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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 1: Management of ITU-T G.998.4, ITU-T G.993.5 and receiver referred virtual noise of ITU-T G.993.2

Recommendation ITU-T G.997.1 (2009) – Amendment 1

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Recommendation ITU-T G.997.1

Physical layer management for digital subscriber line (DSL) transceivers

Amendment 1

Management of ITU-T G.998.4, ITU-T G.993.5 and receiver referred virtual noise of ITU-T G.993.2

Summary

Amendment 1 to Recommendation ITU-T G.997.1 (2009) contains:

– Support of receiver referred virtual noise in the upstream direction for Recommendation ITU-T G.993.2.

– Support of Recommendation ITU-T G.998.4 (ex G.inp).

– Support of Recommendation ITU-T G.993.5 (ex G.vector).

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.997.1	1999-07-02	15
2.0	ITU-T G.997.1	2003-05-22	15
2.1	ITU-T G.997.1 (2003) Amend. 1	2003-12-14	15
2.2	ITU-T G.997.1 (2003) Amend. 2	2005-01-13	15
3.0	ITU-T G.997.1	2005-09-06	15
4.0	ITU-T G.997.1	2006-06-06	15
4.1	ITU-T G.997.1 (2006) Cor. 1	2006-12-14	15
4.2	ITU-T G.997.1 (2006) Amend. 1	2006-12-14	15
4.3	ITU-T G.997.1 (2006) Amend. 2	2007-11-22	15
4.4	ITU-T G.997.1 (2006) Amend. 3	2008-08-22	15
5.0	ITU-T G.997.1	2009-04-22	15
5.1	ITU-T G.997.1 (2009) Cor. 1	2009-11-13	15
5.2	ITU-T G.997.1 (2009) Amend. 1	2010-06-11	15
5.3	ITU-T G.997.1 (2009) Amend. 2	2010-11-29	15

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Physical layer management for digital subscriber line (DSL) transceivers

Amendment 1

Management of ITU-T G.998.4, ITU-T G.993.5 and receiver referred virtual noise of ITU-T G.993.2

1) Support of receiver referred virtual noise in the upstream direction for ITU-T G.993.2

Modify clause 7.3.1.7 as follows:

7.3.1.7 ~~Transmitter Referred~~ Virtual noise configuration parameters

7.3.1.7.1 Downstream signal-to-noise ratio mode (SNRMODEds)

This parameter enables the transmitter referred virtual noise in the downstream direction. If set to 1, the virtual noise is disabled. If set to 2, the virtual noise is enabled. For [ITU-T G.993.2], if set to 4, the virtual noise together with the virtual noise scaling factor is enabled. The value of 3 is reserved by ITU-T.

7.3.1.7.2 Upstream signal-to-noise ratio mode (SNRMODEus)

This parameter enables the transmitter referred virtual noise in the upstream direction. If set to 1, the virtual noise is disabled. If set to 2, the transmitter referred virtual noise is enabled. For [ITU-T G.993.2], if set to 3, the receiver referred virtual noise is enabled. For [ITU-T G.993.2], if set to 4, the receiver referred virtual noise together with the virtual noise scaling factor is enabled.

7.3.1.7.3 Downstream ~~Transmitter Referred~~ virtual noise (~~TXREF~~VNds)

This configuration parameter VNds 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. The same TXREFVNds format shall be applied to ITU-T G.992.3 and ITU-T G.992.5 Annex C FEXT TXREFVNds and NEXT TXREFVNds.

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

7.3.1.7.3.1 FEXT downstream transmitter referred virtual noise (FEXT TXREFVNds)

For ITU-T G.992.3 (ADSL2) Annex C and ITU-T G.992.5 (ADSL2plus) Annex C, the downstream transmitter referred virtual noise (see clause 7.3.1.7.3) specified for $FEXT_R$ duration is defined as FEXT downstream transmitter referred virtual noise (FEXT TXREFVNds).

7.3.1.7.3.2 NEXT downstream transmitter referred virtual noise (NEXT TXREFVNds)

For ITU-T G.992.3 (ADSL2) Annex C and ITU-T G.992.5 (ADSL2plus) Annex C, the downstream transmitter referred virtual noise (see clause 7.3.1.7.3) specified for $NEXT_R$ duration is defined as NEXT downstream transmitter referred virtual noise (NEXT TXREFVNds).

7.3.1.7.4 Upstream ~~Transmitter Referred~~ virtual noise (~~TXREF~~VNus)

If SNRM_MODE =2, ~~This~~ this configuration parameter defines the upstream transmitter referred virtual noise (TXREFVNus). For [ITU-T G.993.2], if SNRM_MODE is equal to 3 or 4, this configuration parameter defines the upstream receiver referred virtual noise (RXREFVNus). The ~~TXREF~~VNus 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 ITU-T G.992.3 or ITU-T G.992.5, no more than 3 breakpoints shall be configured below the upper edge of the passband of every mode enabled for ITU-T G.992.3 and ITU-T G.992.5.

7.3.1.7.5 Upstream virtual noise scaling factor (RXREFVNSFus)

If SNRM_MODE = 4, this configuration parameter defines the upstream receiver-referred virtual noise scaling factor. The valid values for the receiver-referred virtual noise scaling factor range from –64.0 dB to 63.5 dB, in steps of 0.5 dB.

7.3.1.7.6 Downstream virtual noise scaling factor (TXREFVNSFds)

If SNRM_MODE = 4, this configuration parameter defines the downstream transmitter referred virtual noise scaling factor. The valid values for the transmitter referred virtual noise scaling factor range from –64.0 dB to 63.5 dB, in steps of 0.5 dB.

Modify clause 7.5.1.15 as follows:

7.5.1.15 Actual downstream signal-to-noise ratio mode (ACTSNRMODEds)

This parameter indicates if the transmitter referred virtual noise is active on the line in the downstream direction. If ACTSNRMODEds equals 1, the virtual noise is inactive. If ACTSNRMODEds equals 2, the virtual noise is active. If ACTSNRMODEds equals 4, the virtual noise together with the virtual noise scaling factor is active.

Modify clause 7.5.1.18 as follows:

7.5.1.18 Actual upstream signal-to-noise ratio mode (ACTSNRMODEus)

This parameter indicates ~~if~~ the ~~transmitter referred~~type of virtual noise that is active on the line in the upstream direction. If ACTSNRMODEus equals 1, the virtual noise is inactive. If ACTSNRMODEus equals 2, the transmitter referred virtual noise is active. If ACTSNRMODEus equals 3, the receiver referred virtual noise is active. If ACTSNRMODEus equals 4, the receiver referred virtual noise together with the virtual noise scaling factor is active.

Modify Table 7-14 as follows:

Table 7-14 – Line configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
(...)					
Transmitter referred virtual noise					
SNRMODEds	7.3.1.7.1	R/W (M)	R (O)		R (M)
SNRMODEus	7.3.1.7.2	R/W (M)	R (O)		
~~TXREF~~VNds	7.3.1.7.3	R/W (~~M~~O)	R (O)		R (M)

Table 7-14 – Line configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
FEXT TXREFVNds	7.3.1.7.3.1	R/W (~~M~~O)	R (O)		R (M)
NEXT TXREFVNds	7.3.1.7.3.2	R/W (~~M~~O)	R (O)		R (M)
~~TXREF~~VNus	7.3.1.7.4	R/W (~~M~~O)	R (O)		R (M)
RXREFVNSFus	7.3.1.7.5	R/W (O)			
TXREFVNSFds	7.3.1.7.6	R/W (O)			
(...)					

Modify Table 7-15 as follows:

Table 7-15 – 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
~~TXREF~~VNds			Y		Y	Y
FEXT TXREFVNds			Y		Y	
NEXT TXREFVNds			Y		Y	
~~TXREF~~VNus			Y (Note)		Y (Note)	Y (Note)
RXREFVNSFus						Y
TXREFVNSFds						Y
(...)						
NOTE – In SNRM_MODE = 3 or 4 (Receiver referred virtual noise), this parameter is only defined for [ITU-T G.993.2].						

2) Add support for [ITU-T G.998.4] (ex G.inp) Recommendation (retransmission)

Modify clause 7.2.1.1.3 as follows:

7.2.1.1.3 Severely errored second – Line (SES-L)

This parameter is a count of severely errored seconds (SES). An SES is declared if, during a 1-second interval, there are 18 or more CRC-8 anomalies in one or more of the received bearer channels, or one or more LOS defects, or one or more SEF defects, or one or more LPR defects. If [ITU-T G.998.4] is supported and retransmission is enabled in the near-end received direction, a SES is also declared if, during a 1-second interval, there is one or more severe loss of error-free throughput (*seftr*) defect in the near-end received direction.

