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G.998.4

Amendment 1

(06/2011)

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

Digital sections and digital line system – Access networks

Improved impulse noise protection for DSL transceivers

Amendment 1

Recommendation ITU-T G.998.4 (2010) – Amendment 1

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Recommendation ITU-T G.998.4

Improved impulse noise protection for DSL transceivers

Amendment 1

Summary

Amendment 1 to Recommendation ITU-T G.998.4 (2010) adds support for on-line reconfiguration (OLR), specifically bit swapping and seamless rate adaptation (SRA).

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.998.4	2010-06-11	15
1.1	ITU-T G.998.4 (2010) Cor. 1	2010-11-29	15
1.2	ITU-T G.998.4 (2010) Cor. 2	2011-04-13	15
1.3	ITU-T G.998.4 (2010) Amd. 1	2011-06-22	15

FOREWORD

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

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

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

NOTE

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

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, 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/.

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Recommendation ITU-T G.998.4

Improved impulse noise protection for DSL transceivers

Amendment 1

1) On-line Reconfiguration

Replace clause 13 with the following:

13 On-line reconfiguration (OLR)

Any on-line reconfiguration (OLR) that is not defined in the following subclauses is for further study.

13.1 Bit swapping

Bit swapping using Type 1 OLR overhead channel messages shall be as specified in the associated Recommendation: ITU-T G.992.3, ITU-T G.992.5 or ITU-T G.993.2.

13.2 Seamless rate adaptation (SRA)

SRA shall use modified type 5 OLR overhead channel messages as specified in the associated annex of Recommendation ITU-T G.998.4.

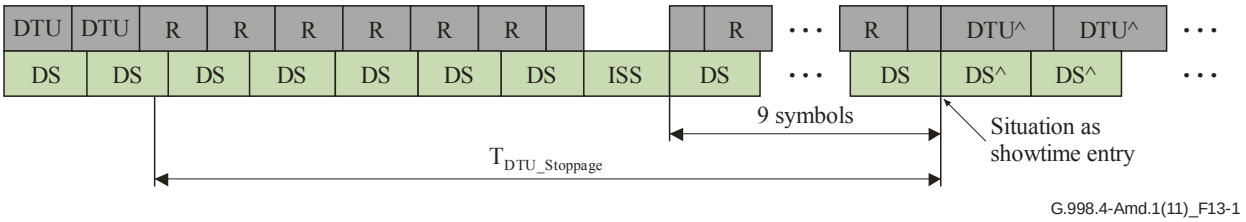
13.3 SOS

SOS shall use modified type 6 OLR overhead channel messages as specified in the associated annex of Recommendation ITU-T G.998.4.

NOTE – Type 6 is not supported in association with Recommendations ITU-T G.992.3 and ITU-T G.992.5.

13.4 Transition mechanism for Type 5 and Type 6 modified OLR commands

When the retransmission transmitter has received an SRA request via a type 5 OLR or an SOS request via type 6 OLR overhead channel message from the retransmission receiver, the procedure shall be as depicted in Figure 13-1 and further defined in this clause.



Stop of DTU framer

DS Data Symbol before SRA/SOS transition execution
ISS Inverted sync symbol at regular location of a sync symbol with respect to sync symbol period
DS^ Data symbol after SRA/SOS transition execution with applied new framing
DTU DTU before SRA/SOS transition
R DTU before SRA/SOS transition, transmitted from retransmission buffer
DTU^ DTU after SRA/SOS transition

Figure 13-1 – Transition mechanism to new OLR configuration parameters

The DTU framer shall stop for a period of time, $T_{dtu\text{-}stoppage}$, prior to ending the transmission of the transition primitive.

$T_{DTU\_Stoppage}$ shall be the greatest of the following durations:

– the minimum stoppage time required to satisfy the *INP_min* and *INP_min_rein* configurations; and

– the minimal delay as configured by *delay_min*.

NOTE – In case one uses the reference state machine in the transmitter, the minimum stoppage time required to satisfy the *INP_min* and *INP_min_rein* configuration is equal to $Nret*Q_{tx}*T_{DTU}$, where *Nret* is the smallest integer that meets the constraints specified in clause 9.5.

When the DTU framer is stopped, DTUs from the retransmission buffer shall be transferred to the retransmission multiplexer. In case a transmitter uses a transmit state machine other than the reference state machine, the transmitted DTUs during the stoppage time may include positively acknowledged DTUs.

Transition primitive is comprised of the inverted sync symbol, ISS marker, as defined within ITU-T G.992.3, ITU-T G.992.5, ITU-T G.993.2, followed by 9 transitory DMT symbols before transmission of data symbols with the new framing parameters is commenced.

