply energy efficiency issues

The following observations about energy efficiency with currently deployed devices can be made:

- switching power supplies achieve much better efficiencies than supplies based upon linear technologies. For example for 24 V outputs, a switch-mode supply normally operates at 80 % or higher efficiency, whereas a linear power supply will typically operate around 60 % efficiency. Switching power supplies also achieve greater constancy of output voltage as current varies;
- a typical switching power supply is able to achieve efficiency close to its maximum efficiency when it is operating at output currents lower than 20 % of the maximum rated output current. Such a characteristic facilitates use of a common power supply for a wider range of load devices while still maintaining efficiency.

The energy efficiency requirements must be aligned with the European Commission Regulations (EC) no. 278/2009 on External Power Supplies [2] (implementing "EuP" Directive 2005/32/EC on ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies), or with the Energy Star requirements applicable to US market [3].

4.2 CPS categories

The definition of a common power supply should consider existing customer equipment, in order to ensure compatibility (where possible and appropriate) with existing devices. However the main focus of this work is to find a solution that will be widely adopted in the future. It did not prove practical to have a single CPS for all device types; this would have resulted in all PSUs being high power. The minimum realistic set is 2 Types, the Type being determined by the Output Voltage, with one of the 2 Types having 3 subcategories (based on current and power). These variants are defined in table 2. This should address the needs of all the home network device types described in the present document:

Table 2: CPS categories

Category	Nameplate Output voltage	Nameplate Output Current	Rated Output Power	Intended applications	Suggested power ranges and connectors
TYPE 1	5 V	2 A	10 W	Covers the needs of CPEs connected to AC mains, with low power absorption. This includes typical cordless phones with a battery that usually need between 2 W and 3 W during the charging phase, and some HNIDs (hubs, access points etc.). It will also provide good efficiency at lower load currents (e.g. after charging has completed).	Indicated for devices needing from approximately 1 W up to 8 W. Typical connector to CPE is coaxial.
TYPE 2 subcategory a (TYPE 2.a)	12 V	1 A	12 W	Covers the needs for powering cable modems connected to AC mains in customer networks with typical power absorption of less than 10 W.	Indicated for devices needing from approximately 2 W to 10 W. Typical connector to CPE is coaxial.
TYPE 2 subcategory b (TYPE 2.b)	12 V	2 A	24 W	Covers the needs for powering home gateways connected to AC mains in customer networks, designed to support the HGI Residential Profile v1.0 functionalities [1]. It could also be used for network terminations interworking with home/service gateways, or set top boxes.	Indicated for devices needing from approximately 8 W to 20 W. Typical connector to CPE is coaxial.
TYPE 2 subcategory c (TYPE 2.c)	12 V	5 A	60 W	Covers the needs for powering home networking equipment connected to AC mains, with higher energy absorption and integrating a wider range of functionalities (NAS, multimedia equipment, game consoles, etc.) but generally excluding portable PCs.	Indicated for devices needing approximately from 20 W to 50 W). Typical connectors to CPE are barrel and/or coaxial.

4.2.1 Connectors

The connectors must be specified according to specific requirements, including output voltage and current provided. However over and above this, there is a need for defining a unique connector solution for each category, to avoid safety or misoperation issues caused by incorrect choice of CPS category for a given end device.

The functional requirements clause contains specific mandatory statements on this topic (see clause 7). Then, the detailed definition of the connector type per category is demanded to the Technical Specification describing the single CPS Type, as also stated in the introduction of the present document.

4.2.2 Reliability and environmental conditions

CPS reliability must be consistent with the expected MTBFs and useful lives of the products they will supply. Note that since one of the main points of a CPS is to allow its reuse with different generations of CPE, it may need to last longer than current power supplies. MTBF is usually given in units of hours. The failure rate is equal to failures/time [9], so MTBF is related to the yearly acceptable (for the service provider or the vendor) number of failures. For example a MTBF of 1 00 000 hours will correspond to a yearly percentage of failures of around 8,7 %.

All CPS types must guarantee normal operation under the same environmental conditions as the powered device.