If the relevant Recommendation (e.g., [ITU-T G.992.3], [ITU-T G.992.5] and [ITU-T G.993.2]) supports one-second normalized CRC-8 anomaly counter increment, the one-second counter used to declare SES shall increment with this value instead of incrementing by 1 for each CRC-8 anomaly.

If a common CRC is applied over multiple bearer channels, then each related CRC-8 anomaly shall be counted only once for the whole set of bearer channels over which the CRC is applied.

Modify clause 7.2.1.2.3 as follows:

7.2.1.2.3 Severely errored second – Line far-end (SES-LFE)

This parameter is a count of severely errored seconds (SES). An SES is declared if, during a 1-second interval, there are 18 or more FEBE anomalies in one or more of the transmitted bearer channels, or one or more far-end LOS defects, or one or more RDI defects, or one or more LPR-FE defects. If [ITU-T G.998.4] is supported and retransmission is enabled in the far-end received direction, a SES-LFE is also declared if, during a 1-second interval, there is one or more severe loss of error-free throughput (*seftr*) defect in the far-end received direction.

If the relevant Recommendation (e.g., [ITU-T G.992.3], [ITU-T G.992.5] and [ITU-T G.993.2]) supports 1-second normalized CRC-8 anomaly counter increment, the one-second counter used to declare SES shall increment with this value instead of incrementing by 1 for each FEBE anomaly.

If a CRC is applied over multiple bearer channels, then each related FEBE anomaly shall be counted only once for the whole set of related bearer channels.

Add clauses 7.2.1.1.6 to 7.2.1.1.8:

7.2.1.1.6 "leftr" defects seconds counter

If retransmission is used in a given transmit direction, this parameter is a count of the seconds with a near-end "leftr" defect present (see clause 11.4.1 of [ITU-T G.998.4] for the definition of this counter).

The near-end counter is only defined in upstream.

The management entity shall generate a 15-min and 24-hour performance history.

7.2.1.1.7 Error-free bits counter

If retransmission is used in a given transmit direction, this parameter is a count of the number of error-free bits passed over the β_1 reference point, divided by 2^{16} (see clause 11.4.2 of [ITU-T G.998.4] for the definition of this counter).

The near-end counter is only defined in upstream.

The management entity shall generate a 15-min and 24-hour performance history.

7.2.1.1.8 Minimum error-free throughput (MINEFTR)

If retransmission is used in a given transmit direction, this parameter MINEFTR reports the minimum of the EFTR observed over the 15-min or 24-hour accumulation period (see clause 11.4.3 of [ITU-T G.998.4] for the definition of this parameter).

The value is reported in bit/s.

The near-end value is only defined in upstream.

The management entity shall generate a 15-min and 24-hour performance history.

The management entity shall read the ITU-T G.998.4 EFTR_min (at least) every 15 minutes to determine the minimum EFTR over the 15-min and 24-hour intervals.

Add clauses 7.2.1.2.6 to 7.2.1.2.8:

7.2.1.2.6 ''leftr'' defects seconds counter

If retransmission is used in a given transmit direction, this parameter is a count of the seconds with a near-end "leftr" defect present (see clause 11.4.1 of [ITU-T G.998.4] for the definition of this counter).

The far-end counter is only defined in downstream.

The management entity shall generate a 15-min and 24-hour performance history.

7.2.1.2.7 Error-free bits counter

If retransmission is used in a given transmit direction, this parameter is a count of the number of error-free bits passed over the β_1 reference point, divided by 2^{16} (see clause 11.4.2 of [ITU-T G.998.4] for the definition of this counter).

The far-end counter is only defined in downstream.

The management entity shall generate a 15-min and 24-hour performance history.

7.2.1.2.8 Minimum error-free throughput (MINEFTR)

If retransmission is used in a given transmit direction, this parameter MINEFTR reports the minimum of the EFTR observed over the 15-min or 24-hour accumulation period (see clause 11.4.3 of [ITU-T G.998.4] for the definition of this parameter).

The value is reported in bit/s.

The far-end value is only defined in downstream.

The management entity shall generate a 15-min and 24-hour performance history.

The management entity shall read the ITU-T G.998.4 EFTR_min (at least) every 15 minutes to determine the minimum EFTR over the 15-min and 24-hour intervals.

Modify clause 7.2.7.13 as follows:

7.2.7.13 Inhibiting performance monitoring parameters

For a given monitored entity, the accumulation of certain performance parameters is inhibited during periods of unavailability, during SESs or during seconds containing defects on that monitored entity. Inhibiting on a given monitored entity (e.g., ADSL ATM data path) is not explicitly affected by conditions on any other monitored entity (xDSL line). The inhibiting rules are as follows:

– UAS and failure count parameters shall not be inhibited.

– *leftr* defect seconds counter and MINEFTR shall not be inhibited.

– INM parameters shall be inhibited during a 1-second interval, if it contains one or more LOS defects, or one or more SEF defects, or one or more LPR defects.

– All other performance parameter counts shall be inhibited during UAS and SES. Inhibiting shall be retroactive to the onset of unavailable time and shall end retroactively to the end of unavailable time.

Modify clause 7.3.1.4.1 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~~ four values: Mode 1, 2, 3 or 4.

NOTE 1 – Modes 1 and 2 both are mandatory modes. The commonality between Modes 1 and 2 is that both are characterized by a constant data rate in showtime. The difference between Modes 1 and 2 is that Mode 1 fixes this data rate at the configured minimum data rate, whereas with Mode 2 forces the modem subsystem to fix the data rate within the range determined by the configured minimum and maximum data rates. In case of ITU-T G.998.4 operation, the 'data rate' is replaced in the above by 'expected throughput'.

Modes 3 and 4 are optional modes that mandate rate changes under specific conditions. In [ITU-T G.998.4], retransmission operation is not possible simultaneously with Modes 3 or 4. This implies a fall-back to Mode 2 when the xTU decides to operate in ITU-T G.998.4 mode and Mode 3 or 4 is configured.

Mode 1: MANUAL – Data rate/Expected throughput changed manually.

Support of this mode is mandatory.

In case ITU-T G.998.4 retransmission is not used in the downstream direction

The downstream minimum data rate parameter (see clause 7.3.2.1.1) specifies the exact data rate the xTU-C transmitter shall operate at for each of the bearer channels.

NOTE 2 – The downstream minimum data rate parameter value shall override the configured maximum data rate parameter value (see clause 7.3.2.1.3).

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 startup

a) For [ITU-T G.992.1] and [ITU-T G.992.2], the channel initialization policy is defined in this paragraph.~~The Downstream Minimum Data Rate parameter specifies the exact data rate the xTU-C transmitter shall operate at for each of the bearer channels,~~ The ATUs shall initialize with a downstream noise margin which is at least as large as the specified downstream target noise margin, TARSNRMds (see clause 7.3.1.3.1), 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.~~

b) For operational modes other than [ITU-T G.992.1] or [ITU-T G.992.2], the channel initialization policy is defined in the relevant Recommendation and controlled by the CIPOLICY parameter (see clause 7.3.2.10).

At showtime

The xTU-C transmitter shall maintain the specified downstream minimum data rate for each of the bearer channels.

In case ITU-T G.998.4 retransmission is used in the downstream direction

The downstream MINETR_RTX parameter (see clause 7.3.2.1.8) specifies the exact expected throughput the xTU-C transmitter shall operate at.

NOTE 3 – The downstream MINETR_RTX parameter value shall override the configured downstream MAXETR_RTX parameter value (see clause 7.3.2.1.9).

At startup

The channel initialization policy is defined in [ITU-T G.998.4] (see clause 11.5 of [ITU-T G.998.4]).

At showtime

The xTU-C transmitter shall maintain the specified downstream minimum expected throughput.

Mode 2: AT_INIT – Data rate/Expected throughput automatically selected at startup only and does not change after that.

Support of this mode is mandatory.

In case ITU-T G.998.4 retransmission is not used in the downstream direction

The downstream minimum data rate parameter (see clause 7.3.2.1.1) and downstream maximum data rate parameter (see clause 7.3.2.1.3) specify the data rate range within which the xTU-C transmitter shall operate at for each of the bearer channels. The data rate is determined during initialization and remains constant during the subsequent showtime phase.

At startup

a) For [ITU-T G.992.1] and [ITU-T G.992.2], the channel initialization policy is defined in this paragraph. ~~The Downstream Minimum Data Rate parameter specifies the minimum data rate the xTU-C transmitter shall operate at for each of the bearer channels,~~ The ATUs shall initialize at a downstream data rate in the range between minimum data rate and maximum data rate and with a downstream noise margin which is at least as large as the specified downstream target noise margin, TARSNRMds (see clause 7.3.1.3.1), 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.

b) For operational modes other than [ITU-T G.992.1] or [ITU-T G.992.2], the channel initialization policy is defined in the relevant Recommendation and controlled by the CIPOLICY parameter (see clause 7.3.2.10).

