

International Telecommunication Union

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**G.994.1**  
**Amendment 3**  
(03/2009)

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

Digital sections and digital line system – Access networks

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Handshake procedures for digital subscriber line  
(DSL) transceivers

**Amendment 3**

Recommendation ITU-T G.994.1 (2007) –  
Amendment 3



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# **Recommendation ITU-T G.994.1**

## **Handshake procedures for digital subscriber line (DSL) transceivers**

### **Amendment 3**

#### **Summary**

Amendment 3 to Recommendation ITU-T G.994.1 contains:

- New codepoints for the support of optional interleaver depth in upstream in G.992.3 and G.992.5.
- New codepoints for the support of erasure decoding in G.992.3 Annex C and G.992.5 Annex C.
- New codepoints for the support of virtual noise in G.992.3 Annex C and G.992.5 Annex C.

#### **Source**

Amendment 3 to Recommendation ITU-T G.994.1 (2007) was approved on 22 March 2009 by ITU-T Study Group 15 (2009-2012) under Recommendation ITU-T A.8 procedure.

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# Recommendation ITU-T G.994.1

## Handshake procedures for digital subscriber line (DSL) transceivers

### Amendment 3

- 1) New codepoints for support of optional interleaver depth in the upstream latency path #0 of G.992.3 and G.992.5

Add following tables.

**Table 11.30.20.2 – Standard information field – G.992.3 Annexes A/L upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

		Bits						
8	7	6	5	4	3	2	1	
x	x			x	x	x	x	<b>G.992.3 Annexes A/L upstream PMS-TC latency path #0 NPar(3)s – Octet 3</b>
x	x	x	x					$D_0$ max value supported, $D_0 = n*4+8$ , $n=2, 6, 14$
								0 – max $D_0$ value for D equal to power of 2-values
								Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.32.20.2 – Standard information field – G.992.3 Annex B upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

		Bits						
8	7	6	5	4	3	2	1	
x	x			x	x	x	x	<b>G.992.3 Annex B upstream PMS-TC latency path #0 NPar(3)s – Octet 3</b>
x	x	x	x					$D_0$ max value supported, $D_0 = n*4+8$ , $n=2, 6, 14$
								0 – max $D_0$ value for D equal to power of 2-values
								Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.34.20.2 – Standard information field – G.992.3 Annex I upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

		Bits						
8	7	6	5	4	3	2	1	
x	x			x	x	x	x	<b>G.992.3 Annex I upstream PMS-TC latency path #0 NPar(3)s – Octet 3</b>
x	x	x	x					$D_0$ max value supported, $D_0 = n*4+8$ , $n=2, 6, 14$
								0 – max $D_0$ value for D equal to power of 2-values
								Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.36.20.2 – Standard information field – G.992.3 Annex J upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

		Bits						
8	7	6	5	4	3	2	1	
x	x			x	x	x	x	<b>G.992.3 Annex J upstream PMS-TC latency path #0 NPar(3)s – Octet 3</b>
x	x	x	x					$D_0$ max value supported, $D_0 = n*4+8$ , $n=2, 6, 14$
								0 – max $D_0$ value for D equal to power of 2-values
								Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.42.20.2 – Standard information field – G.992.3 Annex C  
upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

8		7		6		5		4		3		2		1	
x	x														
x	x	x	x												

**G.992.3 Annex C upstream PMS-TC latency path #0 NPar(3)s – Octet 3**

$D_0$  max value supported,  $D_0 = n*4+8$ ,  $n=2, 6, 14$   
 0 – max  $D_0$  value for D equal to power of 2-values  
 Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.44.20.2 – Standard information field – G.992.5 Annex A  
upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

8		7		6		5		4		3		2		1	
x	x														
x	x	x	x												

**G.992.5 Annex A upstream PMS-TC latency path #0 NPar(3)s – Octet 3**

$D_0$  max value supported,  $D_0 = n*4+8$ ,  $n=2, 6, 14$   
 0 – max  $D_0$  value for D equal to power of 2-values  
 Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.46.20.2 – Standard information field – G.992.5 Annex B  
upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

