International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.992.5

Amendment 3

(12/2006)

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

Digital sections and digital line system – Access networks

Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2plus)

Amendment 3

ITU-T Recommendation G.992.5 (2005) – Amendment 3

ITU-T

International Telecommunication Union

ITU-T G-SERIES RECOMMENDATIONS

TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100–G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200–G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300–G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400–G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450–G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600–G.699
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
General	G.900–G.909
Parameters for optical fibre cable systems	G.910–G.919
Digital sections at hierarchical bit rates based on a bit rate of 2048 kbit/s	G.920–G.929
Digital line transmission systems on cable at non-hierarchical bit rates	G.930–G.939
Digital line systems provided by FDM transmission bearers	G.940–G.949
Digital line systems	G.950–G.959
Digital section and digital transmission systems for customer access to ISDN	G.960–G.969
Optical fibre submarine cable systems	G.970–G.979
Optical line systems for local and access networks	G.980–G.989
Access networks	**G.990–G.999**
QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000–G.7999
PACKET OVER TRANSPORT ASPECTS	G.8000–G.8999
ACCESS NETWORKS	G.9000–G.9999

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

ITU-T Recommendation G.992.5

Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2plus)

Amendment 3

Summary

Amendment 3 to ITU-T Recommendation G.992.5 (2005) addresses the following added functionality:

1) longitudinal conversion loss;
2) upstream PSD shaping and handshake;
3) optional 24'000 bytes interleaver size;
4) new Appendix VII on automode.

Source

Amendment 3 to ITU-T Recommendation G.992.5 (2005) was approved on 14 December 2006 by ITU-T Study Group 15 (2005-2008) under the ITU-T Recommendation A.8 procedure.

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.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

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, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

© ITU 2007

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

CONTENTS

ITU-T Recommendation G.992.5

Asymmetric Digital Subscriber Line (ADSL) transceivers – Extended bandwidth ADSL2 (ADSL2plus)

Amendment 3

1) Changes related to longitudinal conversion loss

Add or replace the paragraphs in the following clauses:

A.4 Electrical characteristics

See A.4 of [ITU-T G.992.3].

The G.992.3 requirements (except longitudinal conversion loss) applying over a frequency band up to 1104 kHz shall be met over a frequency band up to 2208 kHz.

The ATU-C shall have a longitudinal conversion loss (LCL) of at least 40 dB in the frequency range from 1104 kHz to 2208 kHz.

The ATU-R shall have a longitudinal conversion loss (LCL) of at least 40 dB in the frequency range from 1104 kHz to 2208 kHz.

B.4 Electrical characteristics

See B.4 of [ITU-T G.992.3].

The G.992.3 requirements (except longitudinal conversion loss) applying over a frequency band up to 1104 kHz shall be met over a frequency band up to 2208 kHz.

The longitudinal conversion loss (LCL) requirements in the frequency range from 1104 kHz to 2208 kHz are defined in clause A.4.

I.4 Electrical characteristics

See I.4 of [ITU-T G.992.3].

The G.992.3 requirements (except longitudinal conversion loss) applying over a frequency band up to 1104 kHz shall be met over a frequency band up to 2208 kHz.

The longitudinal conversion loss (LCL) requirements in the frequency range from 1104 kHz to 2208 kHz are defined in clause A.4.

J.4 Electrical characteristics

~~The ATU shall meet the electrical characteristics defined in § I.4.~~

See J.4 of [ITU-T G.992.3].

The G.992.3 requirements (except longitudinal conversion loss) applying over a frequency band up to 1104 kHz shall be met over a frequency band up to 2208 kHz.

The longitudinal conversion loss (LCL) requirements in the frequency range from 1104 kHz to 2208 kHz are defined in clause A.4.

M.4 Electrical characteristics

~~The ATU shall meet the electrical characteristics defined in § A.4.~~

See M.4 of [ITU-T G.992.3].

The G.992.3 requirements (except longitudinal conversion loss) applying over a frequency band up to 1104 kHz shall be met over a frequency band up to 2208 kHz.

The longitudinal conversion loss (LCL) requirements in the frequency range from 1104 kHz to 2208 kHz are defined in clause A.4.

2) Changes related to upstream PSD shaping and handshake

a) In clause J.2.2 "ATU-R upstream transmit spectral mask (supplements 8.10)", add the following after Table J.3:

The upstream spectrum bounds default settings in Table J.2 apply for all ADLU-x and shaped PSD Masks. Clause 8.13.2.4 defines how the ATU-R is to resolve inconsistencies between the upstream spectrum bounds, spectrum shaping and MIB PSD Mask parameters contained in the CLR and CL message.

In particular:

1) NOMPSDus shall be changed from its default value for the ADLU-masks 36 up to 64 during the preactivation (G.994.1 phase, see clause 8.13.2) at least to the Template Nominal PSD values listed in Table J.3.
2) MAXNOMPSDus shall be a value within the Limit_PSD_Mask for PSD shaping (Table J.10) minus 3.5 dB.

b) In clause M.2.2 "ATU-R upstream transmit spectral mask (supplements 8.10)", add the following after Table M.3:

The upstream spectrum bounds default settings in Table M.2 apply for all EU-x and shaped PSD Masks. Clause 8.13.2.4 defines how the ATU-R is to resolve inconsistencies between the upstream spectrum bounds, spectrum shaping and MIB PSD Mask parameters contained in the CLR and CL message.