The first DMT symbol after the transition primitive carries the first DTU with the changed framing. The alignment between start of DTU and start of DMT data symbol is identical to the alignment at ShowTime entry.

The absoluteDTUcounts shall be reset to 0 for the first DTU with the changed framing. The RRC in the reverse direction relative to the direction associated with the framing change shall be reset with the conditions specified in clause 8.4.1 when the first DTU with the changed framing is acknowledged.

2) On-line reconfiguration command

Add a new clause A.3.4 as follows:

A.3.4 On-line reconfiguration command

For the support of seamless rate adaptation with retransmission, an additional OLR request (Type 5) is defined. This OLR request shall replace the OLR request Type 02_{16} and the OLR request type 03_{16} of Table 9-7 of ITU-T G.992.3.

The format of the OLR Type 5 command transmitted by the initiating receiver is described in Table A.15. Upon reception of this command, the transceiver shall either trigger a reconfiguration of its transmitter as described in clause 13.2 or generate an OLR reply. The format of the OLR Type 5 command transmitted by the responding transmitter is described in Table A.16. The reason code is defined in clause 9.4.1.1 of ITU-T G.992.3. All reason codes are applicable to OLR Type 5.

In every OLR request of type 5, the new framer settings shall be selected such that all configuration constraints are met.

Table A.15 – Additional on-line reconfiguration commands transmitted by the initiating receiver

Message length (octets)	Element name (command)
$2 + 10 + 3 \times N_f$	05_{16} Request type 5 followed by: 2 octets containing the new L_1 value 1 octet containing the new B_{10} value 1 octet containing the new M_1 value 1 octet containing the new R_1 value 1 octet containing the new Q value 1 octet containing the new V value 1 octet containing the new Q_{tx} value 1 octet containing the new lb value 1 octet for the number of subcarriers N_f $3 \times N_f$ octets describing subcarrier parameter field for each subcarrier

Table A.16 – Additional on-line reconfiguration commands transmitted by the responding transmitter

Message length (octets)	Element name (command)
3	84_{16} Reject type 3 request followed by: 1 octet for reason code

3) Power management commands

Add a new clause A.3.5 as follows:

A.3.5 Power management commands (replaces clause 9.4.1.7 of ITU-T G.992.3)

For further study.

NOTE – The low power mode L2 in conjunction with ITU-T G.998.4 is not supported. So, L2 request should not be sent by the ATU-C when retransmission is enabled. Support of L2 in conjunction with ITU-T G.998.4, including improvements to the functionalities of the low power mode, is for further study.

4) Management plane procedures

Replace clause B.3 with the following:

B.3 Management plane procedures

Management plane procedures shall be as specified in clause A.3 except for clause A.3.4, which shall be replaced by the contents of clauses B.3.4 and B.3.5.

B.3.1 Intentionally left blank

B.3.2 Intentionally left blank

B.3.3 Intentionally left blank

B.3.4 On-line reconfiguration command

For the support of seamless rate adaptation with retransmission, an additional OLR request (Type 5) is defined. This OLR request shall replace the OLR request Type 02_{16} and the OLR request type 03_{16} of Table 9-7 of ITU-T G.992.5.

The format of the OLR Type 5 command transmitted by the initiating receiver is described in Table B.2. Upon reception of this command the transceiver shall either trigger a reconfiguration of its transmitter as described in clause 13.2 or generate an OLR reply. The format of the OLR Type 5 command transmitted by the responding transmitter is described in Table B.3. The reason code is defined in clause 9.4.1.1 of ITU-T G.992.3. All reason codes are applicable to OLR Type 5.

In every OLR request of type 5, the new framer settings shall be selected such that all configuration constraints are met.

Table B.2 – Additional on-line reconfiguration commands transmitted by the initiating receiver

Message length (octets)	Element name (command)
$2 + 11 + 4 \times N_f$	05_{16} Request type 5 followed by: 2 octets containing the new L_1 value 1 octet containing the new B_{10} value 1 octet containing the new M_1 value 1 octet containing the new R_1 value 1 octet containing the new Q value 1 octet containing the new V value 1 octet containing the new Q_{tx} value 1 octet containing the new lb value 2 octets for the number of subcarriers N_f $4 \times N_f$ octets describing subcarrier parameter field for each subcarrier

Table B.3 – Additional on-line reconfiguration commands transmitted by the responding transmitter

Message length (octets)	Element name (command)
3	84_{16} Reject type 3 request followed by: 1 octet for reason code

B.3.5 Power management commands (replaces clause 9.4.1.7 of ITU-T G.992.5)

For further study.

