International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.997.1

Amendment 3

(08/2008)

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

Digital sections and digital line system – Access networks

Physical layer management for digital subscriber line (DSL) transceivers

Amendment 3

Recommendation ITU-T G.997.1 (2006) – 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.

Recommendation ITU-T G.997.1

Physical layer management for digital subscriber line (DSL) transceivers

Amendment 3

Summary

Amendment 3 to Recommendation ITU-T G.997.1 contains:

– Support of the channel configuration parameter FORCEINP by Recommendations ITU-T G.992.3 and G.992.5.

– Support of the impulse noise monitoring parameters by Recommendations ITU-T G.992.3 and G.992.5

– Support of the transmitter referred virtual noise configuration parameters by Recommendations ITU-T G.992.3 and G.992.5.

– Reporting of electrical loop length estimated by the VTU-R.

– Support of configuration and performance monitoring of the SOS.

Source

Amendment 3 to Recommendation ITU-T G.997.1 (2006) was approved on 22 August 2008 by ITU-T Study Group 15 (2005-2008) under Recommendation ITU-T A.8 procedure.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). 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 2008

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

CONTENTS

Recommendation ITU-T G.997.1

Physical layer management for digital subscriber line (DSL) transceivers

Amendment 3

1 Support of the channel configuration parameter FORCEINP by Recommendations ITU-T G.992.3 and G.992.5

Modify clause 7.5.2.4 as follows:

7.5.2.4 Actual impulse noise protection (ACTINP)

This parameter reports the actual impulse noise protection (INP) on the bearer channel in the L0 state. In the L1 or L2 state, the parameter contains the INP in the previous L0 state.

For ~~ADSL2~~G.992.1, this value is computed according to the formula specified in ~~the relevant Recommendation~~G.997.1 based on the actual framing parameters. For ~~ITU-T Rec.~~G.992.3 and G.992.5, this value is estimated by the xTU receiver. It is identical to the INP_act$_n$ for the corresponding bearer channel as defined in these Recommendations (clauses K.1.7/G.992.3, K.2.7/G.992.3 and K.3.7/G.992.3). For G.993.2, the method to report this value is according to the INPREPORT parameter.

The value is coded in fractions of DMT symbols with a granularity of 0.1 symbols. The range is from 0 to 25.4. A special value indicates an ACTINP higher than 25.4.

Modify Table 7-16 and add a note as follows:

Table 7-16/G.997.1 – Channel configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
• • •					
Minimum Impulse Noise Protection (INPMIN)	7.3.2.3	R/W (M/O) (Note 1)	R (O)		
Minimum Impulse Noise Protection 8 kHz (INPMIN8)	7.3.2.4	R/W (M)	R (O)		
FORCEINP	7.3.2.5	R/W (M/O) (Note 2)			
• • •					

NOTE 1 – This parameter is R/W(O) on the Q-interface for G.992.1 and R/W(M) for all other ITU-T Recommendations that support it.

NOTE 2 – This parameter is R/W(M) on the Q-interface for G.993.2 and R/W(O) for all other ITU-T Recommendations that support it.

Modify Table 7-17 as follows:

Table 7-17/G.997.1 – Support of Channel configuration parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
FORCEINP			Y		Y	Y
• • •						

2 Support of the Impulse Noise Monitoring parameters by G.992.3 and G.992.5

Modify clauses 7.3.1.9.3 and 7.3.1.9.4 as follows:

7.3.1.9.3 INM Cluster Continuation value (INMCC)

This is the Cluster Continuation value that the xTU receiver shall use in the cluster indication process described in ~~11.4.2.2.1/G.993.2~~the relevant ITU-T Recommendation. The valid values for INMCC range from 0 to 64 DMT symbols in steps of 1 DMT symbol.

7.3.1.9.4 INM Equivalent INP Mode (INM_INPEQ_MODE)

This is the INM Equivalent INP Mode that the xTU receiver shall use in the computation of the Equivalent INP, as defined in ~~11.4.2.2.1/G.993.2~~the relevant ITU-T Recommendation. The valid values for INM_INPEQ_MODE are 0, 1, 2 ~~and,~~ 3 and 4.