In particular:

1) NOMPSDus shall be changed from its default value for the EU/ADLU-masks 36 up to 64 during the preactivation (G.994.1 phase, see clause 8.13.2) at least to the Template Nominal PSD values listed in Table M.3.
2) MAXNOMPSDus shall be a value within the Limit_PSD_Mask for PSD shaping (Table M.10) minus 3.5 dB.

3) Changes related to optional 24'000 bytes downstream interleaver size

a) In G.992.5 Amendment 1, "clause 7.6.2, Valid framing configurations", change Table 7-8/G.992.5 as follows:

Table 7-8/G.992.5 – Valid framing configurations

Parameter	Capability
D_p	1, 2, 4, 8, 16, 32, 64. For the downstream latency path #0, additional valid D_0 values are: 96, 128, 160, 192, 224, 256, 288, 320, 352, 384, 416, 448, 480, 511. If $R_p = 0$ then $D_p = 1$
Relationship of N_{FEC0} and D_0	Configurations that satisfy the following relationship are valid: $(N_{FEC0} - 1) \times (D_0 - 1) \leq$ ~~254 x 63 = 16002~~24'000
Relation of S_p and M_p	Configurations that satisfy the following relationship are valid: $M_p /3 \leq S_p \leq 32 \times M_p$ (see Note 1). For the downstream latency path #0, additional valid configurations are: $M_0/16 \leq S_0 < M_0/3$
Delay constraints	Configurations that satisfy the following relationship are valid: $1/3 \leq S_p \leq 64$ (see Note 3). For the downstream latency path #0, additional valid S_0 values are: $1/16 \leq S_0 < 1/3$

b) In G.992.5 Amendment 1, change "clause 7.6.3, Mandatory framing configurations" as follows:

7.6.3 Mandatory framing configurations

See 7.6.3 of [ITU-T G.992.3], with the following difference in Table 7-9:

S_0	$1/3 \leq S_0 < 64$. Support of additional optional S_0 values is indicated during initialization, through $S_{0\,min}$, with $1/16 \leq S_{0\,min} \leq 1/3$. All values of S_0, with $S_{0\,min} \leq S_0 < 1/3$, shall be supported.
D_0	1, 2, 4, 8, 16, 32, 64
Relationship of N_{FEC0} and D_0	Configurations that satisfy the following relationship shall be supported: $(N_{FEC0} - 1) \times (D_0 - 1) \leq 254 \times 63 = 16'002$

c) In clause 7.10, Initialization procedures, change the text as follows:

7.10 Initialization procedures

See 7.10 of [ITU-T G.992.3].

~~For use in this Recommendation, the unsigned 12-bit net_max value in Table 7-18/G.992.3 is the data rate divided by 8000 (rather than 4000 for use in ITU-T Rec. G.992.3).~~

For use in this Recommendation, Table 7-18/G.992.3 shall be replaced by the following table:

Table 7-18/G.992.5 – Format for PMS-TC capability list information

Spar(2) bit	Definition of related Npar(3) octets
Downstream PMS-TC latency path #0 supported (always set to 1)	Parameter block of 6 octets that describes the maximum net_max downstream rate, downstream $S_{0\,min}$, ~~and~~ downstream D_0 values and the downstream relationship of N_{FEC0} and D_0 supported in the latency path #0. The unsigned 12-bit net_max value is the data rate divided by 8000. The net_max downstream rate shall be greater than or equal to the maximum required downstream data rate for each TPS-TC type that is supported by the ATU. The supported range of S_0 values shall be indicated by its lowerbound $S_{0\,min}$. $S_{0\,min}$ shall equal 1/(n+1), with n coded as an unsigned 4-bit value, in the 1 to 15 range. The D_0 values supported shall be individually indicated with 1 bit per value. The "24'000 Bytes Interleaver Size" bit indicates the support of different relationships of N_{FEC0} and D_0. If set to ZERO, the ATU shall support all configurations of supported N_{FEC0} and D_0 such that $(N_{FEC0} - 1) \times (D_0 - 1) \leq 16'002$. If set to ONE, the ATU shall support all configurations of supported N_{FEC0} and D_0 such that $(N_{FEC0} - 1) \times (D_0 - 1) \leq 24'000$.
Upstream PMS-TC latency path #0 Supported (always set to 1)	Parameter block of 2 octets that describes the maximum net_max upstream rate supported in the latency path #0. The unsigned 12-bit net_max value is the data rate divided by 8000. The net_max upstream rate shall be greater than or equal to the maximum required upstream data rate for each TPS-TC type that is supported by the ATU.
Downstream PMS-TC latency path #1 Supported	Parameter block of 4 octets that describes the maximum net_max downstream rate, downstream $R_{1\,max}$, and downstream $D_{1\,max}$ supported in the latency path #1. The unsigned 12-bit net_max value is the data rate divided by 8000. $R_{1\,max}$ is an unsigned 4-bit value and shall be one of the valid R_p values divided by 2. $D_{1\,max}$ is an unsigned 3-bit value and shall be the logarithm base 2 of one of the valid D_p values.
Upstream PMS-TC latency path #1 Supported	Parameter block of 4 octets that describes the maximum net_max upstream rate, upstream $R_{1\,max}$, and upstream $D_{1\,max}$ supported in the latency path #1. The unsigned 12-bit net_max value is the data rate divided by 8000. $R_{1\,max}$ is an unsigned 4-bit value and shall be one of the valid R_p values divided by 2. $D_{1\,max}$ is an unsigned 3-bit value and shall be the logarithm base 2 of one of the valid D_p values.
Downstream PMS-TC latency path #2 Supported	Parameter block of 4 octets that describes the maximum net_max downstream rate, downstream $R_{2\,max}$, and downstream $D_{2\,max}$ supported in the latency path #2. The unsigned 12-bit net_max value is the data rate divided by 8000. $R_{2\,max}$ is an unsigned 4-bit value and shall be one of the valid R_p values divided by 2. $D_{2\,max}$ is an unsigned 3-bit value and shall be the logarithm base 2 of one of the valid D_p values.
Upstream PMS-TC latency path #2 Supported	Parameter block of 4 octets that describes the maximum net_max upstream rate, upstream $R_{2\,max}$, and upstream $D_{2\,max}$ supported in the latency path #2. The unsigned 12-bit net_max value is the data rate divided by 8000. $R_{2\,max}$ is an unsigned 4-bit value and shall be one of the valid R_p values divided by 2. $D_{2\,max}$ is an unsigned 3-bit value and shall be the logarithm base 2 of one of the valid D_p values.
Downstream PMS-TC latency path #3 Supported	Parameter block of 4 octets that describes the maximum net_max downstream rate, downstream $R_{3\,max}$, and downstream $D_{3\,max}$ supported in the latency path #3. The unsigned 12-bit net_max value is the data rate divided by 8000. $R_{3\,max}$ is an unsigned 4-bit value and shall be one of the valid R_p values divided by 2. $D_{3\,max}$ is an unsigned 3-bit value and shall be the logarithm base 2 of one of the valid D_p values.

Table 7-18/G.992.5 – Format for PMS-TC capability list information

Spar(2) bit	Definition of related Npar(3) octets
Upstream PMS-TC latency path #3 Supported	Parameter block of 4 octets that describes the maximum net_max upstream rate, upstream $R_{3\,max}$, and upstream $D_{3\,max}$ supported in the latency path #3. The unsigned 12-bit net_max value is the data rate divided by 8000. $R_{3\,max}$ is an unsigned 4-bit value and shall be one of the value R_p values divided by 2. $D_{3\,max}$ is an unsigned 3-bit value and shall be the logarithm base 2 of one of the valid D_p values.

d) Change G.992.5 Amendment 1 "Annex K: TPS-TC functional descriptions" as follows:

3) Replace Table K.3a/G.992.3, Table K.3b/G.992.3 and Table K.3c/G.992.3 with Table K.3a/G.992.5, Table K.3b/G.992.5, ~~and~~ Table K.3c/G.992.5, and Table K.3d/G.992.5. For Table K.3c/G.992.5, the number of subcarriers is 511 and all valid R, S, D and N_{FEC} values listed in Table 7-8/G.992.5 are allowed, within the mandatory $(N_{FEC0} - 1) \times (D_0 - 1)$ values. For Table K.3d/G.992.5, in addition, the optional $(N_{FEC0} - 1) \times (D_0 - 1)$ values are allowed.

e) Add new Table K.3d/G.992.5 at the end of the clause:

Table K.3d/G.992.5 – INP_min and delay_max related downstream net data rates limits using the optional D_0 values and optional $(N_{FEC0} - 1) \times (D_0 - 1)$ values for downstream latency path #0 (in kbit/s)

		INP_min						
		0	**½**	**1**	**2**	**4**	**8**	**16**
delay_max (ms)	**1** (Note)	29556	0	0	0	0	0	0
	2	29556	25718	20928	7616	0	0	0
	4	29556	27612	25718	21092	7616	0	0
	8	29556	28394	27217	24703	19092	8112	0
	16	29556	28394	27217	24703	19092	10844	4024
	32	29556	28394	27217	24703	19092	10844	5393
	63	29556	28394	27217	24703	19092	10844	5393
NOTE – In ITU-T Rec. G.997.1, a 1 ms delay is reserved to mean that $S_p \leq 1$ and $D_p = 1$.								

4) Add the following new Appendix VII

Appendix VII

ADSL2plus automoding

(This appendix does not form an integral part of this Recommendation)

See Appendix VII of [ITU-T G.992.3].

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	**Transmission systems and media, digital systems and networks**
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects and next-generation networks
Series Z	Languages and general software aspects for telecommunication systems

Printed in Switzerland
Geneva, 2007