NOTE – The low power mode L2 in conjunction with ITU-T G.998.4 is not supported. So, L2 request should not be sent by the ATU-C when retransmission is enabled. Support of L2 in conjunction with ITU-T G.998.4, including improvements to the functionalities of the low power mode, is for further study.

5) O-PMS

In clause C.2.1.3, add the following two rows to the end of Table C.4:

7	Downstream OLR capabilities with ITU-T G.998.4	1 byte	Indicates support in the downstream direction for the various OLR mechanisms when retransmission is enabled in downstream.
8	Upstream OLR capabilities with ITU-T G.998.4	1 byte	Indicates support in the upstream direction for the various OLR mechanisms when retransmission is enabled in upstream.

In clause C.2.1.3, add the following text after the description of Field #6 "lb":

Field #7 "Downstream OLR capabilities with ITU-T G.998.4" indicates which of the various optional OLR mechanisms are supported by the VTU-O in the downstream direction when retransmission is enabled in downstream. The field is coded as [0000 00us], where:

– s=1 if OLR type 5 (SRA modified for ITU-T G.998.4) is supported and s=0 otherwise

– u=1 if OLR type 6 (SOS modified for ITU-T G.998.4) is supported and u=0 otherwise

Field #8 "Upstream OLR capabilities with ITU-T G.998.4" indicates which of the various optional OLR mechanisms are supported by the VTU-O in the upstream direction when retransmission is enabled in upstream. The field is coded as [0000 00us], where:

– s=1 if OLR type 5 (SRA modified for ITU-T G.998.4) is supported and s=0 otherwise

– u=1 if OLR type 6 (SOS modified for ITU-T G.998.4) is supported and u=0 otherwise

6) R-PMS

In clause C.2.2.2, add the following two rows to the end of Table C.6:

7	Downstream OLR capabilities with ITU-T G.998.4	1 byte	Indicates support in the downstream direction for the various OLR mechanisms when retransmission is enabled in downstream.
8	Upstream OLR capabilities with ITU-T G.998.4	1 byte	Indicates support in the upstream direction for the various OLR mechanisms when retransmission is enabled in upstream.

In clause C.2.2.2, add the following text after the description of Field #6 "lb":

Field #7 "Downstream OLR capabilities with ITU-T G.998.4" indicates which of the various optional OLR mechanisms are supported by the VTU-R in the downstream direction when retransmission is enabled in downstream. The field is coded as [0000 00us], where:

– s=1 if OLR type 5 (SRA modified for ITU-T G.998.4) is supported and s=0 otherwise

– u=1 if OLR type 6 (SOS modified for ITU-T G.998.4) is supported and u=0 otherwise

Field #8 "Upstream OLR capabilities with ITU-T G.998.4" indicates which of the various optional OLR mechanisms are supported by the VTU-R in the upstream direction when retransmission is enabled in upstream. The field is coded as [0000 00us], where:

– s=1 if OLR type 5 (SRA modified for ITU-T G.998.4) is supported and s=0 otherwise

– u=1 if OLR type 6 (SOS modified for ITU-T G.998.4) is supported and u=0 otherwise

7) On-line reconfiguration commands and responses

Add a new clause C.3.2 with the following contents:

C.3.2 On-line reconfiguration (OLR) commands and responses

ITU-T G.998.4 defines two new OLR commands for ITU-T G.993.2. These OLR commands shall replace the OLR Request Type 3 (SRA) and OLR Request type 4 (SOS) when retransmission is enabled. They are designated in ITU-T G.993.2 as OLR Request types 5 and 6 respectively and are fully defined below in Table C.11. In addition, two new OLR responses are defined, corresponding to OLR Request types 5 and 6. These messages are defined in Table C.12.

When SRA and retransmission are simultaneously enabled, the modems shall use OLR Request Type 5 to initiate an SRA request and OLR response Type 5 to reject an SRA request. When SOS and retransmission are simultaneously enabled, the modems shall use OLR Request Type 6 to initiate an SOS request and OLR response Type 6 to reject an SOS request.

The first byte of the eoc messages defined in Table C.11 and Table C.12 is the value of the OLR command type, as defined in clause 11.2.3.2 of ITU-T G.993.2. The eoc protocol is identical to the one specified in clause 11.2.3 of ITU-T G.993.2.

In every OLR request of type 5, the new framer settings shall be selected such that all configuration constraints are met as well as the maximum number of bytes reserved for the upstream and downstream transmitter retransmission queue as selected during initialization.