Modify Table 7-15 as follows:

Table 7-15/G.997.1 – Support of Line configuration parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
INM configuration parameters						
INMIATOds			Y		Y	Y
INMIATOus			Y		Y	Y
INMIATSds			Y		Y	Y
INMIATSus			Y		Y	Y
INMCCds			Y		Y	Y
INMCCus			Y		Y	Y
INM_INPEQ_MODEds			Y		Y	Y
INM_INPEQ_MODEus			Y		Y	Y

Modify Table 7-23 as follows:

Table 7-23/G.997.1 – Support of Line performance monitoring parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
Near-end Impulse Noise Performance Monitoring Counters (current and previous 15-minute interval)						
INMINPEQ$_{1..17}$-L counter 15 minutes			Y		Y	Y
INMIAT$_{0..7}$-L counter 15 minutes			Y		Y	Y
INMME-L counter 15 minutes			Y		Y	Y
Near-end Impulse Noise Performance Monitoring Counters (current and previous 24-hour interval)						
INMINPEQ$_{1..17}$-L counter 24 hours			Y		Y	Y
INMIAT$_{0..7}$-L counter 24 hours			Y		Y	Y
INMME-L counter 24 hours			Y		Y	Y
Far-end Impulse Noise Performance Monitoring Counters (current and previous 15-minute interval)						
INMINPEQ$_{1..17}$-LFE counter 15 minutes			Y		Y	Y
INMIAT$_{0..7}$-LFE counter 15 minutes			Y		Y	Y
INMME-LFE counter 15 minutes			Y		Y	Y
Far-end Impulse Noise Performance Monitoring Counters (current and previous 24-hour interval)						
INMINPEQ$_{1..17}$-LFE counter 24 hours			Y		Y	Y
INMIAT$_{0..7}$-LFE counter 24 hours			Y		Y	Y
INMME-LFE counter 24 hours			Y		Y	Y

3 Support of the Transmitter Referred Virtual Noise configuration parameters by Recommendations ITU-T G.992.3 and G.992.5

Modify clauses 7.3.1.7.3 and 7.3.1.7.4 as follows:

7.3.1.7.3 Downstream Transmitter Referred Virtual Noise (TXREFVNds)

This configuration parameter defines the downstream transmitter referred virtual noise (TXREFVNds). The TXREFVNds shall be specified through a set of breakpoints. Each breakpoint shall consist of a subcarrier index t, with a subcarrier spacing of 4.3125 kHz, and a noise PSD level (expressed in dBm/Hz) at that subcarrier. The set of breakpoints can then be represented as $[(t_1, PSD_1), (t_2, PSD_2), \ldots, (t_N, PSD_N)]$. The subcarrier index shall be coded as an unsigned integer.

The noise level ranges from –40 dBm/Hz to –140 dBm/Hz in steps of 0.5 dBm/Hz. A special value indicates a noise level of 0 W/Hz. The maximum number of breakpoints is 32.

For G.992.3 or G.992.5, no more than 15 breakpoints shall be configured below the upper edge of the passband of every mode enabled for G.992.3 and G.992.5.

7.3.1.7.4 Upstream Transmitter Referred Virtual Noise (TXREFVNus)

This configuration parameter defines the upstream transmitter referred virtual noise (TXREFVNus). The TXREFVNus shall be specified through a set of breakpoints. Each breakpoint shall consist of a subcarrier index t, with a subcarrier spacing of 4.3125 kHz, and a noise PSD level (expressed in dBm/Hz) at that subcarrier. The set of breakpoints can then be represented as [(t_1, PSD_1), (t_2, PSD_2), … , (t_N, PSD_N)]. The subcarrier index shall be coded as an unsigned integer. The noise level ranges from –40 dBm/Hz to –140 dBm/Hz in steps of 0.5 dBm/Hz. A special value indicates a noise level of 0 W/Hz. The maximum number of breakpoints is 16.

For G.992.3 or G.992.5, no more than 3 breakpoints shall be configured below the upper edge of the passband of every mode enabled for G.992.3 and G.992.5.

Modify Table 7-15 as follows:

Table 7-15/G.997.1 – Support of Line configuration parameters per Recommendation

Category/ Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
Transmitter Referred Virtual Noise						
SNRMODEds			Y		Y	Y
SNRMODEus			Y		Y	Y
TXREFVNds			Y		Y	Y
TXREFVNus			Y		Y	Y
• • •						

Modify Table 7-29 as follows:

Table 7-29/G.997.1 – Support of Line test, diagnostic and status parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
ACTSNRMODEds			Y		Y	Y
• • •						

4 Reporting of electrical length estimated by VTU-R

Modify clause 7.5.1.23 as follows:

7.5.1.23 Estimated Upstream Power Back-Off Electrical lengths ~~(UPBOKLE)~~

7.5.1.23.1 VTU-O Estimated Upstream Power Back-Off Electrical length (UPBOKLE)

This parameter contains the estimated electrical length expressed in dB at 1 MHz, kl_0 (see O-UPDATE in 12.3.3.2.1.2/G.993.2). This is the final electrical length that would have been sent from the VTU-O to VTU-R if the electrical length was not forced by the CO-MIB. The value ranges from 0 to 128 dB in steps of 0.1 dB.