4.3 The usage scenarios

The following use cases concerning the use of a CPS on different devices must be supported:

Use case 1

A specific device using a CPS is discarded at the end of the useful life, or when the BSP decides to upgrade to a new generation of device, or due to a failure. The replacement device can use the same CPS and so avoid the need for the production and supply of a new power unit.

Use case 2

When a device using a CPS is dispensed with, that CPS can be kept by the customer as a spare for subsequent reuse e.g. in the event of failure of another CPS.

Use case 3

A new device which uses a CPS is bought by the user. If a suitable CPS is already owned, the product can be purchased without a power supply. This Use Case requires a labelling scheme (out of the scope of the present document) to allow the user to understand which CPS could be reused with the new device. Note however that if the device is supplied by the BSP, there will need to be a new process to determine whether or not the user already has a suitable, spare CPS, and the ability to supply one, or not, as appropriate. This has implications for packaging and installation guides etc. If the device is provided via a retail outlet, then there need to be a variant with and without a CPS, or the CPS will need to be sold separately.

Use case 4

Some battery powered devices can share a CPS charger (e.g. mobile phones).

4.4 Usability issues and CPS elements

In general, the typical power supply for home networking equipment consists of a cable and the power supply block containing an AC/DC converter and other electronics. This block includes on its primary side the AC plug for connection to the wall socket (or other intermediate connections).

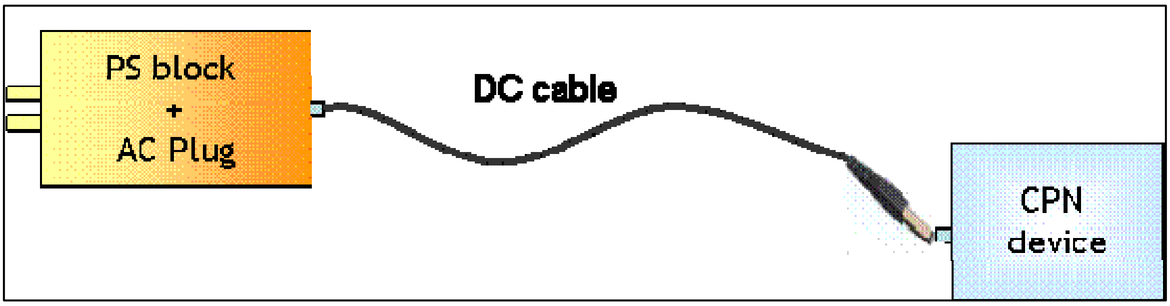

Figure 1: TYPE 1 and TYPE 2.a/2.b power supply configuration

Note that for safety and reliability reasons the DC cable on the secondary side is incorporated in the power supply block; however, a solution providing a completely detachable (from the PS block) DC cable with two connectors i.e. one at each end can be envisaged (although it could add some contact resistance and decrease reliability).

In the case of a Type 2.c CPS, the power supply needs to provide considerably higher power, up to 60 W. The physical dimensions and weight of the product can become significant thereby causing mechanical reliability problems if the power supply incorporates the AC plug, so that a solution with a second cable to connect the power supply to the mains is indicated.

Note that the connector of the AC cable between the wall and the power supply block could be 2 way or 3 way. The case of a two pole connector is shown in figures 1 and 2. If a 3 pole connector is used, it includes a Protective Earth conductor. This Protective Earth conductor must not be connected internally to any of the output low-voltage wires.