In every OLR request of type 6, the new framer settings shall be selected such that all configuration constraints, except those defined for SOS in ITU-T G.993.2, are met as well as the maximum number of bytes reserved for the upstream and downstream transmitter retransmission queues as selected during initialization.

Table C.11 – OLR commands sent by the initiating VTUName

	Length (octets)	**Octet number**	**Content**		**Support**
Request Type 5 (SRA/ ITU-T G.998.4)	14+4 N_f ($N_f \leq 128$)	2	08_{16}		Optional
		3-4	two octets containing the new value for L_1		
		5	one octet containing the new value for B_{10}		
		6	one octet containing the new value for M_1		
		7	one octet containing the new value for R_1		
		8	one octet containing the new value for Q		
		9	one octet containing the new value for V		
		10	one octet containing the new value for Q_{tx}		
		11	one octet containing the new value for *lb*		
		12 – 13	2 octets for the number of sub-carriers N_f to be modified		
		14 – 13+4 N_f	4 N_f octets describing the sub-carrier parameter field for each sub-carrier		
		14+4 N_f	1 octet for Segment Code (SC)		
Request Type 6 (SOS/ ITU-T G.998.4)	N_{TG}/2+12	2	09_{16}		Optional
		3	Message ID		
		4 to N_{TG}/2+3	$\Delta b(2)$	$\Delta b(1)$	
			$\Delta b(4)$	$\Delta b(3)$	
			…		
			$\Delta b(N_{TG})$	$\Delta b(N_{TG} - 1)$	
		N_{TG}/2+4 to N_{TG}/2+5	two octets containing the new value for L_1		

Table C.11 – OLR commands sent by the initiating VTUName

	Length (octets)	Octet number	Content	Support
		N_{TG}/2+6	one octet containing the new value for B_{10}	
		N_{TG}/2+7	one octet containing the new value for M_1	
		N_{TG}/2+8	one octet containing the new value for R_1	
		N_{TG}/2+9	one octet containing the new value for Q	
		N_{TG}/2+10	one octet containing the new value for V	
		N_{TG}/2+11	one octet containing the new value for Q_{tx}	
		N_{TG}/2+12	one octet containing the new value for lb	

Table C.12 – OLR responses sent by the responding VTU

Name	Length (octets)	Octet number	Content	Support
Reject Type 5 Request	3	2	85_{16} (Note)	Optional
		3	1 octet for reason code (Table 11-7)	
Reject Type 6 Request	3	2	86_{16} (Note)	Optional
		3	1 octet for reason code (Table 11-7)	
NOTE – All other values for octet number 2 are reserved by ITU-T.				

8) Timing of changes in control parameters

Add a new clause C.4 with the following contents:

C.4 Timing of changes in control parameters

This clause specifies the timing of changes for the parameters included in OLR types 5 and 6. The timing of the changes in the values of the various control parameters shall be done per the procedure defined in clause 13.2.

NOTE – After the change in RS and DTU parameters, DTUs that were encoded with the old parameter values can no longer be retransmitted. The modems should try to ensure that all DTUs that were encoded with the old framing parameters have been correctly received before the changes in framing parameters are executed. This may be done by temporarily interrupting the transmission of new DTUs over the α_1 interface and autonomously retransmitting only DTUs from the retransmission queue for a suitable period of time. This period of time shall not exceed $T_{DTU\text{-}Stoppage}$.

9) Multiplexing in support of ITU-T G.998.4 with ITU-T G.992.3

Add a new clause A.1.3 as follows:

A.1.3 Multiplexing

If the ROC is enabled then the RRC and L_0 (ROC) bits may share a common sub-carrier. The same SNR margin offset (SNRMOFFSET-ROC) shall be applied to the RRC and the L0 (ROC).

10) Multiplexing in support of ITU-T G.998.4 with ITU-T G.992.5

Add a new clause B.1.3 as follows:

B.1.3 Multiplexing

If the ROC is enabled then the RRC and L_0 (ROC) bits may share a common sub-carrier. The same SNR margin offset (SNRMOFFSET-ROC) shall be applied to the RRC and the L0 (ROC).

11) Multiplexing in support of ITU-T G.998.4 with ITU-T G.993.2

Add a new clause C.1.3 as follows:

C.1.3 Multiplexing

If the ROC is enabled then the RRC and L_0 (ROC) bits may share a common sub-carrier. The same SNR margin offset (SNRMOFFSET-ROC) shall be applied to the RRC and the L0 (ROC).

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