



## **Reference Specification**

for

## **Powerline Communications (PLC) Equipment**

IDA RS PLC  
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### NOTICE

**This Reference Specification is subject to review and revision.**

**Reference Specifications and Guides are informative documents, and are not used for type approval of customer equipment. They are either one of the following types of documents:**

- i. Informative and interim documents on customer equipment standards which are yet to be adopted by the network operators and where standardisation is still in progress.**
- ii. Informative documents describing the network standards adopted by the Public Telecommunication Networks in Singapore.**

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## 1. General Requirements

- 1.1 Powerline Communications (PLC) is a technology which allows the transmission of voice and data through the electrical distribution network (LV distribution cables). Since the electrical distribution network is not meant for telecommunications purposes, any users, operators and providers of PLC equipment, as the case may be, have a responsibility to ensure that they obtain the necessary approval from the relevant authorities that have jurisdiction over the use of electrical distribution cables.
- 1.2 This Specification does not in any way, constitutes an approval to transmit telecommunications signal over the power cables. Reference to this Specification should only be made after prior approval from the relevant authorities (as mentioned in the preceding paragraph) has been obtained.
- 1.3 To facilitate the use of PLC equipment in this environment, operators are required to:
- (a) Ensure that the broadband PLC equipment operates within the frequency range of 1.6 to 30 MHz, and has suppressed the use of HF frequency bands listed in § 4 of this Specification.
  - (b) Ensure that the level of the equipment output power is set to a minimum value for communication, and that the unwanted emissions are within the limits defined in § 5 of this Specification.
- 1.4 Operators of PLC services and suppliers of PLC equipment are required to:
- (a) Provide information to customers and users on how to resolve interference problems. This may involve the need to reduce the equipment output power and/or the need to install frequency band blocking mechanism (refer to § 3.3 of this Specification) at the power cable entrance point of customers' premises. This serves to minimise mutual interference between neighbouring PLC home networking devices and/or PLC access systems (where installed). For installation of frequency band blocking mechanism, suppliers would have to advise their customers to engage qualified technical personnel.
  - (b) Advise their customers that:
    - (i) The operation of PLC equipment is allowed under the condition that no interference is caused to other authorised telecommunications services, and that any interference caused by an authorised radio station, electrical or electronic equipment must be tolerated.
    - (ii) Operation of the PLC equipment may have to cease if it is found causing interference to other telecommunications services.
    - (iii) Compliance with requirements defined in this Specification does not imply a guarantee of a certain level of performance quality or multi-vendor equipment interoperability.