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.

In case ITU-T G.998.4 retransmission is used in the downstream direction

The downstream MINETR_RTX parameter (see clause 7.3.2.1.8) and downstream MAXETR_RTX parameter (see clause 7.3.2.1.9) specify the range of the expected throughput within which the xTU-C transmitter shall operate at.

The expected throughput (ETR) is determined during initialization and remains constant during the subsequent showtime phase.

At startup

The channel initialization policy is defined in [ITU-T G.998.4] (see clause 11.5 of [ITU-T G.998.4]).

At showtime

During showtime, no downstream data rate adaptation is allowed. The downstream expected throughput, which has been selected during initialization, shall be maintained.

Mode 3: DYNAMIC – Data rate/Expected throughput 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.

In case ITU-T G.998.4 retransmission is not used in the downstream direction

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 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 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.

If in [ITU-T G.993.2], it is detected at startup that SRA is not supported in the downstream direction by either XTUs, the XTUs shall fallback to Mode 2. This shall be reported by the dowstream actual rate adaptation mode parameter, ACT-RA-MODEds (see clause 7.5.1.33.1).

In case ITU-T G.998.4 retransmission is used in the downstream direction

At startup

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

At showtime

No rate changes are allowed in [ITU-T G.998.4]. Because of this, the downstream RA-MODE shall fall back to RA-MODE = 2. This shall be reported by the dowstream actual rate adaptation mode parameter, ACT-RA-MODEds (see clause 7.5.1.33.1).

Mode 4: DYNAMIC with SOS – Data rate/Expected throughput 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.

In case ITU-T G.998.4 retransmission is not used in the downstream direction

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 [ITU-T G.993.2].

If at startup, it is detected that SOS is not supported in the downstream direction by either XTUs, but SRA is supported by both XTUs, the XTUs shall fallback to Mode 3. This shall be reported by the dowstream actual rate adaptation mode parameter, ACT-RA-MODEds (see clause 7.5.1.33.1).

If at startup, it is detected that SOS is not supported in the downstream direction by either XTUs, and SRA is not supported by either XTUs, the XTUs shall fallback to Mode 2. This shall be reported by the dowstream actual rate adaptation mode parameter, ACT-RA-MODEds (see clause 7.5.1.33.1).

In case ITU-T G.998.4 retransmission is used in the downstream direction

At startup

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

At showtime

No rate changes are allowed in [ITU-T G.998.4]. Because of this, the downstream RA-MODE shall fall back to RA-MODE = 2. This shall be reported by the dowstream actual rate adaptation mode parameter, ACT-RA-MODEds (see clause 7.5.1.33.1).

Modify clause 7.3.1.8 as follows:

7.3.1.8 Line performance monitoring parameter thresholds

All supported line performance monitoring parameters (counters, see Table 7-1) shall have an individual 15-minute and 24-hour threshold parameter except for the "Error-free bits counter" and MINEFTR for which threshold parameters are not defined.

Add clauses 7.3.1.11 and 7.3.1.12:

7.3.1.11 Retransmission mode (RTX_MODE)

This parameter controls the mode of operation of [ITU-T G.998.4] retransmission in a given transmit direction. The parameter in downstream is RTX_MODE_ds, and the parameter in upstream is RTX_MODE_us. In [ITU-T G.992.3] and [ITU-T G.992.5] only the downstream parameter RTX_MODE_ds is relevant, the value in the upstream direction shall be ignored. In [ITU-T G.993.2], both parameters are relevant.

This parameter has 4 valid values:

0: RTX_FORBIDDEN: ITU-T G.998.4 retransmission not allowed.

1: RTX_PREFERRED: ITU-T G.998.4 retransmission is preferred by the operator (i.e., if ITU-T G.998.4 RTX capability is supported by both XTUs, the XTUs shall select ITU-T G.998.4 operation for this direction).

2: RTX_FORCED: Force the use of the ITU-T G.998.4 retransmission (i.e., if ITU-T G.998.4 RTX capability in this direction is not supported by both XTUs or not selected by the XTUs, an initialization failure shall result).

NOTE – Due to the optionality of ITU-T G.998.4 retransmission in upstream direction, the use of RTX_FORCED in upstream may lead to initialization failure, even if the XTU is supporting ITU-T G.998.4 (in downstream).

3: RTX_TESTMODE: Force the use of the ITU-T G.998.4 retransmission in test mode (i.e., if ITU-T G.998.4 RTX capability is not supported by both XTUs or not selected by the XTUs, an initialization failure shall result).

7.3.1.12 "leftr" defect threshold (LEFTR_THRESH)

If retransmission is used in a given transmit direction, LEFTR_THRESH specifies the threshold for declaring a near-end "leftr" defect (see clause 11.1.12 of [ITU-T G.998.4] for the definition of this threshold).

The value is coded as a fraction of the NDR with valid range from 0.01 to 0.99 with increments of 0.01. A special value means the ETR shall be used as the default threshold for declaring a "leftr" defect.

Modify clause 7.3.2 and its subclauses as follows:

7.3.2 Channel configuration parameters

7.3.2.1 Data rate configuration parameters

These data rate parameters refer to the transmit direction for both the xTU-C and the xTU-R and apply to the configuration of an individual upstream or downstream bearer channel. The ~~two~~ data rate parameters define the data rate minimum and maximum bounds as specified by the operator of the system (the operator of the xTU-C). It is assumed that the xTU-C and the xTU-R will interpret the value set by the operator as appropriate for the specific implementation of xDSL between the xTU-C and the xTU-R in setting the line rates. The ranges of the data rate configuration parameters are not specified. The NMS used by the operator to manage the xTU-R and the xTU-C may implement its own limits on the allowed values for the desired bit rate parameters based on the particulars of the system managed. The definition of such a system is outside the scope of this model.

7.3.2.1.1 Minimum data rate

If retransmission is not used in a given transmit direction, ~~This~~ this parameter specifies the minimum net data rate for the bearer channel as desired by the operator of the system. The rate is coded in steps of 1'000 bit/s.

7.3.2.1.2 Minimum reserved data rate

This parameter specifies the minimum reserved net data rate for the bearer channel as desired by the operator of the system. The rate is coded in steps of 1'000 bit/s.

This parameter is optional. It is used only if the rate adaptation mode is set to DYNAMIC.

7.3.2.1.3 Maximum data rate

If retransmission is not used in a given transmit direction, ~~This~~ this parameter specifies the maximum net data rate for the bearer channel as desired by the operator of the system. The data rate is coded in steps of 1'000 bit/s.

7.3.2.1.4 Rate adaptation ratio

This parameter (expressed in %) specifies the ratio that shall be taken into account for the bearer channel when performing rate adaptation in the transmission direction of the bearer channel. The ratio is defined as a percentage in the 0 to 100 range. A ratio of 20% means that 20% of the available data rate (in excess of the minimum data rate summed over all bearer channels) will be assigned to this bearer channel and 80% to the other bearer channels.

The sum of rate adaptation ratios over all bearers in one direction shall be equal to 100%.

7.3.2.1.5 Minimum data rate in low power state

This parameter specifies the minimum net data rate for the bearer channel as desired by the operator of the system during the low power state (L1/L2). The power management low power states L1 and L2 are defined in [ITU-T G.992.2] and [ITU-T G.992.3], respectively. The data rate is coded in steps of 1'000 bit/s.

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.

7.3.2.1.8 Minimum expected throughput for retransmission (MINETR_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the minimum expected throughput for the bearer channel (as specified in clause 11.1.1 of [ITU-T G.998.4]).

The rate is coded in steps of 1'000 bit/s.

7.3.2.1.9 Maximum expected throughput for retransmission (MAXETR_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the maximum expected throughput for the bearer channel (as specified in clause 11.1.2 of [ITU-T G.998.4]).

The rate is coded in steps of 1'000 bit/s.

7.3.2.1.10 Maximum net data rate for retransmission (MAXNDR_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the maximum net data rate for the bearer channel (as specified in clause 11.1.3 of [ITU-T G.998.4]).

The data rate is coded in steps of 1'000 bit/s.

7.3.2.2 Maximum interleaving delay

If retransmission is not used in a given transmit direction, ~~T~~this parameter is the maximum one-way interleaving delay introduced by the PMS-TC between the alfa and the beta reference points, in the direction of the bearer channel. The one-way interleaving delay is defined in individual ADSL Recommendations as $\lceil S*D \rceil /4$ ms, where "S" is the S-factor and "D" is the "Interleaving Depth" and $\lceil x \rceil$ denotes rounding to the higher integer.