8		7		6		5		4		3		2		1	
x	x														
x	x	x	x												

**G.992.5 Annex B upstream PMS-TC latency path #0 NPar(3)s – Octet 3**

$D_0$  max value supported,  $D_0 = n*4+8$ ,  $n=2, 6, 14$   
 0 – max  $D_0$  value for D equal to power of 2-values  
 Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.48.20.2 – Standard information field – G.992.5 Annex I  
upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

8		7		6		5		4		3		2		1	
x	x														
x	x	x	x												

**G.992.5 Annex I upstream PMS-TC latency path #0 NPar(3)s – Octet 3**

$D_0$  max value supported,  $D_0 = n*4+8$ ,  $n=2, 6, 14$   
 0 – max  $D_0$  value for D equal to power of 2-values  
 Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.50.20.2 – Standard information field – G.992.3 Annex M  
upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

8		7		6		5		4		3		2		1	
x	x														
x	x	x	x												

**G.992.3 Annex M upstream PMS-TC latency path #0 NPar(3)s – Octet 3**

$D_0$  max value supported,  $D_0 = n*4+8$ ,  $n=2, 6, 14$   
 0 – max  $D_0$  value for D equal to power of 2-values  
 Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.52.20.2 – Standard information field – G.992.5 Annex J  
upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

		Bits						
8	7	6	5	4	3	2	1	
x	x			x	x	x	x	G.992.5 Annex J upstream PMS-TC latency path #0 NPar(3)s – Octet 3
x	x	x	x					D <sub>0</sub> max value supported, D <sub>0</sub> = n*4+8, n=2, 6, 14
								0 – max D <sub>0</sub> value for D equal to power of 2-values
								Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.58.20.2 – Standard information field – G.992.5 Annex M  
upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

		Bits						
8	7	6	5	4	3	2	1	
x	x			x	x	x	x	G.992.5 Annex M upstream PMS-TC latency path #0 NPar(3)s – Octet 3
x	x	x	x					D <sub>0</sub> max value supported, D <sub>0</sub> = n*4+8, n=2, 6, 14
								0 – max D <sub>0</sub> value for D equal to power of 2-values
								Coding 1, 2 and 3 Reserved for allocation by ITU-T

**Table 11.66.20.2 – Standard information field – G.992.5 Annex C  
upstream PMS-TC latency path #0 NPar(3) coding – Octet 3**

		Bits						
8	7	6	5	4	3	2	1	
x	x			x	x	x	x	G.992.5 Annex C upstream PMS-TC latency path #0 NPar(3)s – Octet 3
x	x	x	x					D <sub>0</sub> max value supported, D <sub>0</sub> = n*4+8, n=2, 6, 14
								0 – max D <sub>0</sub> value for D equal to power of 2-values
								Coding 1, 2 and 3 Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	No parameters in this octet

- 2) New codepoints for the support of erasure decoding in G.992.3 Annex C and G.992.5 Annex C

Replace Table 11.41 with:

**Table 11.41 – Standard information field – G.992.3 Annex C NPar(2) coding – Octet 1**

		Bits						
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	G.992.3 Annex C NPar(2)s – Octet 1
x	x	x	x	x	x	1	x	NTR
x	x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	x	Diagnostics mode
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	Reserved for allocation by ITU-T
								No parameters in this octet

Add Table 11.41.2 after Table 11.41.1

**Table 11.41.2 – Standard information field – G.992.3  
Annex C NPar(2) coding – Octet 3**

		Bits						
8	7	6	5	4	3	2	1	G.992.3 Annex C NPar(2)s – Octet 3
x	x	x	x	x	x	x	1	Erasure decoding reporting
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	No parameters in this octet

Replace Tables 11.42.15.7, 11.42.27.7, 11.42.39.7, and 11.42.51.7 with:

**Table 11.42.15.7 – Standard information field – G.992.3 Annex C  
downstream ATM TPS-TC #0 NPar(3) coding – Octet 8**

		Bits						
8	7	6	5	4	3	2	1	G.992.3 Annex C downstream ATM TPS-TC #0 NPar(3)s – Octet 8
x	x					x	x	Error_max (Maximum bit error ratio)
x	x			x	x			INP_min (Minimum impulse noise protection) (bits 2 and 1)
x	x		x					INP_no_erasure_not_required
x	x	x						IMA_flag

**Table 11.42.27.7 – Standard information field – G.992.3 Annex C  
downstream ATM TPS-TC #1 NPar(3) coding – Octet 8**

		Bits						
8	7	6	5	4	3	2	1	G.992.3 Annex C downstream ATM TPS-TC #1 NPar(3)s – Octet 8
x	x					x	x	Error_max (Maximum bit error ratio)
x	x			x	x			INP_min (Minimum impulse noise protection) (bits 2 and 1)
x	x		x					INP_no_erasure_not_required
x	x	x						IMA_flag

**Table 11.42.39.7 – Standard information field – G.992.3 Annex C  
downstream ATM TPS-TC #2 NPar(3) coding – Octet 8**

		Bits						
8	7	6	5	4	3	2	1	G.992.3 Annex C downstream ATM TPS-TC #2 NPar(3)s – Octet 8
x	x					x	x	Error_max (Maximum bit error ratio)
x	x			x	x			INP_min (Minimum impulse noise protection) (bits 2 and 1)
x	x		x					INP_no_erasure_not_required
x	x	x						IMA_flag

**Table 11.42.51.7 – Standard information field – G.992.3 Annex C downstream ATM TPS-TC #3 NPar(3) coding – Octet 8**

		Bits						
8	7	6	5	4	3	2	1	G.992.3 Annex C downstream ATM TPS-TC #3 NPar(3)s – Octet 8
x	x					x	x	Error_max (Maximum bit error ratio)
x	x			x	x			INP_min (Minimum impulse noise protection) (bits 2 and 1)
x	x		x					INP_no_erasure_not_required
x	x	x						IMA_flag

Replace Table 11.65 with:

**Table 11.65 – Standard information field – G.992.5 Annex C NPar(2) coding – Octet 1**

		Bits						
8	7	6	5	4	3	2	1	G.992.5 Annex C NPar(2)s – Octet 1
x	x	x	x	x	x	x	1	NTR
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	x	1	x	x	Diagnostics mode
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	No parameters in this octet

Add Table 11.65.1 after Table 11.65

**Table 11.65.1 – Standard information field – G.992.5 Annex C NPar(2) coding – Octet 2**

		Bits						
8	7	6	5	4	3	2	1	G.992.5 Annex C NPar(2)s – Octet 2
x	x	x	x	x	x	x	1	Erasure decoding reporting
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	No parameters in this octet

Replace Tables 11.66.15.7, 11.66.27.7, 11.66.39.7, and 11.66.51.7 with:

**Table 11.66.15.7 – Standard information field – G.992.5 Annex C downstream ATM TPS-TC #0 NPar(3) coding – Octet 8**

		Bits						
8	7	6	5	4	3	2	1	G.992.5 Annex C downstream ATM TPS-TC #0 NPar(3)s – Octet 8
x	x					x	x	Error_max (Maximum bit error ratio)
x	x			x	x			INP_min (Minimum impulse noise protection) (bits 2 and 1)
x	x		x					INP_no_erasure_not_required
x	x	x						IMA_flag

**Table 11.66.27.7 – Standard information field – G.992.5 Annex C  
downstream ATM TPS-TC #1 NPar(3) coding – Octet 8**

		Bits						
8	7	6	5	4	3	2	1	
x	x					x	x	Error_max (Maximum bit error ratio)
x	x			x	x			INP_min (Minimum impulse noise protection) (bits 2 and 1)
x	x		x					INP_no_erasure_not_required
x	x	x						IMA_flag

**Table 11.66.39.7 – Standard information field – G.992.5 Annex C  
downstream ATM TPS-TC #2 NPar(3) coding – Octet 8**

		Bits						
8	7	6	5	4	3	2	1	
x	x					x	x	Error_max (Maximum bit error ratio)
x	x			x	x			INP_min (Minimum impulse noise protection) (bits 2 and 1)
x	x		x					INP_no_erasure_not_required
x	x	x						IMA_flag