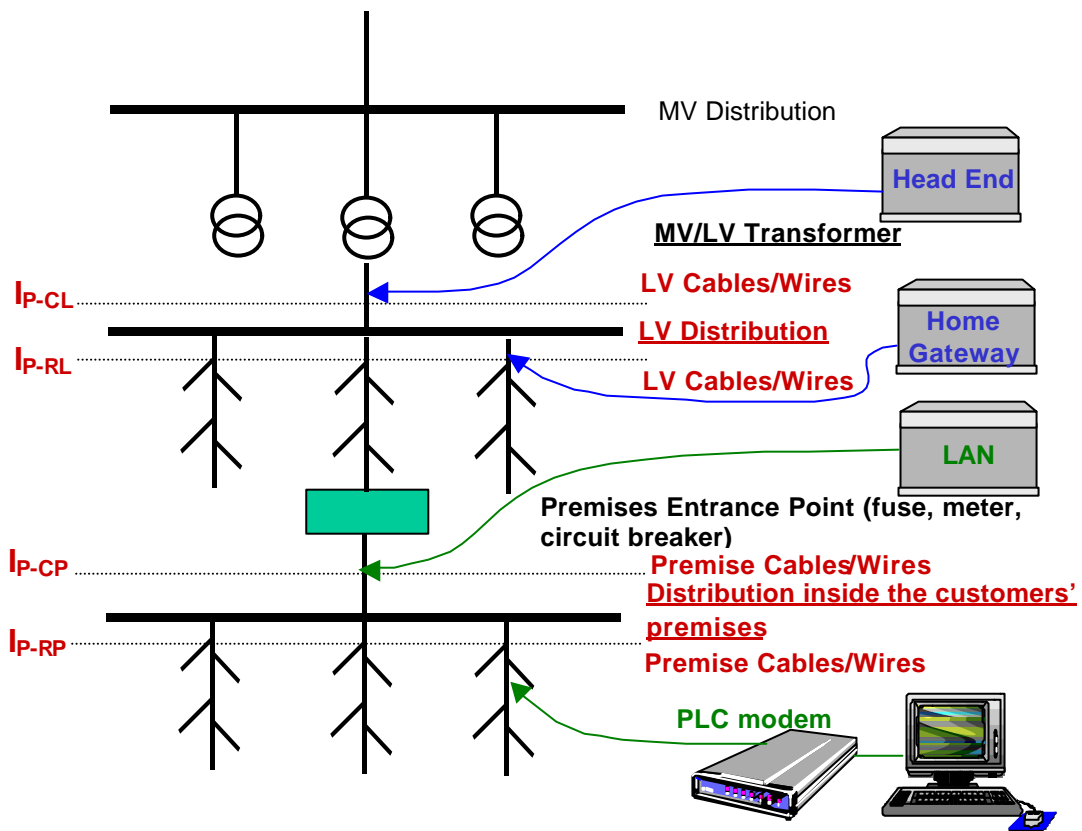
## 2. Scope

- 2.1 This Specification defines the minimum technical requirements for the connection of Powerline Communications (PLC) equipment to the low voltage electrical distribution networks. The Specification is applicable to PLC access (last-mile) and PLC home networking equipment, which can comply with the CISPR 22 standard for limiting radio disturbance or the FCC Part 15 Rules for radio frequency devices, § 15.31, 15.33, 15.35, 15.107 and 15.209. The

PLC access (last-mile) system is generally represented by the access Head End (at the Medium/Low Voltage Transformer), Home Gateway (providing the repeater and Local Area Network functions) and PLC customer premises equipment (e.g. PLC in-house modem).

2.2 The Specification defines the operating frequency bands, emission and output power limits and frequency band blocking mechanism to facilitate the use of the PLC equipment connected on a common power grid. PLC equipment is connected at the powerline interfaces  $I_{P-CL}$ ,  $I_{P-RL}$ ,  $I_{P-CP}$  and  $I_{P-RP}$  of the network architecture model as shown in Figure 1.

2.3 Figure 1 shows a schematic of an Electrical Distribution Network (EDN) substation up to the level of the Medium Voltage/Low Voltage (MV/LV) Transformer. It shows a star configuration although ring configuration is also possible on each power level.



**Note:**  $I_{P-YX}$  Interface Powerline – Y may be C denoting Central or R denoting Remote  
X may be L denoting Low Voltage Outdoor or P denoting Premises

Figure 1 (Figure 3/ETSI TS 101 896): **Physical Interfaces ( $I_{P-YX}$ ) in the EDN.**

2.4 Section 3 of this Specification defines the arrangement for deployment of broadband PLC systems, sharing the use of the frequency band from 1.6 to 30 MHz.

2.5 Section 4 listed the HF frequency bands within the spectrum from 1.6 to 30 MHz that are not permitted for use for PLC transmission in Singapore.

- 2.6** PLC equipment shall comply with the EMC Requirements for PLC Equipment (outlined in section 5 of this Specification) until harmonised EMC standards have been specifically set for such equipment.
- 2.7** PLC equipment shall be tested for compliance with the Singapore Standards SS 337<sup>1</sup> or the International Electrotechnical Commission IEC 60950 safety standard. The requirements in SS 337/IEC 60950 that are applicable to the equipment (e.g. class of equipment, type of TNV circuit and types of components) shall be identified and complied with.
- 2.8** Further standardisation of the  $I_{P-CP}$  and  $I_{P-RP}$  interfaces (Figure 1) for the connection of multi-vendor PLC in-house systems is in progress in the ETSI PLT.
- 2.9** Figure A-1/Annex A of this Specification gives the generic building block for powerline telecommunications,  $PLT_X$ . It shows how PLC system or functionality may be inserted into the different levels of the power network architecture (refer to Figure 1). It also shows how the PLT networks may be connected to the telecommunications networks at the  $I_{T-CX}$  interface for interworking, and the customer premises equipment (CPE) may be connected to the  $I_{T-RX}$  interface.
- 2.10** **References**
- |   |   |
|---|---|
| ETSI TS 101 896 v.1.1.1 (2001-02)               | Powerline Telecommunications (PLT); Reference Network Architecture Model; PLT Phase 1   |
| FCC Part 15 Subpart A – General                 | § 15.31 – Measurement Standards<br>§ 15.33 – Frequency Range of Radiated Measurements<br>§ 15.35 – Measurement Detector Functions and Bandwidths    |
| FCC Part 15 Subpart B – Unintentional Radiators | § 15.107 – Conducted Limits   |
| FCC Part 15 Subpart C – Intentional Radiators   | § 15.209 – Radiated Emission Limits, General Requirements   |
| IEC CISPR 16-1: 2002                            | Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus       |
| IEC CISPR 16-2: 1996+A1:1999                    | Specification for radio disturbance and immunity measuring apparatus and methods – Part 2: Methods of measurement of disturbances and immunity      |
| IEC CISPR 22: 1997                              | Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement  |
| CISPR/1/44/CD                                   | Amendment to CISPR 22: Clarification of its application to telecommunication system on the methods of disturbance measurement at ports used for PLC |
| IEC 60950 1999-04                               | International Electrotechnical Commission – Safety of Information Technology Equipment  |
| SS 337: 2001                                    | Singapore Standards – Safety of Information Technology Equipment  |

<sup>1</sup> The safety standard includes, among others, protection of telecommunications network service personnel and users of other equipment connected to the network from hazards in the PLC equipment.