The xTUs shall choose the S and D values such that the actual one-way interleaving delay (see actual interleaving delay status parameter in clause 7.5.2.3) is less than or equal to the configured maximum interleaving delay. The delay ranges from 2 to 63 ms by steps of 1 ms. Three special values, S0, S1 and S2, are specified. The value S0 indicates no delay bound is being imposed. The value S1 indicates the fast latency path shall be used in the G.992.1 operating mode and S and D shall be selected such that $S \leq 1$ and $D = 1$ in [ITU-T G.992.2], [ITU-T G.992.3], [ITU-T G.992.4], [ITU-T G.992.5] and [ITU-T G.993.2] operating modes. The value S2 indicates a delay bound of 1 ms in [ITU-T G.993.2].

NOTE – A single maximum delay value is configured for operation without ITU-T G.998.4 retransmission mode. As a consequence, xTUs supporting multiple xDSL Recommendations will use the configured value regardless of the xDSL operating mode actually being selected at line initialization.

7.3.2.3 Minimum impulse noise protection (INPMIN)

If retransmission is not used in a given transmit direction, ~~This~~ this parameter specifies the minimum impulse noise protection for the bearer channel if it is transported over DMT symbols with a subcarrier spacing of 4.3125 kHz. The impulse noise protection is expressed in DMT symbols with a subcarrier spacing of 4.3125 kHz and can take the values ½ and any integer from 0 to 16, inclusive.

If the xTU does not support the configured INPMIN value, it shall use the nearest supported impulse noise protection greater than INPMIN.

7.3.2.3.1 Special requirements for [ITU-T G.992.1]

It is optional to apply the INPMIN parameter in the case of [ITU-T G.992.1]. If INPMIN is supported, the ATU-C shall offer to the ATU-R a range of combinations of framing parameters (C-RATES-1 and C-RATES-RA options) during initialization, which provide an ACTINP value equal to or greater than the INPMIN value specified over the Q interface. The ACTINP value for [ITU-T G.992.1] is defined in clause 7.5.2.4.

7.3.2.4 Minimum impulse noise protection for system using 8.625 kHz subcarrier spacing (INPMIN8)

If retransmission is not used in a given transmit direction, ~~This~~ this parameter specifies the minimum impulse noise protection for the bearer channel if it is transported over DMT symbols with a subcarrier spacing of 8.625 kHz. The impulse noise protection is expressed in DMT symbols with a subcarrier spacing of 8.625 kHz and can take any integer value from 0 to 16, inclusive.

7.3.2.5 Force framer setting for impulse noise protection (FORCEINP)

If retransmission is not used in a given transmit direction, ~~This~~ this parameter indicates that the framer settings of the bearer shall be selected such that the impulse noise protection computed according to the formula specified in the relevant Recommendation is greater than or equal to the minimal impulse noise protection requirement.

This flag shall have the same value for all the bearers of one line in the same direction.

7.3.2.6 Maximum bit error ratio

If retransmission is not used in a given transmit direction, ~~This~~ this parameter specifies the maximum bit error ratio for the bearer channel as desired by the operator of the system. The bit error ratio can take the values 10^{-3}, 10^{-5} or 10^{-7}.

NOTE – ATUs supporting multiple ADSL Recommendations may use or ignore the configured value depending on the operating mode actually being selected at line initialization. In [ITU-T G.992.3], [ITU-T G.992.4] and [ITU-T G.992.5], the ATUs will use the configured value. In [ITU-T G.992.1] and [ITU-T G.992.2], ATUs operate with the maximum bit error ratio fixed to 10^{-7}, regardless of the configured value.

7.3.2.7 Channel performance monitoring parameter thresholds

All supported channel performance monitoring parameters (counters, see Table 7-2) shall have an individual 15-minute and 24-hour threshold parameter.

7.3.2.8 Channel data rate thresholds

The data rate threshold parameter procedures shall be as defined in clause 7.2.7.

7.3.2.8.1 Data rate threshold upshift

If retransmission is not used in a given transmit direction, ~~This~~ this parameter is a threshold on the net data rate upshift achieved over one or more bearer channel data rate adaptations. An upshift rate change alarm (event) is triggered when the actual data rate exceeds the data rate at the last entry into showtime by more than the threshold. The data rate threshold is coded in bit/s.

7.3.2.8.2 Data rate threshold downshift

If retransmission is not used in a given transmit direction, ~~This~~ this parameter is a threshold on the net data rate downshift achieved over one or more bearer channel data rate adaptations. A downshift rate change alarm (event) is triggered when the actual data rate is below the data rate at the last entry into showtime by more than the threshold. The data rate threshold is coded in bit/s.

7.3.2.9 Maximum delay variation (DVMAX)

This parameter specifies the maximum value for the delay variation allowed in an OLR procedure.

It ranges from 0.1 to 25.4 in steps of 0.1 ms.

A special value indicates that no delay variation bound is imposed.

7.3.2.10 Channel initialization policy selection (CIPOLICY)

If retransmission is not used in a given transmit direction, this parameter~~The channel initialization policy selection is a parameter that~~ indicates which policy shall be applied to determine the transceiver configuration parameters at initialization. The valid values for CIPOLICY are 0 and 1. They are defined in the respective Recommendations.

7.3.2.11 Maximum delay for retransmission (DELAYMAX_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the maximum for the instantaneous delay due to the effect of retransmission only (see [ITU-T G.998.4] for detailed specification). The delay ranges from 1 to 63 ms by steps of 1 ms.

NOTE – A single maximum delay value is configured for operation in ITU-T G.998.4 retransmission mode. As a consequence, xTUs supporting multiple xDSL Recommendations in conjunction with [ITU-T G.998.4] will use the configured value regardless of the xDSL operating mode actually being selected at line initialization.

7.3.2.12 Minimum delay for retransmission (DELAYMIN_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the minimum for the instantaneous delay due to the effect of retransmission only (see [ITU-T G.998.4] for detailed specification). The delay ranges from 0 to 63 ms by steps of 1 ms.

NOTE – A single minimum delay value is configured for operation in ITU-T G.998.4 retransmission mode. As a consequence, xTUs supporting multiple xDSL Recommendations in conjunction with [ITU-T G.998.4] will use the configured value regardless of the xDSL operating mode actually being selected at line initialization.

7.3.2.13 Minimum impulse noise protection against SHINE for retransmission (INPMIN_SHINE_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the minimum impulse noise protection against SHINE for the bearer channel if it is transported over DMT symbols with a subcarrier spacing of 4.3125 kHz. The impulse noise protection is expressed in DMT symbols with a subcarrier spacing of 4.3125 kHz and can take any integer value from 0 to 63, inclusive.

7.3.2.14 Minimum impulse noise protection against SHINE for retransmission for systems using 8.625 kHz subcarrier spacing (INPMIN8_SHINE_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the minimum impulse noise protection against SHINE for the bearer channel if it is transported over DMT symbols with a subcarrier spacing of 8.625 kHz. The impulse noise protection is expressed in DMT symbols with a subcarrier spacing of 8.625 kHz and can take any integer value from 0 to 127, inclusive.

7.3.2.15 SHINERATIO_RTX

If retransmission is used in a given transmit direction, this parameter specifies the SHINE ratio (see [ITU-T G.998.4] for detailed definition).

The values range from 0 to 0.100 in increments of 0.001.

7.3.2.16 Minimum impulse noise protection against REIN for retransmission (INPMIN_REIN_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the minimum impulse noise protection against REIN for the bearer channel if it is transported over DMT symbols with a subcarrier spacing of 4.3125 kHz. The impulse noise protection is expressed in DMT symbols with a subcarrier spacing of 4.3125 kHz and can take any integer value from 0 to 7, inclusive.

7.3.2.17 Minimum impulse noise protection against REIN for retransmission for systems using 8.625 kHz subcarrier spacing (INPMIN8_REIN_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the minimum impulse noise protection against REIN for the bearer channel if it is transported over DMT symbols with a subcarrier spacing of 8.625 kHz. The impulse noise protection is expressed in DMT symbols with a subcarrier spacing of 8.625 kHz and can take any integer value from 0 to 13, inclusive.

7.3.2.18 REIN inter-arrival time for retransmission (IAT_REIN_RTX)

If retransmission is used in a given transmit direction, this parameter specifies the inter-arrival time that shall be assumed for REIN protection.

- The value 0 indicates an inter-arrival time derived from a REIN at 100 Hz.
- The value 1 indicates an inter-arrival time derived from a REIN at 120 Hz.

