



Reference Specification

for

Phoneline Networking

IDA RS PHLINE NW Issue 1

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NOTICE

This Reference Specification is subject to review and revision.

Reference Specifications and Guides 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.**

PART A INTRODUCTION

1. SCOPE

- 1.1** This Specification describes a high-speed networking (LAN) technology, which allows several PCs connected to the same in-premise telephone lines to share a single Internet connection. The Specification defines the minimum technical requirements for connection of phoneline networking transceivers (PNT) for data transmission over the in-premises telephone wiring. Part B of the Specification defines the system reference model for PNT; the Power Spectral Density (PSD) mask; and the basic electrical characteristics (ITU-T Rec. G.989.1). Part C of the Specification outlines the characteristics of the isolation function (IF) for separating the in-premises wiring from the access network (ITU-T Rec. G.989.3).
- 1.2** These PNT devices shall be compatible with the existing telephony devices connected on the same in-premises wiring. In addition, for spectrum compatibility with radio amateur services, the Specification also requires PNT to have built-in notches for reducing RFI egress in the radio amateur frequency bands.
- 1.3** Compliance with this Specification on the whole is voluntary. However, PNT users and providers can only claim that their devices are in conformity with this Specification when mandatory provisions indicated by the words “shall” or “must” are fulfilled.

2. GENERAL REQUIREMENTS

2.1 Power Supply

The PNT may be a.c. powered or d.c. powered. For an a.c. powered equipment, the Specification shall be complied with when operating from an a.c. mains supply of voltage, 230V \pm 10% and frequency, 50 Hz \pm 2%. Where external power supply is used, e.g. AC adaptor, it shall not affect the capability of the equipment to meet the Specification.

2.2 Identification of Equipment

The PNT equipment shall be marked with the supplier or manufacturer’s name or identification mark, and the supplier or manufacturer’s model or type reference. The markings required shall be legible, indelible and readily visible.

2.3 Safety Requirements

The PNT shall be tested for compliance with the International Electrotechnical Commission IEC 60950 safety standard¹. The requirements in 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.

2.4 Electromagnetic Compatibility (EMC) Requirements

The PNT equipment shall comply with the “EMC requirements for Telecommunication Equipment” (IDA TS EMC).

¹ 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 PNT.

3. REFERENCES

ITU-T Rec. G.989.1 (02/2001)	Phoneline Networking Transceivers – Foundation
ITU-T Rec. G.989.2 (11/2001)	Phoneline Networking Transceivers – Payload Format and Link Layer Requirements
ITU-T Rec. G.989.3 (11/2001)	Phoneline Networking Transceivers – Isolation Functions
IEC CISPR 22: 1997	Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement
IDA TS EMC	EMC requirements for Telecommunication Equipment
IEC 60950: 1999	International Electrotechnical Commission - Safety of Information Technology Equipment

4. ABBREVIATIONS

ADSL	Asymmetrical Digital Subscriber Line (see ITU-T Rec. G.992.1 and G.992.2)
AN	Access Network
CSMA/CD	Carrier Sense Multiple Access/Collision Detection
IF	Isolation Function
LAN	Local Area Network
MAC	Media Access Control
PC	Personal Computer
PHY	Physical Layer
PNT	Phoneline Networking Transceiver
POTS	Plain Old Telephone Service (one of the services using the voiceband; sometimes used as a descriptor for all voiceband services)
RFI	Radio Frequency Interference
VDSL	Very high speed Digital Subscriber Line (see ITU-T Rec. G.993.1)

Note:

The following notations are used in the Specification:

CR	Conformance requirement defines features and functions which must be supported at minimum.
M	Mandatory requirements
O	Optional requirements
	Functionality if implemented, the requirements become "M".
NA	Not Applicable
GID	General Information and Definitions

PART B PHONELINE NETWORKING TRANSCEIVERS

(Based on ITU-T Rec. G.989.1 02/2001)

1. SYSTEM REFERENCE MODEL FOR PHONELINE NETWORKING TRANSCEIVERS

1.1 Figure 1 shows the basic reference model for in-premises phoneline networking transceivers (PNT). The interface of concern in this Specification is the wire-side electrical and logical interface (W1) between a PNT station and the phone wire. Typically, the in-premises wiring is connected to the access network (e.g. ADSL).