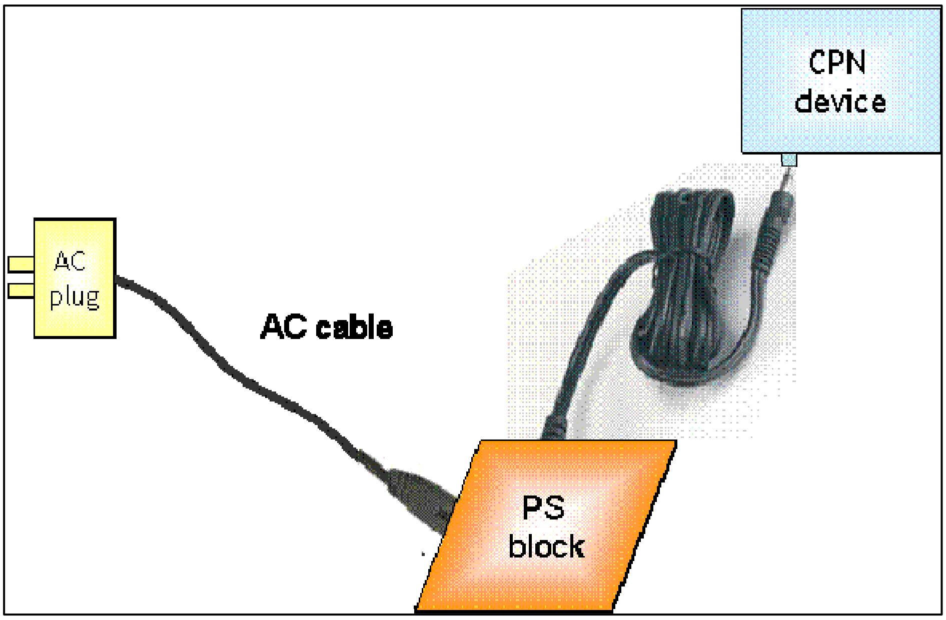

Figure 2: TYPE 2.c power supply configuration

4.5 Coexistence with Powerline communications

This clause describes system considerations related to the use of a CPS within a home network where data transmission over powerlines (PLT) is in use. These considerations, which apply regardless of whether the CPS is used to provide power to the PLT device(s) or to other devices, result in requirements on the CPS so as to minimize interference with PLT communication equipment.

In PLT communications, the power wires themselves act as the data transmission medium and use the spectral region up to 50 MHz (or beyond). It has been noted in the literature, and verified in the laboratories of HGI Service Providers, that switched mode power supplies that are connected to the power wires can significantly impair the characteristics of the communication channel in this band (the "PLT band"). As a result, the attainable bit rate of the PLT communications is reduced.

The main disturbance introduced by the power supply is caused by variations in the input impedance (the impedance looking into the AC supply terminals) of the power supply within the PLT band. The input impedance can vary with time at the frequency of the supply voltage. Because the input impedance changes when the supply voltage exceeds a threshold, the result is a time-varying impedance at 50 Hz or 60 Hz. Service Provider measurements support the conclusions that attainable PLT bit rates can be halved or worse in the presence of this time-varying impedance.

It should be noted that various PLT technologies have mechanisms to counteract cyclo-stationary noise (additive noise in synchronism with the supply voltage) and these mechanisms can partially counteract the impedance variation.

To illustrate the problem, the following charts demonstrate the effect of variation in input impedance as seen in one measurement by an HGI service provider. In the first chart (Figure 3), the magnitude of the PLT channel transfer function, which includes the contribution due to the input impedance of a power supply, is shown in the range 0 MHz to 50 MHz. There is no noticeable variation along the vertical (time) access, therefore this particular power supply is not affected by the time varying impedance.

In the second chart (Figure 4), the same measurement is shown for a power supply which is affected by time varying impedance. The vertical access shows that at intervals of 10 ms, the magnitude of the transfer function strongly decreases, as the 50 Hz supply voltage peaks. In this case, one expects a degradation in PLT performance.