Modify clause 7.5.1.6 as follows:

7.5.1.6 Initialization success/failure cause

This parameter indicates whether the last full initialization procedure was successful. If the last initialization procedure was not successful, this parameter provides the reason. It is coded as an integer in the 0 to 6~~5~~ range, coded as follows:

0 Successful.

1 Configuration error.

This error occurs with inconsistencies in configuration parameters. For example, when the line is initialized in an xDSL transmission system where an xTU does not support the configured maximum delay or the configured minimum or maximum data rate for one or more bearer channels.

2 Configuration not feasible on the line.

This error occurs if the minimum data rate cannot be reached on the line with the minimum noise margin, maximum PSD level, maximum delay and maximum bit error ratio for one or more bearer channels.

3 Communication problem.

This error occurs, for example, due to corrupted messages or bad syntax messages or if no common mode can be selected in the ITU-T G.994.1 handshaking procedure or due to a timeout.

4 No peer xTU detected.

This error occurs if the peer xTU is not powered or not connected or if the line is too long to allow detection of a peer xTU.

5 Any other or unknown initialization failure cause.

6 ITU-T G.998.4 retransmission mode was not selected while RTX_MODE = FORCED or with RTX_MODE = RTX_TESTMODE.

Add clause 7.5.1.38:

7.5.1.38 Retransmission used (RTX_USED)

This parameter specifies whether ITU-T G.998.4 retransmission is used (i.e., active in showtime) in a given transmit direction. The parameter in downstream is RTX_USED_ds, and the parameter in upstream is RTX_USED_us. In [ITU-T G.992.3] and [ITU-T G.992.5] only the downstream parameter RTX_USED_ds is relevant, the value in the upstream direction shall be ignored. In [ITU-T G.993.2], both parameters are relevant.

1: RTX in use.

2: RTX not in use, due to RTX_MODE = FORBIDDEN.

3: RTX not in use, due to not supported by the XTU-C.

4: RTX not in use, due to not supported by the XTU-R.

5: RTX not in use, due to not supported by the XTU-C and XTU-R.

This parameter shall also be reported in the case of RTX_MODE = RTX_FORCED with INIT FAILURE or with RTX_MODE = RTX_TESTMODE with INIT FAILURE.

NOTE – In the latter case, this parameter will give detailed information on top of the INIT FAILURE reason code.

Modify clause 7.5.2 and its subclauses as follows:

7.5.2 Channel status parameters

7.5.2.1 Actual data rate

If retransmission is not used in a given transmit direction:

– In L0 state, this parameter reports the actual net data rate at which the bearer channel is operating ~~at~~.

– In L1 or L2 states, the parameter contains the net data rate in the previous L0 state.

If retransmission is used in a given transmit direction:

– In L0 state, this parameter reports the expected throughput (ETR) (as defined in [ITU-T G.998.4]) at which the bearer channel is operating.

– In L2 state, the parameter contains the expected throughput (ETR) (as defined in [ITU-T G.998.4]) in the previous L0 state.

The data rate is coded in steps of 1'000 bit/s.

This parameter shall be reported with the most recent values when read over the Q interface.

7.5.2.2 Previous data rate

If retransmission is not used in a given transmit direction, ~~This~~ this parameter reports the previous net data rate the bearer channel was operating at just before the latest net data rate change event occurred, excluding all transitions between L0 state and L1 or L2 states.

If retransmission is used in a given transmit direction, this parameter reports the previous expected throughput (ETR) (as defined in [ITU-T G.998.4]) the bearer channel was operating at just before the latest ETR change event occurred, excluding all transitions between L0 state and L1 or L2 states.

A ~~net data~~ rate change can occur at a power management state transition, e.g., at full or short initialization, fast retrain or power down or at a dynamic rate adaptation. The rate is coded in steps of 1'000 bit/s.

7.5.2.3 Actual ~~interleaving~~ delay

If retransmission is not used in a given transmit direction, ~~This~~ this parameter is the actual one-way interleaving delay introduced by the PMS-TC between the alfa and beta reference points excluding delay in L1 and L2 state. In L1 and L2 state, the parameter contains the interleaving delay in the previous L0 state. For ADSL, this parameter is derived from the S and D parameters as $\lceil S*D \rceil/4$ ms, where "S" is the symbols per codeword, and "D" is the "Interleaving Depth" and $\lceil x \rceil$ denotes rounding to the higher integer. For [ITU-T G.993.2], this parameter shall be computed according to the formula in clause 9.7 of [ITU-T G.993.2].

If retransmission is used in a given transmit direction, this parameter specifies the actual value of the time-independent component of the delay due to retransmission only (see [ITU-T G.998.4] for detailed specification).

The actual ~~Interleaving~~ delay is coded in ms (rounded to the nearest ms).

7.5.2.4 Actual impulse noise protection (ACTINP)

If retransmission is not used in a given transmit direction, ~~This~~ 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 [ITU-T G.992.1], this value is computed according to the formula specified in this Recommendation based on the actual framing parameters. For [ITU-T G.992.3] and [ITU-T 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, K.2.7, and K.3.7 of [ITU-T G.992.3]). For [ITU-T 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.

If retransmission is used in a given transmit direction, this parameter reports the actual impulse noise protection (INP) against SHINE (under specific conditions detailed in [ITU-T G.998.4]) on the bearer channel in the L0 state. In the L2 state, the parameter contains the INP in the previous L0 state.

The value is coded in fractions of DMT symbols with a granularity of 0.1 symbols.

The range is from 0 to 204.6. A special value indicates an ACTINP of 204.7 or higher.

7.5.2.4.1 Special requirements for [ITU-T G.992.1]

For [ITU-T G.992.1], the reporting of ACTINP is optional. If reported, the ACTINP value of a bearer mapped in the interleaved path shall be computed by the formula:

$$ACTINP = \left(\frac{1}{2}\right) \times (S \times D) \times \left(\frac{R_I}{N_I}\right)$$

where S, D, R_I and N_I are defined in [ITU-T G.992.1]. The ACTINP value of a bearer mapped in the fast path shall be 0.

7.5.2.5 Impulse noise protection reporting mode (INPREPORT)

This parameter reports the method used to compute the ACTINP. If set to 0, the ACTINP is computed according to the INP_no_erasure formula (see clause 9.6 of [ITU-T G.993.2]). If set to 1, the ACTINP is the value estimated by the xTU receiver.

7.5.2.6 Actual framer settings

7.5.2.6.1 Actual size of Reed-Solomon codeword (NFEC)

This parameter reports the actual Reed-Solomon codeword size used in the latency path in which the bearer channel is transported. The value is coded in bytes. It ranges from 0 to 255.

7.5.2.6.2 Actual number of Reed-Solomon redundancy bytes (RFEC)

This parameter reports the actual number of Reed-Solomon redundancy bytes per codeword used in the latency path in which the bearer channel is transported. The value is coded in bytes. It ranges from 0 to 16. The value 0 indicates no Reed-Solomon coding.

7.5.2.6.3 Actual number of bits per symbol (LSYMB)

This parameter reports the actual number of bits per symbol assigned to the latency path in which the bearer channel is transported. This value does not include trellis overhead. The value is coded in bits. It ranges from 0 to 65535.

7.5.2.6.4 Actual interleaving depth (INTLVDEPTH)

This parameter reports the actual depth of the interleaver used in the latency path in which the bearer channel is transported. The value ranges from 1 to 4096 in steps of 1. The value 1 indicates no interleaving.

7.5.2.6.5 Actual interleaving block length (INTLVBLOCK)

This parameter reports the actual block length of the interleaver used in the latency path in which the bearer channel is transported. The value ranges from 4 to 255 in steps of 1.

7.5.2.7 Actual latency path (LPATH)

This parameter reports the index of the actual latency path in which the bearer is transported. The valid values are 0, 1, 2, 3. For [ITU-T G.992.1], the FAST path shall be mapped to the latency index 0, and the INTERLEAVED path shall be mapped to the latency index 1.

7.5.2.8 Actual net data rate (ACTNDR)

Independent whether retransmission is used or not in a given transmit direction:

– In L0 state, this parameter reports the net data rate (as specified in [ITU-T G.992.3], [ITU-T G.992.5] or [ITU-T G.993.2]) at which the bearer channel is operating.

– In L2 state, the parameter contains the net data rate (as specified in [ITU-T G.992.3], [ITU-T G.992.5] or [ITU-T G.993.2]) in the previous L0 state.

The data rate is coded in steps of 1'000 bit/s.

This parameter shall be reported with the most recent values when read over the Q interface.

This parameter is optional if [ITU-T G.998.4] is not supported.

7.5.2.9 Actual impulse noise protection against REIN (ACTINP_REIN)

If retransmission is used in a given transmit direction, this parameter reports the actual impulse noise protection (INP) against REIN (under specific conditions detailed in [ITU-T G.998.4]) on the bearer channel in the L0 state. In the L2 state, the parameter contains the INP in the previous L0 state.