1.2 An isolation function (IF) shall be implemented to prevent interference between PNT devices operating on in-premises wiring and access network technologies that use an overlapping frequency spectrum, e.g. VDSL. Examples of usage of IF are given in ITU-T Recommendation G.989.3 § 6. The IF performs spectral isolation by means of a filter, taking into consideration the PNT frequencies in the band 4 MHz – 30 MHz.

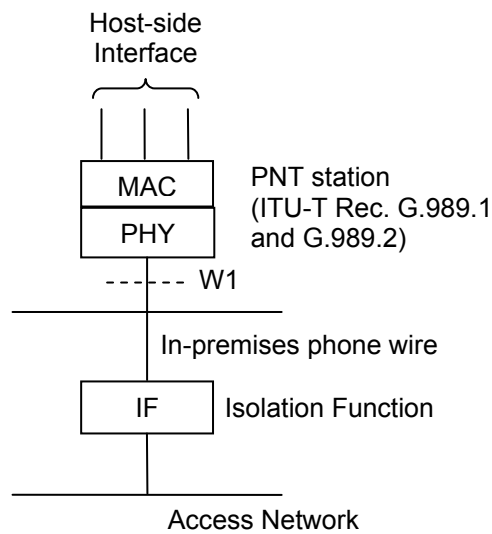
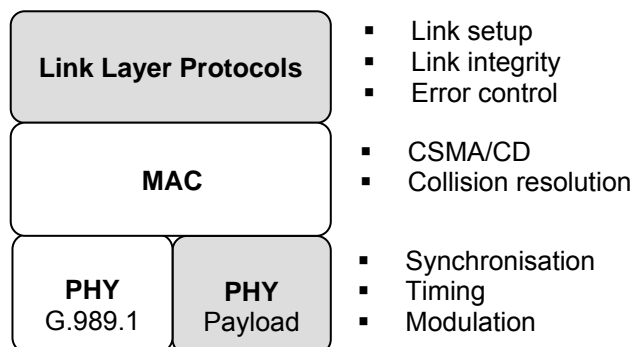


Figure 1 (Figure 1/G.989.1): **Basic Reference Model**

1.3 Figure 2 shows the functional view of the system reference model. The MAC and G.989.1 PHY functions are defined in the ITU-T Recommendation G.989.1 while the Payload PHY and Link Layer Protocol functions are defined in the ITU-T Recommendation G.989.2.



- Functions defined in ITU-T Rec. G.989.1
- Functions defined in ITU-T Rec. G.989.2

Figure 2 (Figure 2/G.989.1): **Functional View of Reference Model**

2. POWER SPECTRAL DENSITY

The transmit PSD mask is shown in Figure 3. The PNT shall be constrained by the upper bound shown in Figure 3 with measurement made across a 100 Ω load at the two-wire W1 interface. Measurement method and requirements are given in ITU-T Recommendation G.989.1 § 5. The 10 dB notches at 4.0, 7.0 and 10.0 MHz are designed to reduce RFI egress in the radio amateur bands.