7.5.1.23.2 VTU-R Estimated Upstream Power Back-Off Electrical length (UPBOKLE-R)

This parameter contains the electrical length estimated by the VTU-R expressed in dB at 1 MHz. This is the value contained in the message R-MSG1 (see 12.3.3.2.2.1/G.993.2). The value ranges from 0 to 128 dB in steps of 0.1 dB.

Modify Table 7-28 as follows:

Table 7-28/G.997.1 – Line test, diagnostic and status parameters

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface	G-Interface
• • •						
Upstream Power Back-Off						
UPBOKLE	7.5.1.23.1	R (M)	R (O)			R (O)
UPBOKLE-R	7.5.1.23.2	R (O)	R (O)			R (O)
• • •						

Modify Table 7-29 as follows:

Table 7-29/G.997.1 – Support of Line test, diagnostic and status parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
Upstream Power Back-Off						
UPBOKLE						Y
UPBOKLE-R						Y
• • •						

5 Support for SOS triggering configuration and support

Add new clauses 7.2.1.6 and 7.2.1.7:

7.2.1.6 Near-end SOS performance monitoring parameters

7.2.1.6.1 Near-end successful SOS count (SOS-SUCCESS-NE)

This parameter is a count of the total number of successful SOS procedures initiated by the near-end xTU on the line during the accumulation period. Parameter procedures shall be as defined in 7.2.7.

Successful SOS is defined in 12.1.4/G.993.2.

7.2.1.7 Far-end SOS performance monitoring parameters

7.2.1.7.1 Far-end successful SOS count (SOS-SUCCESS-FE)

This parameter is a count of the total number of successful SOS procedures initiated by the far-end xTU on the line during the accumulation period. Parameter procedures shall be as defined in 7.2.7.

Successful SOS is defined in 12.1.4/G.993.2.

Modify clauses 7.3.1.4.1 and 7.3.1.4.2 as follows:

7.3.1.4.1 Downstream Rate Adaptation Mode (RA-MODEds)

This parameter specifies the mode of operation of a rate-adaptive xTU-C in the transmit direction. The parameter can take three values.

Mode 1: MANUAL – Rate changed manually.

At startup

The Downstream Minimum Data Rate parameter specifies the exact data rate the xTU-C transmitter shall operate at for each of the bearer channels, with a downstream noise margin which is at least as large as the specified Downstream Target Noise Margin, relative to the required BER for each of the downstream bearer channels, or better. If the xTU-C fails to achieve the Downstream Minimum Data Rate for one of the bearer channels, the xTU-C will fail to initialize, and the NMS will be notified. Although the xTU-C and the line might be able to support a higher data rate, the xTU-C shall not transmit a higher data rate than what is requested for each of the bearer channels.

At showtime

The xTU-C transmitter shall maintain the specified Downstream Minimum Data Rate for each of the bearer channels.

Mode 2: AT_INIT – Rate automatically selected at startup only and does not change after that.

At startup

The Downstream Minimum Data Rate parameter specifies the minimum data rate the xTU-C transmitter shall operate at for each of the bearer channels, with a downstream noise margin which is at least as large as the specified Downstream Target Noise Margin, relative to the required BER for each of the bearer channels, or better. If the xTU-C fails to achieve the Downstream Minimum Data Rate for one of the bearer channels, the xTU-C will fail to initialize, and the NMS will be notified. If the xTU-C transmitter is able to support a higher downstream data rate at initialization, the excess data rate will be distributed amongst the downstream bearer channels according to the ratio (0 to 100%) specified by the Rate Adaptation Ratio parameter for each bearer channel (adding up to 100% over all bearer channels). When the Downstream Maximum Data Rate is achieved in one of the bearer channels, then the remaining excess bit rate is assigned to the other bearer channels, still according to their relative Rate Adaptation Ratio parameters. As long as the downstream data rate is below the Downstream Maximum Data Rate for one of the bearer channels, data rate increase shall take priority over transmit power reduction.

At showtime

During showtime, no downstream data rate adaptation is allowed. The downstream data rate, which has been selected during initialization for each of the bearer channels, shall be maintained.