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_REIN of 25.5 or higher.

Modify clause 7.6 as follows:

7.6 Network management elements partitioning

This clause defines the network management elements which correspond to the specific management interfaces:

Q-interface: Management interface towards the xTU-C, from the network side perspective. The xTU-C provides its near-end (at xTU-C) and far-end (at xTU-R) parameters for the system operator to read and write.

U-C interface: Management interface towards the xTU-C, from the xTU-R's perspective. The xTU-C provides its near-end parameters (xTU-R far-end) for the xTU-R to read.

U-R interface: Management interface towards the xTU-R, from the xTU-C's perspective. The xTU-R provides its near-end parameters (xTU-C far-end) for the xTU-C to read.

T-/S-interface: Management interface towards the xTU-R, from the premises side perspective. The xTU-R provides its near-end (at xTU-R) and far-end (at xTU-C) parameters for the subscriber to read and write.

G-interface: Management interface towards the xTU-R, from the NMS perspective. The xTU-R provides its near-end (at xTU-R) and far-end (at xTU-C) parameters for the NMS to read.

The U-C and U-R management interfaces represent the network management elements to be supported through the OAM communications channel specified in this Recommendation (see clause 6). The exchange between the xTU-C and xTU-R of some or all of these network management elements may already be obtained by the EOC commands defined in the respective Recommendations.

The parameters at the management interfaces are described in two categories. Each category is presented by two tables. The first table (e.g., Table 7-10 for "Line failures") indicates the status of the parameter at the corresponding management interface as:

- R: Read only.
- W: Write only.
- R/W: Read and write.
- (M): Mandatory.
- (O): Optional.

If the status of the parameter over the G-interface is not explicitly stated, it is identical to the status of the same parameter over the T-/S-interface.

NOTE – Some management elements are useful only when optional features of the physical layer Recommendation are supported by the xTUs.

The far-end fault and performance monitoring over the Q-interface is equivalent to the near-end fault and performance monitoring over the T-/S-interface. The near-end fault and performance monitoring over the Q-interface is equivalent to the far-end fault and performance monitoring over the T-/S-interface. Over the Q-interface, near-end fault and performance monitoring applies to the upstream direction only and far-end performance monitoring applies to the downstream direction only. Over the T-/S-interface, near-end fault and performance monitoring applies to the downstream direction only and far-end performance monitoring applies to the upstream direction only.

The second table for each category (e.g., Table 7-11 for "Line failures") indicates for which Recommendations the management element is relevant. A "Y" in a column means that this MIB element is relevant for the specified Recommendation over at least one of the interfaces. The column labelled with [ITU-T G.998.4] indicates the MIB elements that are relevant in addition to those relevant to the xDSL Recommendation associated with [ITU-T G.998.4].

Add the following rows to Table 7-14:

Table 7-14 – Line configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
...					
Near-end (xTU-C) performance monitoring thresholds (15-minute interval)					
FECS-L threshold 15 minutes	7.3.1.8	R/W (O)	R (O)		
ES-L threshold 15 minutes	7.3.1.8	R/W (M)	R (O)		
SES-L threshold 15 minutes	7.3.1.8	R/W (M)	R (O)		
LOSS-L threshold 15 minutes	7.3.1.8	R/W (O)	R (O)		
UAS-L threshold 15 minutes	7.3.1.8	R/W (M)	R (O)		
"leftr" defect seconds threshold 15 minutes	7.3.1.8	R/W (M)			
Near-end (xTU-C) performance monitoring thresholds (24-hour interval)					
FECS-L threshold 24 hours	7.3.1.8	R/W (O)	R (O)		
ES-L threshold 24 hours	7.3.1.8	R/W (M)	R (O)		
SES-L threshold 24 hours	7.3.1.8	R/W (M)	R (O)		
LOSS-L threshold 24 hours	7.3.1.8	R/W (O)	R (O)		
UAS-L threshold 24 hours	7.3.1.8	R/W (M)	R (O)		
"leftr" defect seconds threshold 24 hours	7.3.1.8	R/W (M)			
Far-end (xTU-R) performance monitoring thresholds (15-minute interval)					
FECS-LFE threshold 15 minutes	7.3.1.8	R/W (O)	R (O)		
ES-LFE threshold 15 minutes	7.3.1.8	R/W (M)	R (O)		
SES-LFE threshold 15 minutes	7.3.1.8	R/W (M)	R (O)		
LOSS-LFE threshold 15 minutes	7.3.1.8	R/W (O)	R (O)		
UAS-LFE threshold 15 minutes	7.3.1.8	R/W (M)	R (O)		
"leftr" defect seconds threshold 15 minutes	7.3.1.8	R/W (M)			

Table 7-14 – Line configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
Far-end (xTU-R) performance monitoring thresholds (24-hour interval)					
FECS-LFE threshold 24 hours	7.3.1.8	R/W (O)	R (O)		
ES-LFE threshold 24 hours	7.3.1.8	R/W (M)	R (O)		
SES-LFE threshold 24 hours	7.3.1.8	R/W (M)	R (O)		
LOSS-LFE threshold 24 hours	7.3.1.8	R/W (O)	R (O)		
UAS-LFE threshold 24 hours	7.3.1.8	R/W (M)	R (O)		
"leftr" defect seconds threshold 24 hours	7.3.1.8	R/W (M)			
Initialization performance monitoring thresholds (15-minute interval)					
...					
INPMIN-ROC-us	7.3.1.10.12	R/W (O)			
Retransmission					
RTX_MODE	7.3.1.11	R/W (M)			
LEFTR_THRESH	7.3.1.12	R/W (M)			

Add the following rows to Table 7-15:

Table 7-15 – 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	G.998.4
...							
Near-end performance monitoring thresholds (15-minute interval)							
FECS-L threshold 15 minutes	Y	Y	Y	Y	Y	Y	
ES-L threshold 15 minutes	Y	Y	Y	Y	Y	Y	
SES-L threshold 15 minutes	Y	Y	Y	Y	Y	Y	
LOSS-L threshold 15 minutes	Y	Y	Y	Y	Y	Y	
UAS-L threshold 15 minutes	Y	Y	Y	Y	Y	Y	
"leftr" defect seconds threshold 15 minutes							Y

Table 7-15 – 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	G.998.4
Near-end performance monitoring thresholds (24-hour interval)							
FECS-L threshold 24 hours	Y	Y	Y	Y	Y	Y	
ES-L threshold 24 hours	Y	Y	Y	Y	Y	Y	
SES-L threshold 24 hours	Y	Y	Y	Y	Y	Y	
LOSS-L threshold 24 hours	Y	Y	Y	Y	Y	Y	
UAS-L threshold 24 hours	Y	Y	Y	Y	Y	Y	
"leftr" defect seconds threshold 24 hours							Y
Far-end performance monitoring thresholds (15-minute interval)							
FECS-LFE threshold 15 minutes	Y	Y	Y	Y	Y	Y	
ES-LFE threshold 15 minutes	Y	Y	Y	Y	Y	Y	
SES-LFE threshold 15 minutes	Y	Y	Y	Y	Y	Y	
LOSS-LFE threshold 15 minutes	Y	Y	Y	Y	Y	Y	
UAS-LFE threshold 15 minutes	Y	Y	Y	Y	Y	Y	
"leftr" defect seconds threshold 15 minutes							Y
Far-end performance monitoring thresholds (24-hour interval)							
FECS-LFE threshold 24 hours	Y	Y	Y	Y	Y	Y	
ES-LFE threshold 24 hours	Y	Y	Y	Y	Y	Y	
SES-LFE threshold 24 hours	Y	Y	Y	Y	Y	Y	
LOSS-LFE threshold 24 hours	Y	Y	Y	Y	Y	Y	
UAS-LFE threshold 24 hours	Y	Y	Y	Y	Y	Y	
"leftr" defect seconds threshold 24 hours							Y
...							
INPMIN-ROC-us						Y	
Retransmission							
RTX_MODE							Y
LEFTR_THRESH							Y

Add the following rows to Table 7-16:

Table 7-16 – Channel configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
Data rate					
...					
MIN-SOS-BR-us	7.3.2.1.7	R/W (O)			
MINETR_RTX	7.3.2.1.8	R/W (M)			
MAXETR_RTX	7.3.2.1.9	R/W (M)			
MAXNDR_RTX	7.3.2.1.10	R/W (M)			
DELAYMAX_RTX	7.3.2.11	R/W (M)			
DELAYMIN_RTX	7.3.2.12	R/W (M)			
INPMIN_SHINE_RTX	7.3.2.13	R/W (M)			
INPMIN8_SHINE_RTX	7.3.2.14	R/W (M)			
SHINERATIO_RTX	7.3.2.15	R/W (M)			
INPMIN_REIN_RTX	7.3.2.16	R/W (M)			
INPMIN8_REIN_RTX	7.3.2.17	R/W (M)			
IAT_REIN_RTX	7.3.2.18	R/W (M)			
Maximum interleaving delay	7.3.2.2	R/W (M)	R (O)		
...					