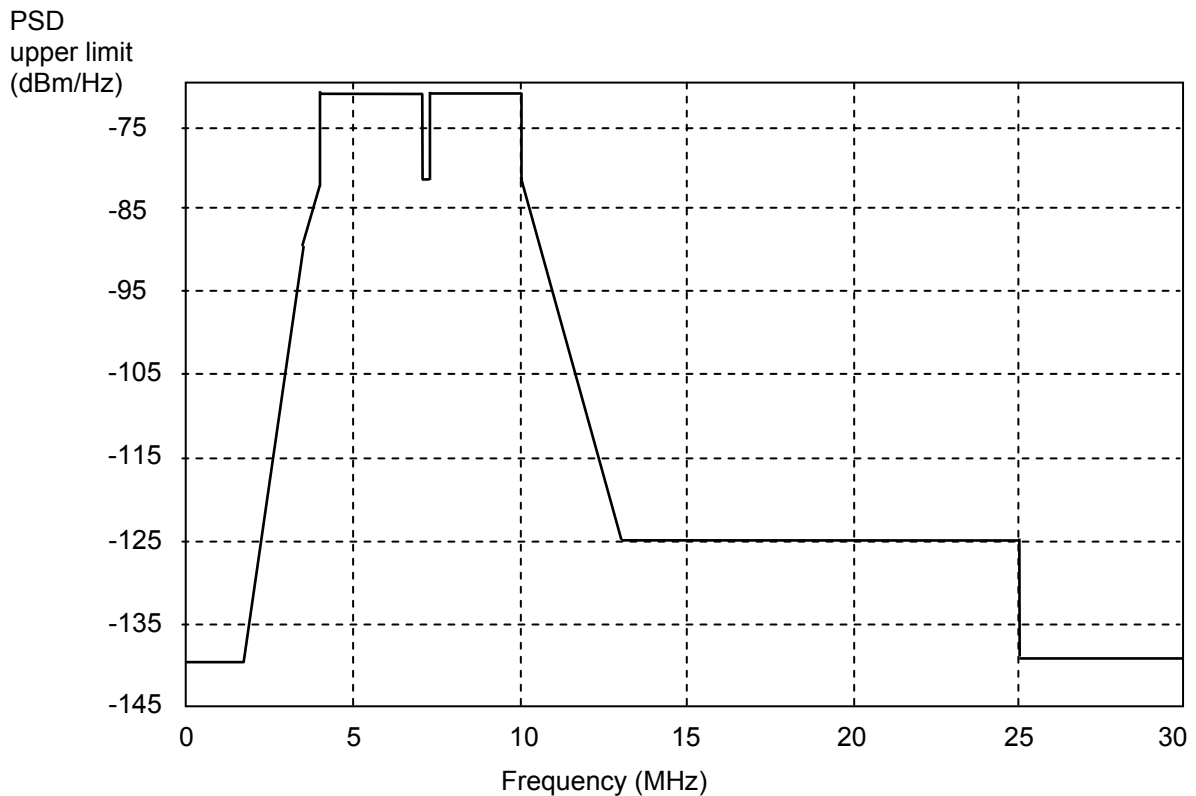


Figure 3 (Figure 5/G.989.1): PSD Mask

3. ELECTRICAL CHARACTERISTICS

The PNT shall limit the longitudinal voltage emitted from the W1 interface such that the level shall not exceed -55 dBVrms in the frequency range 0.1 to 30 MHz. The longitudinal balance at W1 shall be greater than 35 dB over the frequency range 0.1 to 30 MHz. Measurement methods for the longitudinal voltage and longitudinal balance are given in ITU-T Recommendation G.989.1 § 6.

PART C ELECTRICAL CHARACTERISTICS OF IF FILTER

(Based on ITU-T Rec. G.989.3 03/2003)