Mode 3: DYNAMIC – Data rate is automatically selected at initialization and is continuously adapted during operation (showtime). The DYNAMIC Rate Adaptation mode is optional. All related configuration parameters are also optional.

At startup

In Mode 3, the xTU-C shall start up as in Mode 2.

At showtime

During showtime, rate adaptation is allowed with respect to the Rate Adaptation Ratio for distributing the excess data rate amongst the bearer channels (see Mode 2), and assuring that the Downstream Minimum Data Rate remains available at the required BER for each of the bearer channels or better. The downstream data rate can vary between the Downstream Minimum Data Rate, and the Downstream Maximum Data Rate. Downstream Rate Adaptation is performed when the conditions specified for Downstream Upshift Noise Margin and Downstream Upshift Interval – or for Downstream Downshift Noise Margin and Downstream Downshift Interval – are satisfied. This means:

– For an Upshift action: Allowed when the downstream noise margin is above the Downstream Upshift Noise Margin during Downstream Minimum Time Interval for Upshift Rate Adaptation (i.e., upon RAU anomaly – see ITU-T Rec. G.992.3).

– For a Downshift action: Allowed when the downstream noise margin is below the Downstream Downshift Noise Margin during Downstream Minimum Time Interval for Downshift Rate Adaptation (i.e., upon RAD anomaly – see ITU-T Rec. G.992.3).

As long as the downstream data rate is below the Downstream Maximum Data Rate for one of the bearer channels, data rate increase shall take priority over transmit power reduction.

In G.993.2, if it is detected at startup that SRA is not supported in the downstream direction by either XTU, the XTUs shall fallback to Mode 2.

Mode 4: DYNAMIC with SOS – Data rate is automatically selected at initialization and may be continuously adapted during operation (showtime) by SOS and SRA. The Rate Adaptation mode 4 is optional. In this mode, enabling of SOS and SRA is mandatory.

At startup

In Mode 4, the xTU-C shall start up as in Mode 2.

At showtime

SRA behaviour shall be identical as described for Mode 3, unless the actual net data rate is below the Minimum net data rate as a result of an SOS procedure.

Additionally, SOS may be performed, when the conditions specified by the SOS trigger parameters are satisfied. The detailed specification of SOS OLR procedure is in G.993.2.

If, at startup, it is detected that SOS is not supported in the downstream direction by either XTU, but SRA is supported by both XTUs, the XTUs shall fallback to Mode 3.

If, at startup, it is detected that SOS is not supported in the downstream direction by either XTU, and SRA is not supported by either XTU, the XTUs shall fallback to Mode 2.

7.3.1.4.2 Upstream Rate Adaptation Mode (RA-MODEus)

This parameter specifies the mode of operation of a rate-adaptive xTU-R in the transmit direction. The parameter is used only if the rate-adaptive functionality is supported and can take four~~three~~ values (Mode 1 = MANUAL, Mode 2 = AT_INIT, Mode 3 = DYNAMIC, Mode 4 = DYNAMIC with SOS). The definition of each of the values is identical to its definition in the Downstream Rate Adaptation Mode (with xTU-C replaced by xTU-R and downstream replaced by upstream).

Add new clause 7.3.1.10:

7.3.1.10 SOS line-related configuration parameters

7.3.1.10.1 Downstream SOS time window (SOS-TIME-ds)

The parameter SOS-TIME-ds is used in the specification of the receiver initiated SOS (see 13.4.3/G.993.2). If the value of this parameter is not zero, the standard SOS triggering criteria are enabled, and the value corresponds with duration of the time window used in the standard SOS triggering criteria in the downstream direction. See G.993.2 for detailed usage rules.

The special value zero indicates that the standard SOS triggering criteria are disabled, i.e., vendor-discretionary values may be used instead of the values configured in the MIB for the following parameters: SOS-NTONES-ds, SOS-CRC-ds, SOS-TIME-ds.

This parameter applies in the downstream direction. The valid range of non-zero values is from 64 ms to 16320 ms in steps of 64 ms.

7.3.1.10.2 Upstream SOS time window (SOS-TIME-us)

The parameter SOS-TIME-us is used in the specification of the receiver initiated SOS (see 13.4.3/G.993.2). If the value of this parameter is not zero, the standard SOS triggering criteria are enabled, and the value corresponds with duration of the time window used in the standard SOS triggering criteria in the upstream direction. See G.993.2 for detailed usage rules.

The special value zero indicates that the standard SOS triggering criteria are disabled, i.e., vendor-discretionary values may be used instead of the values configured in the MIB for the following parameters: SOS-NTONES-us, SOS-CRC-us, SOS-TIME-us.