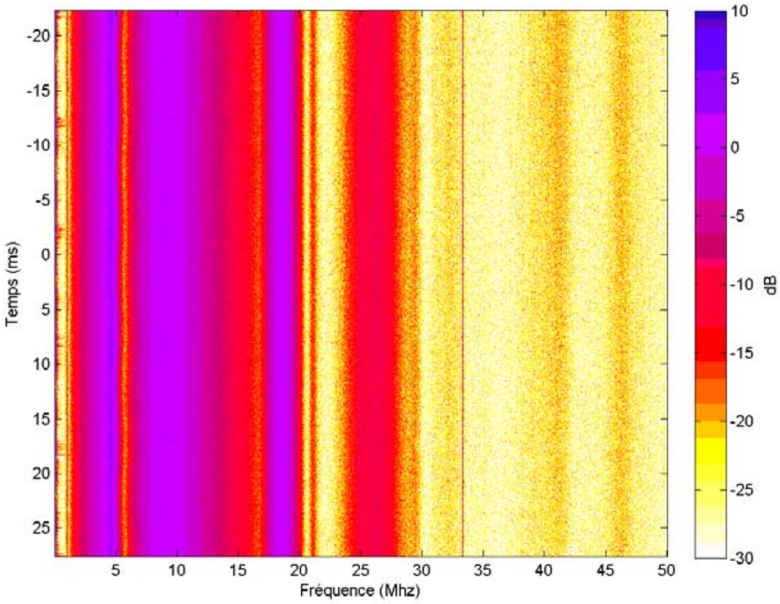

Figure 3: Transfer function of PLT line with low impedance variation

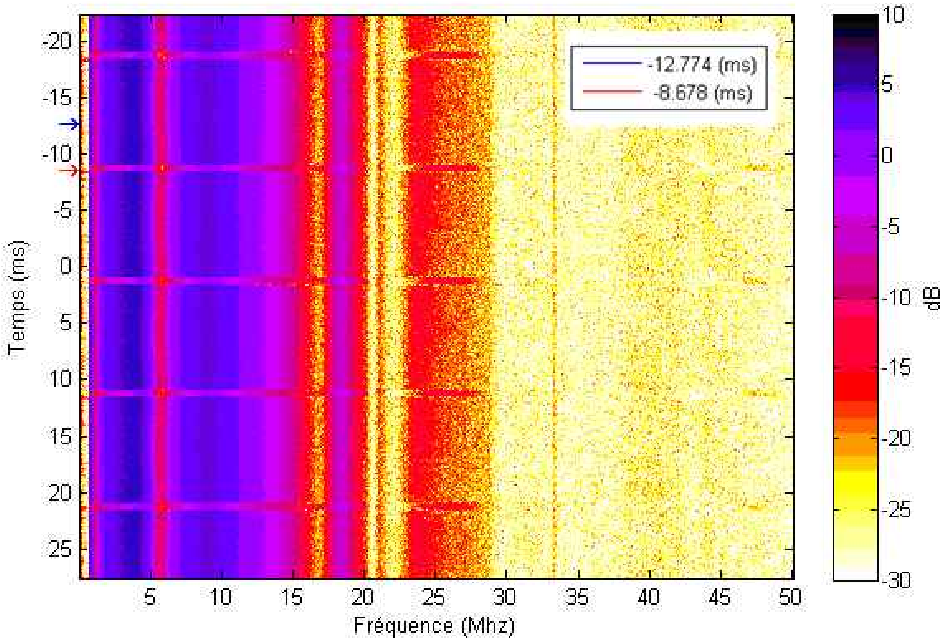

Figure 4: Transfer function of PLT line with high impedance variation

The implication of this analysis is that CPS must be designed so as to minimise time varying impedance changes. Specific requirements for measurement methods and values are for further study.

One potential technique for amelioration of the CPS in this regard is the introduction of filter circuits at the AC input. The following figure is an example of such a filter, with specific values being for further study.

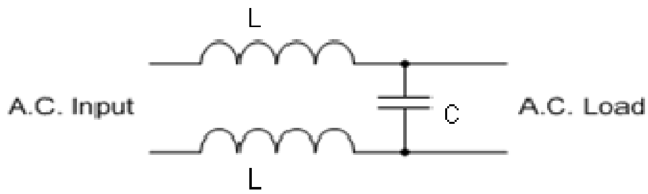

Figure 5: Example of how to improve coexistence between CPS and PLT technology

5 Requirements for CPS operating conditions

R1 All CPS categories MUST support an AC input voltage of 100 V to 240 V at 50 Hz to 60 Hz frequency and with the following possible maximum variation ranges: 90 V to 264 V for the voltage, 47 Hz to 63 Hz for the frequency.

R2 The DC output voltages for all categories MUST remain within the ±5 % of their nominal specified value when measured at the load end of the output connectors under all line, load, and environmental conditions.