Title	ITU-T Rec. G.989.3	Comments	CR
Stress withstand	7.1		M
Voltage	7.1.1	The filter shall remain functional with the following applied: 100 V dc; and 100 V ac rms 25-50 Hz.	M
Current	7.1.2	The filter shall remain functional with the following applied: 100 mA max continuous	M
Isolation	7.2	Heading	—
Between wires	7.2.1	> 5 M Ω at 100 V	M
Wire-ground	7.2.2	> 100 M Ω at 100 V	M
DC resistance	7.3	The loop resistance should be less than 5 Ω	O
Reference impedance	7.4	Z _{ref} is 100 Ω .	M
Differential insertion loss	7.5	Heading	—
At voice frequencies	7.5.1	> 0; < 0.5 dB in the band 200 Hz – 4 kHz between 600 Ω loads; < 0.5 dB in the band 200 Hz – 4 kHz between loads of (150 nF // 750 Ω) + 270 Ω , see Figure 7/G.989.3.	M
Above voiceband up to 1104 kHz	7.5.2	> 0; < 0.5 dB in the band 4 kHz – 552 kHz between Z _{ref} - Ω loads; < an amount increasing linearly with the logarithm of frequency from 0.5 dB at 552 kHz and 1 dB at 1104 kHz, as shown in Figure 8/G.989.3.	M
At PNT frequencies	7.5.3	> 35 dB in the band 4 – 5.1 MHz; > 41 dB in the band 5.1 – 8.5 MHz; > 35 dB in the band 8.5 – 30 MHz, between Z _{ref} - Ω loads.	M
Common mode insertion loss	7.6	Heading	—
At PNT frequencies	7.6.1	> 20 dB in the band 4 – 30 MHz between 50- Ω loads, as shown in Figure 9/G.989.3.	M
Differential mode return loss	7.7	Figure 10/G.989.3 – differential mode return loss measurements	M
At POTS frequencies	7.7.1	> 18 dB in the band 200 Hz – 4 kHz between 600- Ω loads; > 18 dB in the band 200 Hz 4 kHz between loads of (150 nF // 750 Ω) + 270 Ω , see Figure 7/G.989.3 (ETSI TBR 21).	M
Above voiceband up to 1104 kHz	7.7.2	> 18 dB in the band 10 kHz – 552 kHz between Z _{ref} - Ω loads; > 6 dB at 1104 kHz between Z _{ref} - Ω loads; as shown in Figure 11/G.989.3.	M

Title	ITU-T Rec. G.989.3	Comments	CR
Differential mode impedance	7.8	Heading	—
At PNT frequencies	7.8.1	> 160 Ω in the band 4 – 40 MHz, at the in-premises wiring side of IF	M
Balance	7.9	Heading	—
At voice frequencies	7.9.1	> 40 dB in the band 15 – 50 Hz when terminated with 600 Ω ; > 46 dB in the band 50 – 600 Hz when terminated with 600 Ω ; > 52 dB in the band 600 – 3400 Hz when terminated with 600 Ω .	M
Above voiceband up to 1104 kHz	7.9.2	> 46 dB in the band 10 – 552 kHz when terminated with $Z_{ref}\text{-}\Omega$ centre tap grounded at the in-premises wiring side; > 40 dB in the band 552 – 1104 kHz when terminated with $Z_{ref}\text{-}\Omega$ centre tap grounded at the in-premises wiring side.	M
At PNT frequencies	7.9.3	> 35 dB in the band 4 – 30 MHz when terminated with $Z_{ref}\text{-}\Omega$ differential, and 100 Ω from one leg to ground at in-premises wiring side.	M
Noise	7.10	Measured at the AN port of filter	M
At POTS frequencies	7.10.1	< -80 dBVp total into 600 Ω in the band 200 Hz – 3.4 kHz	M
Between voiceband and PNT frequencies	7.10.2	< -80 dBVp total into $Z_{ref}\text{-}\Omega$ in the band 10 – 1104 kHz	M
At PNT frequencies	7.10.3	< -66 dBm total into $Z_{ref}\text{-}\Omega$ in the band 4 – 30 MHz	M
Group delay distortion	7.11	Heading	—
Between voiceband and PNT frequencies	7.11.1	Under further study by ITU-T	—
Distortion	7.12	Heading	—
Between voiceband and PNT frequencies	7.12.1	< -140 dBm/Hz	M
Physical properties	7.13	Not defined by ITU-T Rec. G.989.3	—