This parameter applies in the upstream direction. The valid range of non-zero values is from 64 ms to 16320 ms in steps of 64 ms.

7.3.1.10.3 Downstream minimum percentage of degraded tones (SOS-NTONES-ds)

This parameter is defined as the minimum percentage of tones in the downstream MEDLEY SET that must be degraded in order to arm the first sub-condition of the standard SOS triggering criteria (see 13.4.3.2/G.993.2) in the downstream direction. The parameter SOS-NTONES-ds is defined as a percentage of tones. See G.993.2 for detailed usage rules. The valid range of values is from 1 to 100 in steps of 1. Use of the special value 0 is described in 13.4.3.2/G.993.2.

7.3.1.10.4 Upstream minimum percentage of degraded tones (SOS-NTONES-us)

The minimum percentage of tones in the upstream MEDLEY SET that must be degraded in order to arm the first sub-condition of the standard SOS triggering criteria (see 13.4.3.2/G.993.2) in the upstream direction. The parameter SOS-NTONES-us is defined as a percentage of tones. See G.993.2 for detailed usage rules. The valid range of values is from 1 to 100 in steps of 1. Use of the special value 0 is described in 13.4.3.2/G.993.2.

7.3.1.10.5 Downstream minimum number of normalized CRC anomalies (SOS-CRC-ds)

This parameter is defined as the minimum number of normalized CRC anomalies received in SOS-TIME-ds seconds in order to arm the second sub-condition of the standard SOS triggering criteria

(see 13.4.3.2/G.993.2) in the downstream direction. See G.993.2 for detailed usage rules. The valid range of SOS-CRC values is 0.02 to ((2^16)–1)*0.02, in steps of 0.02.

7.3.1.10.6 Upstream minimum number of normalized CRC (SOS-CRC-us)

This parameter is defined as the minimum number of normalized CRC anomalies received in SOS-TIME-us seconds in order to arm the second sub-condition of the standard SOS triggering criteria (see 13.4.3.2/G.993.2) in the upstream direction. See G.993.2 for detailed usage rules. The valid range of SOS-CRC values is 0.02 to ((2^16)–1)*0.02, in steps of 0.02.

7.3.1.10.7 Downstream maximum number of SOS (MAX-SOS-ds)

This parameter is used in G.993.2 de-activation (see 12.1.4/G.993.2). If the number of successful SOS procedures in the downstream direction performed within a 120-second interval exceeds MAX-SOS-ds, the modem shall transition to the L3 state. See G.993.2 for detailed usage rules (see 12.1.4/G.993.2). The valid range of values is 1 to 15. Use of the special value 0 is described in 12.1/G.993.2.

7.3.1.10.8 Upstream maximum number of SOS (MAX-SOS-us)

This parameter is used in G.993.2 de-activation (see 12.1.4/G.993.2). If the number of successful SOS procedures in the upstream direction performed within a 120-second interval exceeds MAX-SOS-us, the modem shall transition to the L3 state. See G.993.2 for detailed usage rules (see 12.1.4/G.993.2). The valid range of values is 1 to 15. Use of the special value 0 is described in 12.1/G.993.2.

7.3.1.10.9 Downstream SNR margin offset of ROC (SNRMOFFSET-ROC-ds)

The parameter is defined as the SNR margin offset for the ROC channel in the downstream direction. The parameter is used in the specification of the channel initialization policy (see 12.3.7.1/G.993.2).

The valid range of SNR margin offset values is from 0 to 31 dB with 0.1 dB steps.

7.3.1.10.10 Upstream SNR Margin Offset of ROC (SNRMOFFSET-ROC-us)

The parameter is defined as the SNR margin offset for the ROC channel in the upstream direction. The parameter is used in the specification of the channel initialization policy (see 12.3.7.1/G.993.2).

The valid range of SNR margin offset values is from 0 to 31 dB with 0.1 dB steps.

7.3.1.10.11 Downstream minimum INP of ROC (INPMIN-ROC-ds)

This parameter contains the minimum impulse noise protection to apply on the ROC in the downstream direction. The minimum impulse noise protection is an integer ranging from 0 to 16.

7.3.1.10.12 Upstream minimum INP of ROC (INPMIN-ROC-us)

This parameter contains the minimum impulse noise protection to apply on the robust ROC in the upstream direction. The minimum impulse noise protection is an integer ranging from 0 to 16.