R3 CPS TYPE 1 MUST provide a nameplate output voltage of 5 V (measured at the end plug and with minimum/maximum load).

R4 CPS TYPE 2.a, TYPE 2.b and TYPE 2.c MUST provide a nameplate output voltage of 12 V (measured at the end plug and with minimum/maximum load).

R5 CPS TYPE 1 MUST support a nameplate output current of 2 A (corresponding to a max. rated output power of 10 W).

R6 CPS TYPE 2.a MUST support a nameplate output current of 1 A (corresponding to a max. nameplate rated output power of 12 W).

R7 CPS TYPE 2.b MUST support a nameplate output current of 2 A (corresponding to a max. nameplate rated output power of 24 W).

R8 CPS TYPE 2.c MUST support a nameplate output current of 5 A (corresponding to a max. nameplate rated output power of 60 W).

5.1 EMC and safety requirements

The CPS must be compliant with all the requirements needed to obtain the CE label and to a number of standards for electrical safety. This implies that the scenario including the possible reuse of the same power supply with different devices must be treated carefully from the directives' compliance and liability point of view.

Typically a product is labelled as CE compliant when tested together with its specific power supply. Also, a standalone power supply (e.g. a "common" power supply") can be marked as CE compliant independent of the product supported. Despite this, the combination of different CE devices coupled with a CE common power supply may pass or fail CE/immunity tests, as each device implementation/technology represents a unique type of load with unique sensitivities. At the time of publication of the present document, this issue is expected to be addressed by SDOs.

The present document does not address the specific issue, being limited to the definition of the technical specifications for the common power supply.

R9 All CPS categories MUST be compliant to all the harmonised standards requested for CE compliance [6], [7], [8], [15], [16], [17], [18] and [19].

R10 An important application of the CPS is as the power source for commonly deployed xDSL modems. All CPS categories MUST be designed so as not to introduce significant interference with normal operation of xDSL modems.

NOTE 1: The following test procedure is suggested to verify the proper operation of a CPS with an xDSL modem. First, the Quiet Line Noise (QLN) [13] is measured, for each DSL subchannel, after DSL line synchronization when the DSL is powered by a reference battery set to the nameplate DC voltage and current corresponding to the CPS category. Second, the QLN is measured for each DSL subchannel after DSL line synchronisation when the DSL is powered by the CPS. The QLN associated with the CPS for each subchannel, and in the aggregate, MUST be within 2 dB of the reference measurement.

R11 To limit interference with Powerline equipment, the AC Power Port conducted emissions MUST NOT exceed 35 dBµV as peak and 33 dBµV as average in the frequency band from 1,6 MHz to 100 MHz. Other regulatory limits MUST be applied if they are defining values below these or are applied in a different frequency area.

R12 As power supplies can introduce significant impedance variations on an AC line used for data transmission over Powerlines, all CPS categories MUST be designed so as not to reduce the bit rate of the data over PLT traffic by more than 5 % of the reference throughput.

NOTE 2: The following test procedure is suggested to verify the proper operation of a CPS within an environment where PLT communication is occurring on the supply wires: first, the attainable reference error-free throughput is measured, when a load device is powered by a reference battery, set to the nameplate DC voltage and current corresponding to the CPS category. Second, the attainable error-free bit rate is measured when the load device is powered by the CPS connected to the same supply wires as the PLT communications. The bit rate associated with the CPS usage MUST be within 5 % of the reference measurement.

R13 To avoid introduction of noise into voice related communications, all CPS categories MUST have a common mode leakage current from primary to secondary side as low as possible, but in any case lower then 10 µA.

5.2 Reliability

R14 All CPS categories MUST have an expected lifetime of 10 years continual operation at maximum output power.

R15 All CPS categories MUST have a minimum MTBF of 300 000 hours corresponding to a yearly failure rate of 2,9 %.

5.3 Protection

R16 All CPS categories MUST be compliant with ITU-T Recommendation K.21 [14] Enhanced level protection requirements.

5.4 Environmental conditions

R17 All CPS categories MUST be able to operate in the following environmental conditions:

- temperature: -5 °C to +45 °C;
- relative humidity: 5 % to 95 %.

