International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.998.4

Corrigendum 3

(12/2011)

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

Corrigendum 3

Recommendation ITU-T G.998.4 (2010) – Corrigendum 3

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Recommendation ITU-T G.998.4

Improved impulse noise protection for DSL transceivers

Corrigendum 3

Summary

Corrigendum 3 to Recommendation ITU-T G.998.4 (2010) covers the following functionalities:

– Correction to support of SRA/SOS OLR procedures (corrigendum to Amendment 1).

– Correction to memory requirements (corrigendum).

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
1.4	ITU-T G.998.4 (2010) Cor. 3	2011-12-16	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.

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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

Corrigendum 3

1) Correction to support of SRA/SOS OLR procedures (corrigendum)

1.1) New clause A.4

Add a new clause A.4, as follows:

A.4 OLR timing of changes in control parameters

This clause specifies the timing of changes for the parameters included in OLR type 5. The timing of the changes in the values of the various control parameters shall be done per the procedure defined in clause 13.

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 $T_{dtu\text{-}stoppage}$.

A change in the b_i and g_i values of one or more subcarriers is implemented by changing the corresponding PMD control parameter (see Table 8-4 of ITU-T G.992.3).

1.2) New clause B.4

Add a new clause B.4, as follows:

B.4 OLR timing of changes in control parameters

Timing of changes in control parameters shall be as specified in clause A.4.

1.3) New clause C.4

Change clause C.4, as follows:

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 13.4.

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 $T_{dtu\text{-}stoppage}$.

For all the used tones in an SOS tone group k, the same b_i reduction $\Delta b(k)$ is applied, except for tones that belong to the ROC. Specifically, the new $b_i'=b_i-\Delta b(k)$. If the new b_i' value is <2, it shall be set to 0. Thus, no new 1-bit loading will be created in SOS. If the resulting b_i' contains an odd number of 1-bit constellation points and trellis is enabled, the last (according to reordered tone ordering table) 1-bit constellation should be set to $b_i'=0$.

If SOS is supported, single step SOS is a mandatory capability. The VTU-O shall set O-MSG 1 field #14 and field #15 to 00_{16}. The VTU-R shall set R-MSG 2 field #5 and field #6 to 00_{16}. Execution of the SOS request in multiple steps is for further study.

After it has received an SOS request, the VTU shall respond within 200 ms with either a Syncflag or a reject type 6 invalid parameters response (see Table 11-7 of ITU-T G.993.2).

During the transition of OLR type 6 in a single step, bit errors may occur. Once the transition is completed, the VTU shall operate at a BER not exceeding the nominal BER, unless the line conditions do not allow it.

1.4) Add new clause C.3.3

Add a new clause C.3.3 and subclauses as follows:

C.3.3 OLR receiver initiated procedure

If a VTU receiver initiates a reconfiguration, it computes the necessary change in the related parameters (e.g., bits and gains table) and requests this change in the transmit PMD function of the VTU at the other end of the line. After it receives a positive acknowledgment, as specified in clause 11.2.3.3 of ITU-T G.993.2, the VTU shall change the relevant control parameters of its own receive PMD function and the PMS-TC function at the time specified in clause C.4.

A VTU receiver may initiate an OLR type 1 (Bit Swapping). A bit swap request shall change only the bits and gains table. It shall not modify the L value. Bit swapping reconfigurations involve changes of only the PMD sub-layer configuration parameters. They do not change the TPS-TC and PMS-TC sub-layer configuration parameters.

The transmit PMD function shall support bit swaps requested by the receive PMD function.

If OLR type 5 (SRA) is supported (in downstream or upstream direction, respectively), and enabled (through RA-MODE=3), a VTU receiver shall initiate an SRA when the conditions in clause C.3.3.1 or clause C.3.3.2 are satisfied.

If OLR type 5 (SRA) is supported (in downstream or upstream direction, respectively), and enabled (through RA-MODE=4), a VTU receiver shall initiate an SRA when the conditions in clause C.3.3.1, clause C.3.3.2, or clause C.3.3.3 are satisfied. A VTU receiver may initiate a SRA when the conditions in clause C.3.3.4 are satisfied.

If OLR type 6 (SOS) is supported (in downstream or upstream direction, respectively), and enabled (through RA-MODE=4), a VTU receiver shall initiate an SOS when the conditions in clause C.3.3.3 are satisfied.

A VTU receiver shall only send OLR request commands that meet all of following constraints:

- Impulse noise protection at least against a combined threat of worst-case REIN impulses as described by the CO MIB parameters INPmin_REIN and IAT_REIN_flag and of worst-case SHINE impulses as described by the CO MIB parameter INPmin.
- Minimum delay ≤ Delay ≤ Maximum delay.