Add new clauses 7.3.2.1.6 and 7.3.2.1.7:

7.3.2.1.6 Downstream minimum SOS bit rate (MIN-SOS-BR-ds)

This parameter specifies the minimum net data rate required for a valid SOS request in the downstream direction. The value shall be coded as an unsigned integer representing the data rate as a multiple of 8 kbit/s.

7.3.2.1.7 Upstream minimum SOS bit rate (MIN-SOS-BR-us)

This parameter specifies the minimum net data rate required for a valid SOS request in the upstream direction. The value shall be coded as an unsigned integer representing the data rate as a multiple of 8 kbit/s.

Add new clause 7.5.1.33:

7.5.1.33 Actual rate adaptation mode

7.5.1.33.1 Actual downstream rate adaptation mode (ACT-RA-MODEds)

This parameter indicates the actual active RA-MODE in the downstream direction.

If ACT-RA-MODEds equals 1, the link is operating in RA-MODE 1 (MANUAL).

If ACT-RA-MODEds equals 2, the link is operating in RA-MODE 2 (AT_INIT).

If ACT-RA-MODEds equals 3, the link is operating in RA-MODE 3 (DYNAMIC).

NOTE 1 – In G.992.3, ACT-RA-MODEds=3 corresponds to SRA supported. In G.993.2, ACT-RA-MODEds=3 corresponds to SRA supported by both XTUs in the downstream direction, but SOS not supported by both XTUs in the downstream direction.

If ACT-RA-MODEds equals 4, the link is operating in RA-MODE 4 (DYNAMIC with SOS).

NOTE 2 – In G.992.3, ACT-RA-MODEds=4 is not defined. In G.993.2 ACT-RA-MODEds=4 corresponds to SOS and SRA supported by both XTUs in the downstream direction.

7.5.1.33.2 Actual upstream rate adaptation mode (ACT-RA-MODEus)

This parameter indicates the actual active RA-MODE in the upstream direction.

If ACT-RA-MODEus equals 1, the link is operating in RA-MODE 1 (MANUAL).

If ACT-RA-MODEus equals 2, the link is operating in RA-MODE 2 (AT_INIT).

If ACT-RA-MODEus equals 3, the link is operating in RA-MODE 3 (DYNAMIC).

NOTE 1 – In G.992.3, ACT-RA-MODEus=3 corresponds to SRA supported. In G.993.2 ACT-RA-MODEus=3 corresponds to SRA supported by both XTUs in the upstream direction, but SOS not supported by both XTUs in the upstream direction.

If ACT-RA-MODEus equals 4, the link is operating in RA-MODE 4 (DYNAMIC with SOS).

NOTE 2 – In G.992.3, ACT-RA-MODEus=4 is not defined. In G.993.2, ACT-RA-MODEus=4 corresponds to SOS and SRA supported by both XTUs in the upstream direction.

Add new clauses 7.5.1.34 and 7.5.1.35:

7.5.1.34 Actual impulse noise protection of ROC

7.5.1.34.1 Downstream actual impulse noise protection of ROC (ACTINP-ROC-ds)

This parameter reports the actual impulse noise protection (INP) of the ROC in the downstream direction. The format and usage is identical to the channel status parameter ACTINP (see 7.5.2.4).

7.5.1.34.2 Upstream actual impulse noise protection of ROC (ACTINP-ROC-us)

This parameter reports the actual impulse noise protection (INP) of the ROC in the upstream direction. The format and usage is identical to the channel status parameter ACTINP (see 7.5.2.4).

7.5.1.35 Actual SNR margin of ROC

7.5.1.35.1 Downstream actual SNR margin of ROC (SNRM-ROC-ds)

This parameter reports the actual signal-to-noise ratio margin of the ROC in the downstream direction. The format is identical to the format of the line status parameter SNRM (see 7.5.1.13).

7.5.1.35.2 Upstream actual SNR margin of ROC (SNRM-ROC-us)

This parameter reports the actual signal-to-noise ratio margin of the ROC in the upstream direction. The format is identical to the format of the line status parameter SNRM (see 7.5.1.16).