Add and modify the following rows to Table 7-17:

Table 7-17 – 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	G.998.4
Data rate							
Minimum data rate (Note)	Y	Y	Y	Y	Y	Y	
Minimum reserved data rate (Note)		Y	Y	Y	Y	Y	
Maximum data rate (Note)	Y	Y	Y	Y	Y	Y	
...							
Minimum data rate in low power state (Note)		Y	Y	Y	Y		
MIN-SOS-BR-ds (Note)						Y	
MIN-SOS-BR-us (Note)						Y	
Maximum interleaving delay (Note)	Y	Y	Y	Y	Y	Y	
Minimum impulse noise protection (INPMIN) (Note)	Y		Y	Y	Y	Y	
Minimum impulse noise protection 8 kHz (INPMIN8) (Note)						Y	

Table 7-17 – 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	G.998.4
FORCEINP (Note)			Y		Y	Y	
Maximum bit error ratio (Note)			Y	Y	Y		
Data rate threshold upshift (Note)	Y	Y	Y	Y	Y		
Data rate threshold downshift (Note)	Y	Y	Y	Y	Y		
Maximum delay variation (DVMAX) (Note)						Y	
Channel initialization policy selection (CIPOLICY) (Note)			Y		Y	Y	
MINETR_RTX							Y
MAXETR_RTX							Y
MAXNDR_RTX							Y
DELAYMAX_RTX							Y
DELAYMIN_RTX							Y
INPMIN_SHINE_RTX							Y
INPMIN8_SHINE_RTX							Y
SHINERATIO_RTX							Y
INPMIN_REIN_RTX							Y
INPMIN8_REIN_RTX							Y
IAT_REIN_RTX							Y
...							
NOTE – The parameter is not applicable to [ITU-T G.992.3] or [ITU-T G.992.5] and [ITU-T G.993.2] when retransmission is enabled.							

Add the following rows to Table 7-22:

Table 7-22 – Line performance monitoring parameters

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
Near-end (xTU-C) performance monitoring ~~counters~~ parameters (current and previous 15-minute interval)					
FECS-L counter 15 minutes	7.2.1.1.1	R (M)	R (O)		
ES-L counter 15 minutes	7.2.1.1.2	R (M)	R (O)		R (O)
SES-L counter 15 minutes	7.2.1.1.3	R (M)	R (O)		R (O)
LOSS-L counter 15 minutes	7.2.1.1.4	R (M)	R (O)		
UAS-L counter 15 minutes	7.2.1.1.5	R (M)	R (O)		
"leftr" defect seconds counter 15 minutes	7.2.1.1.6	R (M)			

Table 7-22 – Line performance monitoring parameters

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
Error-free bits counter 15 minutes	7.2.1.1.7	R (M)			
MINEFTR 15 minutes	7.2.1.1.8	R (M)			
Near-end (xTU-C) performance monitoring ~~counters~~ parameters (current and previous 24-hour interval)					
FECS-L counter 24 hours	7.2.1.1.1	R (M)	R (O)		
ES-L counter 24 hours	7.2.1.1.2	R (M)	R (O)		R(O)
SES-L counter 24 hours	7.2.1.1.3	R (M)	R (O)		R(O)
LOSS-L counter 24 hours	7.2.1.1.4	R (M)	R (O)		
UAS-L counter 24 hours	7.2.1.1.5	R (M)	R (O)		
"leftr" defect seconds counter 24 hours	7.2.1.1.6	R (M)			
Error-free bits counter 24 hours	7.2.1.1.7	R (M)			
MINEFTR 24 hours	7.2.1.1.8	R (M)			
Far-end (xTU-R) performance monitoring ~~counters~~ parameters (current and previous 15-minute interval)					
FECS-LFE counter 15 minutes	7.2.1.2.1	R (M)		R (O)	
ES-LFE counter 15 minutes	7.2.1.2.2	R (M)		R (O)	R(O)
SES-LFE counter 15 minutes	7.2.1.2.3	R (M)		R (O)	R(O)
LOSS-LFE counter 15 minutes	7.2.1.2.4	R (M)		R (O)	
UAS-LFE counter 15 minutes	7.2.1.2.5	R (M)		R (O)	
"leftr" defect seconds counter 15 minutes	7.2.1.2.6	R (M)			
Error-free bits counter 15 minutes	7.2.1.2.7	R (M)			
MINEFTR 15 minutes	7.2.1.1.8	R (M)			
Far-end (xTU-R) performance monitoring ~~counters~~ parameters (current and previous 24-hour interval)					
FECS-LFE counter 24 hours	7.2.1.2.1	R (M)		R (O)	
ES-LFE counter 24 hours	7.2.1.2.2	R (M)		R (O)	R(O)
SES-LFE counter 24 hours	7.2.1.2.3	R (M)		R (O)	R(O)
LOSS-LFE counter 24 hours	7.2.1.2.4	R (M)		R (O)	
UAS-LFE counter 24 hours	7.2.1.2.5	R (M)		R (O)	
"leftr" defect seconds counter 24 hours	7.2.1.2.6	R (M)			
Error-free bits counter 24 hours	7.2.1.2.7	R (M)			
MINEFTR 24 hours	7.2.1.1.8	R (M)			
...					

Add the following row to Table 7-23:

Table 7-23 – 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	G.998.4
Near-end performance monitoring ~~counters~~ parameters (current and previous 15-minute interval)							
FECS-L counter 15 minutes	Y	Y	Y	Y	Y	Y	
ES-L counter 15 minutes	Y	Y	Y	Y	Y	Y	
SES-L counter 15 minutes	Y	Y	Y	Y	Y	Y	
LOSS-L counter 15 minutes	Y	Y	Y	Y	Y	Y	
UAS-L counter 15 minutes	Y	Y	Y	Y	Y	Y	
"leftr" defect seconds counter 15 minutes							Y
Error-free bits counter 15 minutes							Y
MINEFTR 15 minutes							Y
Near-end performance monitoring ~~counters~~ parameters (current and previous 24-hour interval)							
FECS-L counter 24 hours	Y	Y	Y	Y	Y	Y	
ES-L counter 24 hours	Y	Y	Y	Y	Y	Y	
SES-L counter 24 hours	Y	Y	Y	Y	Y	Y	
LOSS-L counter 24 hours	Y	Y	Y	Y	Y	Y	
UAS-L counter 24 hours	Y	Y	Y	Y	Y	Y	
"leftr" defect seconds counter 24 hours							Y
Error-free bits counter 24 hours							Y
MINEFTR 24 hours							Y
Far-end performance monitoring ~~counters~~ parameters (current and previous 15-minute interval)							
FECS-LFE counter 15 minutes	Y	Y	Y	Y	Y	Y	
ES-LFE counter 15 minutes	Y	Y	Y	Y	Y	Y	
SES-LFE counter 15 minutes	Y	Y	Y	Y	Y	Y	
LOSS-LFE counter 15 minutes	Y	Y	Y	Y	Y	Y	
UAS-LFE counter 15 minutes	Y	Y	Y	Y	Y	Y	
"leftr" defect seconds counter 15 minutes							Y
Error-free bits counter 15 minutes							Y

Table 7-23 – 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	G.998.4
MINEFTR 15 minutes							Y
Far-end performance monitoring ~~counters~~ parameters (current and previous 24-hour interval)							
FECS-LFE counter 24 hours	Y	Y	Y	Y	Y	Y	
ES-LFE counter 24 hours	Y	Y	Y	Y	Y	Y	
SES-LFE counter 24 hours	Y	Y	Y	Y	Y	Y	
LOSS-LFE counter 24 hours	Y	Y	Y	Y	Y	Y	
UAS-LFE counter 24 hours	Y	Y	Y	Y	Y	Y	
"leftr" defect seconds counter 24 hours							Y
Error-free bits counter 24 hours							Y
MINEFTR 24 hours							Y
...							

Add the following row to Table 7-28:

Table 7-28 – Line test, diagnostic and status parameters

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface	G-Interface
...						
Power management state	7.5.1.5	R (M)			R (O)	R (O)
RTX_USED_ds	7.5.1.38	R (M)				
RTX_USED_us	7.5.1.38	R (M)				
Initialization						
...						

Add the following rows to Table 7-29:

Table 7-29 – 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	G.998.4
...							
Power management state	Y	Y	Y	Y	Y	Y	
RTX_USED_ds							Y
RTX_USED_us							Y
Initialization							
...							