A VTU receiver shall only send SOS requests that meet the following constraint:

- Expected throughput (*ETR*) ≥ Minimum SOS net data rate (MIN-SOS-BR) for the bearer channel.

NOTE 1 – Due to framing parameter range constraints it may not be possible to decrease ETR down to MIN-SOS-BR.

NOTE 2 – An SOS request could result in a message overhead data rate that is temporarily below the configured minimum message overhead data rate. This will be corrected by a subsequent SRA procedure. See clause 13.4.3.3 of ITU-T G.993.2.

A VTU receiver shall only send SRA requests that meet the following constraints:

- *ETR_max* ≥ *ETR* ≥ *ETR_min* for the bearer channel, unless the actual net data rate is below the minimum net data rate as a result of an SOS procedure. In that case, SRA is only allowed to ask for rate increases, but the requested *ETR* is allowed to be below *ETR_min* .
- Message overhead data rate ≥ Minimum message overhead data rate.

C.3.3.1 Receiver Initiated SRA downshift procedure

See clause 13.4.1 of ITU-T G.993.2.

C.3.3.2 Receiver initiated SRA upshift procedure

See clause 13.4.2 of ITU-T G.993.2.

C.3.3.3 Receiver initiated SOS

See clause 13.4.3 of ITU-T G.993.2.

C.3.3.4 Receiver Initiated SRA following an SOS procedure

A VTU shall send one or more SRA requests following an SOS procedure to remediate the situation in which the current *ETR* is less than *ETR_min*. As long as the current *ETR* is less than *ETR_min*, these SRA requests are not required to respect either RA-UTIME or RA-USNRM.

NOTE – Although these SRA requests can be issued at the discretion of the VTU, the NOTE in clause 13.1 of ITU-T G.993.2 defines a goal for the overall duration of the SOS procedure.

2) Correction to memory requirements (corrigendum)

2.1) Clause C.1.1

Change clause C.1.1 as follows:

C.1.1 Memory

The following definitions shall apply:

$$\text{delay\_octet}_{DS,0} = (D_{DS,0} - 1) \times (I_{DS,0} - 1)$$

$$\text{delay\_octet}_{US,0} = (D_{US,0} - 1) \times (I_{US,0} - 1).$$

If retransmission is enabled in the downstream direction,

then $\text{delay\_octet}_{DS,1} = 2 \times Q_{tx,DS} \times Q_{DS} \times H_{DS}$

otherwise $\text{delay\_octet}_{DS,1} = (D_{DS,1} - 1) \times (I_{DS,1} - 1)$

If retransmission is enabled in the upstream direction,

then $\text{delay\_octet}_{US,1} = 2 \times Q_{tx,US} \times Q_{US} \times H_{US}$

otherwise $\text{delay\_octet}_{DS,1} = (D_{US,1} - 1) \times (I_{US,1} - 1)$

The following constraint shall apply:

$$\text{delay\_octet}_{DS,0} + \text{delay\_octet}_{DS,1} + \text{delay\_octet}_{US,0} + \text{delay\_octet}_{US,1} \leq \text{MAXDELAYOCTET},$$

where MAXDELAYOCTET is the parameter "aggregate interleaver and de-interleaver delay", in octets, specified in Table 6-1 of ITU-T G.993.2 for the profile.

The VTU-O and VTU-R shall support all values of ($\text{delay\_octet}_{DS,0}$ + $\text{delay\_octet}_{DS,1}$ + $\text{delay\_octet}_{US,0}$ + $\text{delay\_octet}_{US,1}$) up to the maximum of MAXDELAYOCTET. The minimum amount of memory required in a transceiver (VTU-O or VTU-R) to meet this requirement is MAXDELAYOCTET/2 octets. The actual amount of memory used is implementation specific.

~~If retransmission is enabled in both downstream and upstream directions, the sum of the memory sizes of the DS and US transmit retransmission queues is limited to the maximum available interleaving memory at one side defined for the profile in use (*MAXDELAYOCTET*) minus the memory needed at one side for the latency path carrying the overhead channel. The memory is constrained by the formula:~~

~~$$Q_{tx,US} \times Q_{US} \times H_{US} + Q_{tx,DS} \times Q_{DS} \times H_{DS} \leq (MAXDELAYOCTET - MemOH)/2$$~~

~~where *MemOH* is the interleaver-deinterleaver delay in bytes of the latency path carrying the overhead channel.~~

~~The VTU-O shall support downstream and the VTU-R shall support upstream transmit retransmission queue sizes up to the maximum of the constraint given above.~~