Add the following lines to Tables 7-22 and 7-23:

Table 7-22/G.997.1 – Line performance monitoring parameters

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface	G-Interface
• • •						
Near-end (xTU-C) SOS Performance Monitoring Counters (current and previous 15-minute interval)						
SOS-SUCCESS-NE counter 15 minutes	7.2.1.6.1	R (O)				
Near-end (xTU-C) SOS Performance Monitoring Counters (current and previous 24-hour interval)						
SOS-SUCCESS-NE counter 24 hours	7.2.1.6.1	R (O)				
Far-end (xTU-R) SOS Performance Monitoring Counters (current and previous 15-minute interval)						
SOS-SUCCESS-FE counter 15 minutes	7.2.1.7.1	R (O)				
Far-end (xTU-R) SOS Performance Monitoring Counters (current and previous 24-hour interval)						
SOS-SUCCESS-FE counter 24 hours	7.2.1.7.1	R (O)				

Table 7-23/G.997.1 – Support of Line performance monitoring parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
Near-end (xTU-C) SOS Performance Monitoring Counters (current and previous 15-minute interval)						
SOS-SUCCESS-NE counter 15 minutes						Y
Near-end (xTU-C) SOS Performance Monitoring Counters (current and previous 24-hour interval)						
SOS-SUCCESS-NE counter 24 hours						Y
Far-end (xTU-R) SOS Performance Monitoring Counters (current and previous 15-minute interval)						
SOS-SUCCESS-FE counter 15 minutes						Y
Far-end (xTU-R) SOS Performance Monitoring Counters (current and previous 24-hour interval)						
SOS-SUCCESS-FE counter 24 hours						Y

Add the following lines to Tables 7-14 and 7-15:

Table 7-14/G.997.1 – Line configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
• • •					
SOS configuration parameters					
SOS-TIME-ds	7.3.1.10.1	R/W(O)	R(O)		
SOS-TIME-us	7.3.1.10.2	R/W(O)			
SOS-NTONES-ds	7.3.1.10.3	R/W(O)	R(O)		
SOS-NTONES-us	7.3.1.10.4	R/W(O)			
SOS-CRC-ds	7.3.1.10.5	R/W(O)	R(O)		
SOS-CRC-us	7.3.1.10.6	R/W(O)			
MAX-SOS-ds	7.3.1.10.7	R/W(O)	R(O)		
MAX-SOS-us	7.3.1.10.8	R/W(O)			
SNRMOFFSET-ROC-ds	7.3.1.10.9	R/W(O)	R(O)		
SNRMOFFSET-ROC-us	7.3.1.10.10	R/W(O)			
INPMIN-ROC-ds	7.3.1.10.11	R/W(O)	R(O)		
INPMIN-ROC-us	7.3.1.10.12	R/W(O)			

Table 7-15/G.997.1 – Support of Line configuration parameters per Recommendation

Category/ Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
SOS configuration parameters						
SOS-TIME-ds						Y
SOS-TIME-us						Y
SOS-NTONES-ds						Y
SOS-NTONES-us						Y
SOS-CRC-ds						Y
SOS-CRC-us						Y
MAX-SOS-ds						Y
MAX-SOS-us						Y
SNRMOFFSET-ROC-ds						Y
SNRMOFFSET-ROC-us						Y
INPMIN-ROC-ds						Y
INPMIN-ROC-us						Y

Modify Tables 7-16 and 7-17 as follows:

Table 7-16/G.997.1 – Channel configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
Data Rate					
Minimum Data Rate	7.3.2.1.1	R/W (M)	R (O)		
Minimum Reserved Data Rate	7.3.2.1.2	R/W (O)	R (O)		
Maximum Data Rate	7.3.2.1.3	R/W (M)	R (O)		
Rate Adaptation Ratio	7.3.2.1.4	R/W (O)	R (O)		
Minimum Data Rate in low power state	7.3.2.1.5	R/W (M)	R (O)		
MIN-SOS-BR-ds	7.3.2.1.6	R/W(O)	R(O)		
MIN-SOS-BR-us	7.3.2.1.7	R/W(O)			
Maximum Interleaving Delay	7.3.2.2	R/W (M)	R (O)		
Minimum Impulse Noise Protection (INPMIN)	7.3.2.3	R/W (M/O) (Note)	R (O)		
Minimum Impulse Noise Protection 8 kHz (INPMIN8)	7.3.2.4	R/W (M)	R (O)		
FORCEINP	7.3.2.5	R/W(M)			
Maximum Bit Error Ratio	7.3.2.6	R/W(M)	R (O)		
Data Rate Threshold Upshift	7.3.2.8.1	R/W(M)			
Data Rate Threshold Downshift	7.3.2.8.2	R/W(M)			
Maximum Delay Variation (DVMAX)	7.3.2.9	R/W(O)			
Channel Initialization Policy selection (CIPOLICY)	7.3.2.10	R/W(O)			
Near-end (xTU-C) Performance Monitoring Thresholds (15-minute interval)					
CV-C threshold 15 minutes	7.3.2.7	R/W (O)	R (O)		
FEC-C threshold 15 minutes	7.3.2.7	R/W (O)	R (O)		
Near-end (xTU-C) Performance Monitoring Thresholds (24-hour interval)					
CV-C threshold 24 hours	7.3.2.7	R/W (O)	R (O)		
FEC-C threshold 24 hours	7.3.2.7	R/W (O)	R (O)		
Far-end (xTU-R) Performance Monitoring Thresholds (15-minute interval)					
CV-CFE threshold 15 minutes	7.3.2.7	R/W (O)	R (O)		
FEC-CFE threshold 15 minutes	7.3.2.7	R/W (O)	R (O)		
Far-end (xTU-R) Performance Monitoring Thresholds (24-hour interval)					
CV-CFE threshold 24 hours	7.3.2.7	R/W (O)	R (O)		
FEC-CFE threshold 24 hours	7.3.2.7	R/W (O)	R (O)		
NOTE – This parameter is R/W(O) on the Q-interface for G.992.1 and R/W(M) for all other ITU-T Recommendations that support it.					