## 2.11 Abbreviations

CISPR	International Special Committee on Radio Interference
EDN	Electrical Distribution Network
EMC	Electromagnetic Compatibility
ETSI	European Telecommunications Standards Institute
ETSI PLT	ETSI Powerline Telecommunications project
FCC	Federal Communications Commission (Washington DC, USA)
HF	High Frequency
LCL	Longitudinal Conversion Loss
LV	Low Voltage
MV	Medium Voltage
T-ISN	Termination Impedance Stabilisation Network

## 3. Operating Frequencies and Coexistence

### 3.1 Broadband PLC System

A broadband PLC system, including PLC access and PLC in-house systems, shall operate within the frequency band from 1.6 to 30 MHz. It shall have the capability to limit the output power to – 50 dBm/Hz or below, and the aggregated output power to not higher than 13 dBm.

### 3.2 Coexistence using Frequency Band Blocking Mechanism

3.3.1 To facilitate coexistence of PLC systems operating in different premises on the same LV power grid, frequency band blocking mechanism at the premises entrance point shall be provided and packaged as part of the PLC access. Where installed, it will be used to block PLC signals from entering or leaving the premises. This will prevent mutual interference between neighbouring PLC access and/or home networking systems.

3.3.2 The band blocking mechanism must ensure that attenuation in the frequency band from 1.6 to 30 MHz is greater than 30 dB.

## 4. Prohibited frequencies

Broadband PLC systems must have the capability to suppress the use of critical frequencies. Also, PLC transmission in the following HF frequency bands is prohibited:

- (a) 2.850 – 3.025 MHz
- (b) 5.480 – 5.730 MHz

- (c) 6.525 – 6.685 MHz
- (d) 8.815 – 8.965 MHz
- (e) 10.005 – 10.100 MHz
- (f) 10.7 MHz
- (g) 11.275 – 11.400 MHz

## 5. Electromagnetic Compatibility/Interference (EMC/EMI) Requirements

### 5.1 EMC Requirements for PLC Equipment Compliance

5.1.1 IDA intends to adopt the CISPR 22 after it is established with the appropriate amendment and provisions for PLC. The amendment will provide the method for disturbance measurement at ports used for PLC.

5.1.2 In the interim, PLC equipment is required to comply with either 5.1.2.1 or 5.1.2.2.

5.1.2.1 PLC equipment shall operate within the CISPR 22 limits for the conducted common mode voltage/current when measured at the multi purpose port for PLC (class B equipment), using a T-ISO with an LCL of 30 dB proposed for low voltage distribution networks; and limits for radiated emissions (class B equipment). Applicable limits for PLC equipment are specified as follows:

- (a) Conducted common mode voltage or current limits at the power line during data transmission (74 dB $\mu$ V or 30 dB $\mu$ A in the frequency range from 150 kHz to 30 MHz);
- (b) Radiated emission limits (30 dB $\mu$ V/m, measuring at 10 m, in the frequency range from 30 to 230 MHz, and 37 dB $\mu$ V/m, measuring at 10 m, in the frequency range from 230 to 1000 MHz).

5.1.2.2 PLC equipment shall comply with the limits for radiated emissions and measurement methods specified in FCC Part 15 § 15.31, 15.33, 15.35, 15.107 and 15.209. The applicable FCC Part 15 radiated emission limits are:

- (a) § 15.209 for frequency range of 9 kHz to 30 MHz, [2400/F (kHz) measured at 300 m for 0.009 to 0.490 MHz, 24000/F (kHz) measured at 30 m for 0.490 to 1.705 MHz, and 30  $\mu$ V/m measured at 30 m for 1.705 to 30 MHz];
- (b) § 15.109 (e) for frequencies above 30 MHz, the radiated emission limits of CISPR 22 are accepted as alternative.

### 5.2 EMI Requirements for PLC Installation

The field strength of radiated emissions from PLC installations (including access and in-house systems), connected over the outdoor and in-house electrical distribution network (LV distribution cables), shall not exceed the limits specified in the table in FCC Part 15 § 15.209 (a) [in particular, 30  $\mu$ V/m for frequencies in the band of 1.705 – 30.0 MHz when measured at a distance of 30 m], following the methods described in FCC Part 15, § 15.31, 15.33 and 15.35. The applicable FCC Part 15 radiated emission limits are given in § 5.1.2.2 of this Specification.



The current IDA Specifications for equipment connection to the various telecommunications networks (core backbone networks) are:

- IDA TS PSTN 1
- IDA TS ISDN1, ISDN2 and ISDN3
- IDA TS ADSL1 and ADSL2
- IDA TS CM2
- IDA TS DLCN 1
- IDA TS BISDN1
- IDA RS SDH 1, SDH 2 and SDH 3

This list is subject to review and updating.

These IDA Specifications are available from [www.ida.gov.sg](http://www.ida.gov.sg) under Policy & Regulation.