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DIGITAL SYSTEMS AND NETWORKS

Digital sections and digital line system – Access networks

Splitterless asymmetric digital subscriber line transceivers 2 (splitterless ADSL2)

ITU-T Recommendation G.992.4

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For further details, please refer to the list of ITU-T Recommendations.

ITU-T Recommendation G.992.4

Splitterless asymmetric digital subscriber line transceivers 2 (splitterless ADSL2)

Summary

This Recommendation describes the interface between the telecommunications network and the customer installation in terms of their interaction and electrical characteristics. G.992.4 allows the transmission of POTS and V-series data services simultaneously with a digital channel over a single mixed gauge twisted metallic pair. Operation in a TCM-ISDN noise environment is for further study. This Recommendation is structured as a delta document to ITU-T Rec. G.992.3.

This Recommendation includes procedures to allow provisioning without the need for "splitters", typically installed at the ingress to the customer premises. Additionally, power management procedures and link states are specified to achieve power savings at the central office and customer premises.

This Recommendation describes the second generation of splitterless ADSL, based on the first generation ITU-T Rec. G.992.2. This Recommendation may be easily implemented in multi-mode devices that support both G.992.4 and G.992.2 with the following major additions and revisions:

- Improved application support for an all digital mode of operation and voice over ADSL operation.
- A new packet TPS-TC function and a STM TPS-TC function in addition to the existing ATM support.
- Support for IMA in the ATM TPS-TC.
- Improved configuration capability for each TPS-TC with configuration of latency, BER and minimum, maximum and reserve data rate.
- New line diagnostic procedures available for both successful and unsuccessful initialization scenarios.
- Enhanced on-line reconfiguration capabilities including bit-swaps, dynamic rate repartitioning, and seamless rate adaptation.
- A more flexible TPS-TC function including support for up to 4 frame bearers, 4 latency paths, and control parameters allowing enhanced configuration of the overhead channel.
- Performance improvements including mandatory support for $R = 16$, one-bit constellations, and trellis coding.
- A more robust initialization procedure that includes splitterless capability features of the G.992.2 fast retrain procedure, CO and CP controlled adaptive signal durations, receiver determined adaptive frequency modulation for data exchange, and an optional adaptive length fast start-up procedure.
- Improved RFI and spectrum management tools including transmit power cutback at both ends of the line, spectrum shaping, sub-carrier black-out lists to avoid RFI, and improved sub-carrier ordering to help mitigate the propagation of RFI from sub-carrier to sub-carrier.
- Power saving features including mandatory reduction of excess margin under management layer control and a new L2 power management link state with low power features for the central office.

Source

ITU-T Recommendation G.992.4 was prepared by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 29 July 2002.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation G.992.4

Splitterless asymmetric digital subscriber line transceivers 2 (splitterless ADSL2)

1 Scope

This Recommendation describes the interface between the telecommunications network and the customer installation in terms of their interaction and electrical characteristics. The requirements of this Recommendation apply only to a single asymmetric digital subscriber line (ADSL). ADSL allows the provision of voiceband services, including POTS and V-series data services, and a number of digital channels. This Recommendation is structured as a delta document to ITU-T Rec. G.992.3.

The transmission system is designed to operate on mixed gauge two-wire twisted metallic pairs over the existing copper facilities and over the customer premises wiring. The transmission system is based on the use of loop plant cables without loading coils. Bridged taps in the loop plant are acceptable in all but a few unusual situations.

Operation in a TCM-ISDN noise environment is for further study.

An overview of Digital Subscriber Line Transceivers can be found in ITU-T Rec. G.995.1.

This Recommendation describes the second generation of splitterless ADSL, based on the first generation ITU-T Rec. G.992.2. This Recommendation is easily implemented in multi-mode devices that support both G.992.4 and G.992.2 with the following major additions or revisions:

- Improved application support for an all digital mode of operation and voice over ADSL operation.
- A new packet TPS-TC function and a STM TPS-TC function in addition to the existing ATM support.
- Support for IMA in the ATM TPS-TC.
- Improved configuration capability for each TPS-TC with configuration of latency, BER and minimum, maximum and reserve data rate.
- New line diagnostic procedures available for both successful and unsuccessful initialization scenarios.
- Enhanced on-line reconfiguration capabilities including bit-swaps, dynamic rate repartitioning, and seamless rate adaptation.
- A more flexible TPS-TC function including support for up to 4 frame bearers, 4 latency paths, and control parameters allowing enhanced configuration of the overhead channel.
- Performance improvements including mandatory support for $R = 16$, one-bit constellations, and trellis coding.
- A more robust initialization procedure that includes splitterless capability features of the G.992.2 fast retrain procedure, CO and CP controlled adaptive signal durations, receiver determined adaptive frequency modulation for data exchange, and an optional adaptive length fast start-up procedure.
- Improved RFI and spectrum management tools including transmit power cutback at both ends of the line, spectrum shaping, sub-carrier black-out lists to avoid RFI, and improved sub-carrier ordering to help mitigate the propagation of RFI from sub-carrier to sub-carrier.
- Power saving features including mandatory reduction of excess margin under management layer control and a new L2 mode with low power features for the central office.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation

- [1] ITU-T Recommendation G.994.1 (2002), *Handshake procedures for Digital Subscriber Line (DSL) transceivers*.
- [2] ITU-T Recommendation G.992.3 (2002), *Asymmetric Digital Subscriber Line transceivers 2 (ADSL2)*.
- [3] ITU-T Recommendation G.997.1 (1999), *Physical layer management for Digital Subscriber Line (DSL) transceivers*.

3 Definitions

The definitions in clause 3/G.992.3 shall apply for this Recommendation.

4 Abbreviations

The abbreviations in clause 4/G.992.3 shall apply for this Recommendation.

5 Reference models

G.992.4 devices fit within the XDSL Recommendations described in ITU-T Rec. G.995.1. Additionally, G.992.4 devices rely upon constituent components described within ITU-T Recs G.994.1 and G.997.1. This clause provides the necessary functional, application, and protocol reference models so that the subclauses of G.992.4 may be related to these additional Recommendations.

5.1 ATU functional model

The ATU functional model for G.992.4 shall be identical to that provided in 5.1/G.992.3. Figure 5-1/G.992.3 is duplicated here for reference.

Figure 5-1/G.992.3 is duplicated here for reference.