Table 7-17/G.997.1 – Support of Channel configuration parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
Data Rate						
Minimum Data Rate	Y	Y	Y	Y	Y	Y
Minimum Reserved Data Rate		Y	Y	Y	Y	Y
Maximum Data Rate	Y	Y	Y	Y	Y	Y
Rate Adaptation Ratio	Y	Y	Y	Y	Y	Y
Minimum Data Rate in low power state		Y	Y	Y	Y	
MIN-SOS-BR-ds						Y
MIN-SOS-BR-us						Y
Maximum Interleaving Delay	Y	Y	Y	Y	Y	Y
Minimum Impulse Noise Protection (INPMIN)	Y		Y	Y	Y	Y
Minimum Impulse Noise Protection 8 kHz (INPMIN8)						Y
FORCEINP						Y
Maximum Bit Error Ratio			Y	Y	Y	
Data Rate Threshold Upshift	Y	Y	Y	Y	Y	
Data Rate Threshold Downshift	Y	Y	Y	Y	Y	
Maximum Delay Variation (DVMAX)						Y
Channel Initialization Policy selection (CIPOLICY)			Y		Y	Y
Near-end Performance Monitoring Thresholds (15-minute interval)						
CV-C threshold 15 minutes	Y	Y	Y	Y	Y	Y
FEC-C threshold 15 minutes	Y	Y	Y	Y	Y	Y
Near-end Performance Monitoring Thresholds (24-hour interval)						
CV-C threshold 24 hours	Y	Y	Y	Y	Y	Y
FEC-C threshold 24 hours	Y	Y	Y	Y	Y	Y
Far-end Performance Monitoring Thresholds (15-minute interval)						

Table 7-17/G.997.1 – Support of Channel configuration parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
CV-CFE threshold 15 minutes	Y	Y	Y	Y	Y	Y
FEC-CFE threshold 15 minutes	Y	Y	Y	Y	Y	Y
Far-end Performance Monitoring Thresholds (24-hour interval)						
CV-CFE threshold 24 hours	Y	Y	Y	Y	Y	Y
FEC-CFE threshold 24 hours	Y	Y	Y	Y	Y	Y

Modify Tables 7-28 and 7-29 as follows:

Table 7-28/G.997.1 – Line test, diagnostic and status parameters

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface	G-Interface
. . .						
Actual Rate Adaptation Mode						
ACT-RA-MODEds	7.5.1.33.1	R(O)				R(O)
ACT-RA-MODEus	**7.5.1.33.2**	R(O)				R(O)
Actual impulse noise protection of ROC						
ACTINP-ROC-ds	7.5.1.34.1	R(O)				R(O)
ACTINP-ROC-us	7.5.1.34.2	R(O)				R(O)
Actual SNR Margin of ROC						
SNRM-ROC-ds	7.5.1.35.1	R(O)				R(O)
SNRM-ROC-us	7.5.1.35.2	R(O)				R(O)
NOTE – These parameters are R (M) on the Q-interface for G.993.2 and R (O) for all other ITU-T Recommendations which support them.						

Table 7-29/G.997.1 – Support of Line test, diagnostic and status parameters per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2
• • •						
Actual Rate Adaptation Mode						
ACT-RA-MODEds						Y
ACT-RA-MODEus						Y
ACTINP-ROC-ds						Y
ACTINP-ROC-us						Y
SNRM-ROC-ds						Y
SNRM-ROC-us						Y

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, 2008