This corresponds to Class 3.2 "Partly temperature-controlled locations" of EN 300 019-1-3 [11].

R18 All CPS categories MUST be able to withstand the following storage conditions:

- temperature: -25 °C to +55 °C;
- relative humidity: 5 % to 100 %.

This corresponds to Class 1.2 "Weather protected, not temperature-controlled storage locations" of EN 300 019-1-1 [10].

R19 All CPS categories MUST be withstand the following transportation conditions:

- temperature: -40 °C to +70 °C;
- relative humidity: 5 % to 100 %.

This corresponds to Class 2.3 "Public transportation" of EN 300 019-1-2 [12].

6 Requirements for CPS energy efficiency

6.1 Efficiency targets

R20 All CPS categories MUST be compliant with all the current regional directives and obligations (for European countries, see [2]; for US, see [4]).

R21 The following efficiency targets for CPS Type 1 (10 W) MUST be met:

- minimum average required efficiency 77 % (calculated as average of 25 %, 50 %, 75 % and 100 % load);
- minimum required efficiency 70 % at load of 10 % and above;
- no load power consumption less than 0,3 W.

R22 The following efficiency targets for CPS Type 2.a (12 W) MUST be met:

- minimum average required efficiency 77,85 % (calculated as average of 25 %, 50 %, 75 % and 100 % load);

- minimum required efficiency 71 % at load of 10 % and above;
- no load power consumption less than 0,3 W.

R23 The following efficiency targets for CPS Type 2.b (24 W) MUST be met:

- minimum average required efficiency 82,5 % (calculated as average of 25 %, 50 %, 75 % and 100 % load);
- minimum required efficiency 75 % at load of 10 % and above;
- no load power consumption less than 0,3 W.

R24 The following efficiency targets for the CPS Type 2.c (60 W) MUST be met:

- minimum average required efficiency 87 % (calculated as average of 25 %, 50 %, 75 % and 100 % load);
- minimum required efficiency 80 % at load of 10 % and above;
- no load power consumption less than 0,3 W.

6.2 Efficiency measurement method

R25 The energy efficiency of all CPS categories MUST be tested according to the common guidelines [5] established by the US EPA Energy Star Program and endorsed by EU, Asia and Australia.

R26 In addition to [5], the following measurements must be made and reported:

- no-load power consumption;
- efficiency at 25 %, 50 %, 75 % and 100 % of full rated output current;
- the efficiency at 10 % of the full rated output current.

7 Requirements for CPS connectors

R27 Each CPS variant MUST use a unique connector type.

R28 The different connector types MUST prevent the connection of a given CPS type to a device not designed to be powered by that CPS type.

8 Requirements for CPS eco-design

R29 The external case of all CPS categories MUST be manufactured using recyclable plastic.

R30 The external case of all CPS categories SHOULD be manufactured using at least 50 % of recycled plastic (preferred choice: ABS).

R31 The cables of all CPS categories SHOULD be manufactured using coating materials other than PVC. Preferred choices are Polyolefins and Polyurethane.

R32 The electronic parts of all CPS categories SHOULD be manufactured using materials with low halogenated compounds content.

R33 Provided that all the safety related requirements are satisfied, all CPS categories MUST be designed to enable separation between plastic case and electronics at the end of the CPS life, regardless of the specific disposal processes defined for the product; use of screws must be minimised and snap-fits possible adoption is preferred.

Annex A (informative): Bibliography

AS/NZS 4665.2 (2005): "Performance of external power supplies - Australia and New Zealand".

DIN 45323: "Connectors for coupling an external low-voltage power to portable entertainment equipment (describes at least two DC coaxial power plugs)".

IEC 60320 standards series: "Appliance couplers for household and similar general purposes".

HGI-RD009-R3: "Home Gateway Initiative Requirements for Energy Efficiency".

Umehara D., Hayasaki T., Denno S., Morikura M.: "The influence of time-varying channels synchronized with commercial power supply on PLC equipments", IEEE Symposium on Power Line Communications and Its Applications, April 2008.

History

Document history			
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