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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

Digital sections and digital line system – Access networks

**Asymmetric digital subscriber line
transceivers 2 (ADSL2)**

ITU-T Recommendation G.992.3

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Asymmetric digital subscriber line transceivers 2 (ADSL2)

Summary

This Recommendation describes Asymmetric Digital Subscriber Line (ADSL) Transceivers on a metallic twisted pair that allows high-speed data transmission between the network operator end (ATU-C) and the customer end (ATU-R). It defines a variety of frame bearers in conjunction with one of two other services or without underlying service, dependent on the environment:

- 1) ADSL transmission simultaneously on the same pair with voice band service;
- 2) ADSL transmission simultaneously on the same pair with ISDN (Appendix I or II/G.961 [1]) services;
- 3) ADSL transmission without underlying service, optimized for deployment with ADSL over voiceband service in the same binder cable;
- 4) ADSL transmission without underlying service, optimized for deployment with ADSL over ISDN service in the same binder cable.

ADSL transmission on the same pair with voiceband services and operating in an environment with TCM-ISDN (Appendix III/G.961 [1]) services in an adjacent pair, is for further study.

This Recommendation specifies the physical layer characteristics of the Asymmetric Digital Subscriber Line (ADSL) interface to metallic loops.

This Recommendation has been written to help ensure the proper interfacing and interworking of ADSL transmission units at the customer end (ATU-R) and at the network operator end (ATU-C), and also to define the transport capability of the units. Proper operation shall be ensured when these two units are manufactured and provided independently. A single twisted pair of telephone wires is used to connect the ATU-C to the ATU-R. The ADSL transmission units must deal with a variety of wire pair characteristics and typical impairments (e.g., crosstalk and noise).

An ADSL transmission unit can simultaneously convey all of the following: a number of downstream frame bearers, a number of upstream frame bearers, a baseband POTS/ISDN duplex channel, and ADSL line overhead for framing, error control, operations, and maintenance. Systems support a net data rate ranging up to a minimum of 8 Mbit/s downstream and 800 kbit/s upstream. Support of net data rates above 8 Mbit/s downstream and support of net data rates above 800 kbit/s upstream are optional.

This Recommendation includes mandatory requirements, recommendations and options; these are designated by the words "shall", "should" and "may" respectively. The word "will" is used only to designate events that take place under some defined set of circumstances.

This Recommendation defines several optional capabilities and features:

- transport of STM and/or ATM and/or Packets;
- transport of a network timing reference;
- multiple latency paths;
- multiple frame bearers;
- short initialization procedure;
- dynamic rate repartitioning;
- seamless rate adaptation.

It is the intention of this Recommendation to provide, by negotiation during initialization, for U-interface compatibility and interoperability between transceivers complying with this Recommendation and between transceivers that include different combinations of options.

History

This Recommendation describes the second generation of ADSL, based on the first generation ITU-T Rec. G.992.1. It is intended that this Recommendation be implemented in multi-mode devices that support both ITU-T Recs G.992.3 and G.992.1.

This Recommendation has been written to provide additional features, relative to ITU-T Rec. G.992.1. ITU-T Rec. G.992.1 was approved in June 1999. Since then, several potential improvements have been identified in areas such as data rate versus loop reach performance, loop diagnostics, deployment from remote cabinets, spectrum control, power control, robustness against loop impairments and RFI, and operations and maintenance. This Recommendation provides a new ADSL U-interface specification, including the identified improvements, which the ITU-T believes will be most helpful to the ADSL industry.

Relative to ITU-T Rec. G.992.1, the following application-related features have been added:

- Improved application support for an all digital mode of operation and voice over ADSL operation;
- Packet TPS-TC function, in addition to the existing STM and ATM TPS-TC functions;
- Mandatory support of 8 Mbit/s downstream and 800 kbit/s upstream for TPS-TC function #0 and frame bearer #0;
- Support for IMA in the ATM TPS-TC;
- Improved configuration capability for each TPS-TC with configuration of latency, BER and minimum, maximum and reserved data rate.

Relative to ITU-T Rec. G.992.1, the following PMS-TC-related features have been added:

- A more flexible framing, including support for up to 4 frame bearers, 4 latency paths;
- Parameters allowing enhanced configuration of the overhead channel;
- Frame structure with receiver selected coding parameters;
- Frame structure with optimized use of RS coding gain;
- Frame structure with configurable latency and bit error ratio;
- OAM protocol to retrieve more detailed performance monitoring information;
- Enhanced on-line reconfiguration capabilities including dynamic rate repartitioning.

Relative to ITU-T Rec. G.992.1, the following PMD-related features have been added:

- New line diagnostics procedures available for both successful and unsuccessful initialization scenarios, loop characterization and troubleshooting;
- Enhanced on-line reconfiguration capabilities including bitswaps and seamless rate adaptation;
- Optional short initialization sequence for recovery from errors or fast resumption of operation;
- Optional seamless rate adaptation with line rate changes during showtime;
- Improved robustness against bridged taps with receiver determined pilot tone;
- Improved transceiver training with exchange of detailed transmit signal characteristics;
- Improved SNR measurement during channel analysis;
- Subcarrier blackout to allow RFI measurement during initialization and SHOWTIME;
- Improved performance with mandatory support of trellis coding;
- Improved performance with mandatory one-bit constellations;
- Improved performance with data modulated on the pilot tone;
- Improved RFI robustness with receiver determined tone ordering;
- Improved transmit power cutback possibilities at both CO and remote side;
- Improved Initialization with receiver and transmitter controlled duration of initialization states;
- Improved Initialization with receiver-determined carriers for modulation of messages;
- Improved channel identification capability with spectral shaping during Channel Discovery and Transceiver Training;
- Mandatory transmit power reduction to minimize excess margin under management layer control;
- Power saving feature for the central office ATU with new L2 low power state;
- Power saving feature with new L3 idle state;
- Spectrum control with individual tone masking under operator control through CO-MIB;
- Improved conformance testing including increase in data rates for many existing tests.

Through negotiation during initialization, the capability of equipment to support the G.992.3 and/or the G.992.1 Recommendations is identified. For reasons of interoperability, equipment may choose to support both Recommendations, such that it is able to adapt to the operating mode supported by the far-end equipment.

Source

ITU-T Recommendation G.992.3 was approved by ITU-T Study Group 15 (2001-2004) under the ITU-T Recommendation A.8 procedure on 29 July 2003.

It integrates the modifications introduced by ITU-T Rec. G.992.3 (2002) Amendment 1 approved on 22 May 2003.

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