**Table 11.66.51.7 – Standard information field – G.992.5 Annex C  
downstream ATM TPS-TC #3 NPar(3) coding – Octet 8**

		Bits						
8	7	6	5	4	3	2	1	
x	x					x	x	Error_max (Maximum bit error ratio)
x	x			x	x			INP_min (Minimum impulse noise protection) (bits 2 and 1)
x	x		x					INP_no_erasure_not_required
x	x	x						IMA_flag

- 3) New codepoints for the support of virtual noise in G.992.3 Annex C and G.992.5 Annex C.  
*Replace Table 11.41 with:*

**Table 11.41 – Standard information field – G.992.3 Annex C NPar(2) coding – Octet 1**

		Bits						
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	NTR
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	x	1	x	x	Diagnostics mode
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Support of downstream virtual noise
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	No parameters in this octet

Replace Table 11.42.0.1 with:

**Table 11.42.0.1 – Standard information field – G.992.3 Annex C SPar(2) coding – Octet 2**

		Bits							
8	7	6	5	4	3	2	1	G.992.3 Annex C SPar(2)s – Octet 2	
x	x	x	x	x	x	x	1	Downstream overhead data rate	
x	x	x	x	x	x	1	x	Upstream overhead data rate	
x	x	x	x	x	1	x	x	Maximum number of downstream TPS-TC functions of each type	
x	x	x	x	1	x	x	x	Maximum number of upstream TPS-TC functions of each type	
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T	
x	x	1	x	x	x	x	x	Number of breakpoints for downstream virtual noise PSD ( <i>NBPs</i> )	
x	x	0	0	0	0	0	0	No parameters in this octet	

Add Table 11.42.12

**Table 11.42.12 – Standard information field – G.992.3 Annex C number of breakpoints for downstream virtual noise PSD NPar(3) coding – Octet 1**

		Bits						G.992.3 Annex C number of breakpoints for downstream virtual noise PSD NPar(3)s – Octet 1	
8	7	6	5	4	3	2	1		
x	x		x	x	x	x	x	<i>NBPs</i> (coded in bits 1 to 5)	
x	x	x						Reserved for allocation by ITU-T	

Replace Table 11.65 with:

**Table 11.65 – Standard information field – G.992.5 Annex C NPar(2) coding – Octet 1**

		Bits						G.992.5 Annex C NPar(2)s – Octet 1	
8	7	6	5	4	3	2	1		
x	x	x	x	x	x	x	1	NTR	
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T	
x	x	x	x	x	1	x	x	Diagnostics mode	
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T	
x	x	x	1	x	x	x	x	Support of downstream virtual noise	
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T	
x	x	0	0	0	0	0	0	No parameters in this octet	

Replace Table 11.66.0.1 with:

**Table 11.66.0.1 – Standard information field – G.992.5  
Annex C SPar(2) coding – Octet 2**

		Bits						G.992.5 Annex C SPar(2)s – Octet 2
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Downstream overhead data rate
x	x	x	x	x	x	1	x	Upstream overhead data rate
x	x	x	x	x	1	x	x	Maximum number of downstream TPS-TC functions of each type
x	x	x	x	1	x	x	x	Maximum number of upstream TPS-TC functions of each type
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Number of breakpoints for downstream virtual noise PSD ( <i>NBPds</i> )
x	x	0	0	0	0	0	0	No parameters in this octet

Add Table 11.66.12

**Table 11.66.12 – Standard information field – G.992.5 Annex C  
number of breakpoints for downstream virtual noise PSD NPar(3) coding – Octet 1**

		Bits						G.992.5 Annex C number of breakpoints for downstream virtual noise PSD NPar(3)s – Octet 1
8	7	6	5	4	3	2	1	
x	x		x	x	x	x	x	<i>NBPds</i> (coded in bits 1 to 5)
x	x	x						Reserved for allocation by ITU-T



## SERIES OF ITU-T RECOMMENDATIONS

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