~~If the retransmission is enabled only in one direction, the sum of the memory used for the transmit queue and the memory use for the interleaver in the reverse direction is limited to the maximum available interleaving memory at one side defined for the profile in use minus the memory needed at one side for the latency path carrying the overhead channel.~~

~~If retransmission is enabled only in DS, the memory is constrained by the formula:~~

~~$$(D_{p,US}^{-1}) \times (N_{p,US}^{-1})/2 + Q_{tx,DS} \times Q_{DS} \times H_{DS} \leq (MAXDELAYOCTET - MemOH)/2$$~~

~~The VTU-O shall support downstream transmit retransmission queue sizes and the VTU-R shall support upstream interleaver delay up to the maximum of the constraint given above.~~

~~If retransmission is enabled only in US, the memory is constrained by the formula:~~

~~$$(D_{p,DS}^{-1}) \times (N_{p,DS}^{-1})/2 + {}^{Qtx,US} \times QUS \times H_{US} \leq (MAXDELAYOCTET - MemOH)/2$$~~

~~The VTU-O shall support downstream interleaver delay and the VTU-R shall support upstream transmit retransmission queue sizes up to the maximum of the constraint given above.~~

The minimum memory for the receiver retransmission queue shall be identical to the amount of the memory for the related transmit queue of the same direction.

The maximal DTU size in octets ($Q \times H$) shall be equal to the value given in Table C.1 depending on the profile and direction.

Table C.1 – Maximal DTU size

Profile	**Maximal DTU size ($Q \times H$)**	
	Downstream	Upstream
8a,8b,8c,8d	2048 bytes	512 bytes
12a	2048 bytes	1536 bytes
17a	3072 bytes	1536 bytes
30a	3072 bytes	3072 bytes

The MAXDELAYOCTET-split (MDOSPLIT) configuration parameter shall be applied in ITU-T G.998.4. With delay_octet$_{x,p}$ (with x = DS or US and p = 0 or 1) as defined in this clause, the sum of the max_delay_octet values specified in O-PMS (see clause C.2.1.3) shall be limited to (see clause 11.4.2.7 of ITU-T G.993.2):

max_delay_octetDS,0 + max_delay_octetDS,1 ≤ MAXDELAYOCTETS_DS

max_delay_octet$_{US,0}$ + max_delay_octet$_{US,1}$ ≤ MAXDELAYOCTETS_US

2.2) Clause C.2.1.3

Change clause C.2.1.3 as follows:

C.2.1.3 O-PMS

. . .

When retransmission is enabled in the upstream direction, the remaining parameter values exchanged in O-PMS shall keep their original meaning (as defined in ITU-T G.993.2), with the following exceptions:

– The fields *F*, *I* and *D* of the of the latency path #1 shall be set to 0 and ignored by the receiver.

– The field max_delay_octet$_{US,0}$ shall specify~~indicate~~ the maximal value of delay_octet$_{US,0}$ (defined in clause C.1.1)~~number of octets allocated to the de-interleaver in the latency path #0~~.

– The field max_delay_octet$_{US,1}$ shall specify~~indicate~~ the maximum value of delay_octet$_{US,1}$ (defined in clause C.1.1),~~maximal number of octets allocated to the upstream receive retransmission queue~~ specified in bytes as an unsigned integer.

When retransmission is enabled in the downstream direction, the remaining parameter values exchanged in O-PMS shall keep their original meaning (as defined in ITU-T G.993.2), with the following exceptions:

– The field max_delay_octet$_{DS,0}$ shall specify~~ies~~ the maximum value of delay_octet$_{DS,0}$ (defined in clause C.1.1)~~interleaver delay that the VTU-R shall be allowed to use to de-interleave the data stream in downstream latency path #0~~.

– The field max_delay_octet$_{DS,1}$ shall specify~~indicate~~ the maximum value of delay_octet$_{DS,1}$ (defined in clause C.1.1),~~maximal number of octets allocated to the downstream transmit retransmission queue~~ specified in bytes as an unsigned integer. If ~~max_delay_octet$_{DS,1}$~~ the value of this field is set to the special value FFFFFF$_{16}$, the field "max_delay_octet$_{DS,0}$" shall indicate the maximum value of (delay_octet$_{DS,0}$ + delay_octet$_{DS,1}$) and the VTU-R shall autonomously partition the number of octets between both downstream latency paths.~~contain the sum of the number of octets allocated to the interleaver of the overhead channel and to the downstream transmit retransmission queue. The split of number of octets between the interleaver and the queue is left to the VTU-R.~~

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Printed in Switzerland
Geneva, 2012