Add the following rows to Table 7-30:

Table 7-30 – Channel test, diagnostic and status parameters

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface	G-Interface
...						
INPREPORT	7.5.2.5	R (M)		R (O)	R (O)	R (O)
ACTNDR	7.5.2.8	R (M)		R (O)	R (O)	R (O)
ACTINP_REIN	7.5.2.9	R (M)		R (O)	R (O)	R (O)
Actual framer setting						
...						

Add the following rows to Table 7-31:

Table 7-31 – Support of channel 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	G.998.4
...							
INPREPORT						Y	
ACTNDR							Y
ACTINP_REIN							Y
Actual framer setting							
...							

3) Support of [ITU-T G.993.5]

Add clause 7.3.1.13 and subclauses as follows:

7.3.1.13 Line configuration parameters for [ITU-T G.993.5]

7.3.1.13.1 Vectoring frequency-band control upstream (VECTOR_BAND_CONTROLus)

This configuration parameter is an array of pairs of sub-carrier indices ($a(i)$, $b(i)$). Each pair specifies a frequency band starting from sub-carrier index $a(i)$ and ending at sub-carrier index $b(i)$ (including both start and end points) in which upstream FEXT cancellation for the line is not required. Up to 8 frequency bands may be configured. The same value of this parameter shall be set for all lines of the same vector group.

7.3.1.13.2 Vectoring frequency-band control downstream (VECTOR_BAND_CONTROLds)

This configuration parameter is an array of pairs of sub-carrier indices ($a(i)$, $b(i)$). Each pair specifies a frequency band starting from sub-carrier index $a(i)$ and ending at sub-carrier index $b(i)$ (including both start and end points) in which downstream FEXT cancellation for the line is not required. Up to 8 frequency bands may be configured. The same value of this parameter shall be set for all lines of the same vector group.

7.3.1.13.3 FEXT cancellation line priorities upstream (FEXT_CANCEL_PRIORITYus)

This parameter specifies line priority for the line in the vectored group in the upstream direction, as defined in [ITU-T G.993.5]. Two line priorities are defined as LOW and HIGH.

7.3.1.13.4 FEXT cancellation line priorities downstream (FEXT_CANCEL_PRIORITYds)

This parameter specifies line priority for the line in the vectored group in the downstream direction, as defined in [ITU-T G.993.5]. Two line priorities are defined as LOW and HIGH.

7.3.1.13.5 FEXT cancellation enabling/disabling upstream (FEXT_CANCEL_ENABLEus)

A value of 1 enables and a value of 0 disables FEXT cancellation in the upstream direction from all the other vectored lines into the line in the vectored group.

7.3.1.13.6 FEXT cancellation enabling/disabling downstream (FEXT_CANCEL_ENABLEds)

A value of 1 enables and a value of 0 disables FEXT cancellation in the downstream direction from all the other vectored lines into the line in the vectored group.

Add clause 7.3.2.19 and subclauses:

7.3.2.19 Channel configuration parameters for [ITU-T G.993.5]

7.3.2.19.1 Target net data rate (TARGET_NDR)

If retransmission is not used in a given transmit direction, this parameter specifies the target net data rate as defined in [ITU-T G.993.5] of the bearer channel.

The target net data rate is coded in steps of 1'000 bit/s.

7.3.2.19.2 Target expected throughput for retransmission (TARGET_ETR)

If retransmission is used in a given transmit direction, this parameter specifies the target expected throughput as defined in [ITU-T G.993.5] for the bearer channel.

The target expected throughput is coded in steps of 1'000 bit/s.

Add clause 7.4.13 and subclauses:

7.4.13 Inventory information for [ITU-T G.993.5]

7.4.13.1 VCE ID (VCE_ID)

For the line in a vectored group, the VCE ID uniquely identifies the VCE that manages and controls the vectored group to which the line belongs. It consists of one octet and valid ranges are from 1 to 255. A special value means the line is not in a vectored group.

7.4.13.2 VCE port index (VCE_port_index)

For the line in a vectored group, the VCE port index is the physical index that uniquely identifies the VCE port to which the line is connected. It is an integer from 1 to the maximum number of lines supported by the VCE.

NOTE – The combination of VCE ID and VCE port index creates a unique identifier for each vectored VTU-O/-R.

Add clause 7.5.1.38 and subclauses:

7.5.1.38 Test parameters for [ITU-T G.993.5]

7.5.1.38.1 FEXT coupling function downstream (XLOGds)

For each given VCE port index *j*, XLOGds is a one-dimensional array of real values in dB for downstream FEXT coupling coefficients over sub-carrier frequencies. For VCE port index *j*, XLOGds(*n* * XLOGGds * Δ*f*) is the downstream FEXT coupling coefficient originating from the loop connected to the VCE port *j* into the loop for which Xlog is being reported over the sub-carrier frequency *n* * XLOGGds * Δ*f*. The VCE port index varies from 1 to the maximum number of lines supported by the VCE. The format of XLOGds-(*n* * XLOGGds * Δ*f*) is defined in [ITU-T G.993.5].

7.5.1.38.2 Downstream XLOG subcarrier group size (XLOGGds)

This parameter is the number of subcarriers per group used to report XLOGds. The valid values are 1, 2, 4, and 8.

Add the following rows in Table 7-14:

Table 7-14 – Line configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
...					
ITU-T G.993.5 specific (Vectoring)					
Vectoring frequency-band control upstream (VECTOR_BAND_CONTROLus)	7.3.1.13.1	R/W (M)			
Vectoring frequency-band control downstream (VECTOR_BAND_CONTROLds)	7.3.1.13.2	R/W (M)			
FEXT cancellation line priorities upstream (FEXT_CANCEL_PRIORITYus)	7.3.1.13.3	R/W (O)			
FEXT cancellation line priorities downstream (FEXT_CANCEL_PRIORITYds)	7.3.1.13.4	R/W (O)			
FEXT cancellation enabling/disabling upstream (FEXT_CANCEL_ENABLEus)	7.3.1.13.5	R/W (M)			
FEXT cancellation enabling/disabling downstream (FEXT_CANCEL_ENABLEds)	7.3.1.13.6	R/W (M)			

Add the following rows in Table 7-15:

Table 7-15 – 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	G.993.5
...							
VECTOR_BAND_CONTROLus							Y
VECTOR_BAND_CONTROLds							Y
FEXT_CANCEL_PRIORITYus							Y
FEXT_CANCEL_PRIORITYds							Y
FEXT_CANCEL_ENABLEus							Y
FEXT_CANCEL_ENABLEds							Y

Add the following rows in Table 7-16:

Table 7-16 – Channel configuration profile

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
...					
ITU-T G.993.5 specific (Vectoring)					
Target net data rate (TARGET_NDR)	7.3.2.19.1	R/W (M)			
Target expected throughput (TARGET_ETR)	7.3.2.19.2	R/W (M)			

Add the following rows in Table 7-17:

Table 7-17 – 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	G.993.5
...							
ITU-T G.993.5 specific (Vectoring)							
TARGET_NDR							Y
TARGET_ETR							Y

Add the following rows in Table 7-20:

Table 7-20 – Line inventory

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface
...					
ITU-T G.993.5 specific (Vectoring)					
VCE ID (VCE_ID)	7.4.13.1	R (M)			
VCE port index (VCE_port_index)	7.4.13.2	R (M)			

Add the following rows in Table 7-21:

Table 7-21 – Support of line inventory information per Recommendation

Category/Element	G.992.1	G.992.2	G.992.3	G.992.4	G.992.5	G.993.2	G.993.5
...							
ITU-T G.993.5 specific (Vectoring)							
VCE_ID							Y
VCE_port_index							Y

Add the following rows to Table 7-28:

Table 7-28 – Line test, diagnostic and status parameters

Category/Element	Defined in:	Q-Interface	U-C Interface	U-R Interface	T-/S-Interface	G-Interface
...						
ITU-T G.993.5 specific (Vectoring)						
FEXT coupling function downstream (XLOGds)	7.5.1.38.1	R (M)				
Downstream XLOG subcarrier group size (XLOGGds)	7.5.1.38.2	R (M)				

Add the following rows to Table 7-29:

Table 7-29 – 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	G.993.5
...							
ITU-T G.993.5 specific (Vectoring)							
XLOGds							Y
XLOGGds							Y

4) Clause 2, References

Add the following ITU-T Recommendations to clause 2:

[ITU-T G.993.5] Recommendation ITU-T G.993.5 (2010), *Self-FEXT cancellation (vectoring) for use with VDSL2 transceivers*.

[ITU-T G.998.4] Recommendation ITU-T G.998.4 (2010), *Improved impulse noise protection for DSL transceivers*.

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