

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.994.1

Amendment 4

(12/2014)

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

Digital sections and digital line system – Metallic access
networks

Handshake procedures for digital subscriber line
transceivers

**Amendment 4 – Additional codepoints for the
support of ITU-T G.9701**

Recommendation ITU-T G.994.1 (2012) –
Amendment 4

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For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T G.994.1

Handshake procedures for digital subscriber line transceivers

Amendment 4

Additional codepoints for the support of ITU-T G.9701

Summary

Amendment 4 to Recommendation ITU-T G.994.1 (2012) covers the following functionalities:

- Additional codepoints for the support of ITU-T G.9701.
- Mandatory tone sets for ITU-T G.9701.

History

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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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Recommendation ITU-T G.994.1

Handshake procedures for digital subscriber line transceivers:

Amendment 4

Additional codepoints for the support of ITU-T G.9701

1) Clause 6.1, Description of signals

Modify clause 6.1 as follows:

6.1 Description of signals

The signalling families used in this Recommendation, and the carrier sets defined within each family, are described in this clause.

Each xDSL mode of operation has a mandatory carrier set associated with it. For each xDSL mode of operation implemented by an ITU-T G.994.1 station, the initial ITU-T G.994.1 transmission from the station shall include the associated mandatory carrier set for that mode.

NOTE 1 – In the interest of explicitly indicating the presence of HSTU-x that might not have common modes, the initial transmission should use as many carriers as possible, and HSTU-x are encouraged to detect all carriers from all signalling families.

Both duplex and half-duplex transmission modes are defined for use within this Recommendation. The transmission mode supported is a function of carrier set and is specified in Tables 1 and 3.

In some jurisdictions it may be necessary to shape the power of the downstream and upstream carriers in order to be compliant with PSD masks enforced by regulation. Implementations shall shape the power of the carriers, or disabled carriers as appropriate, to meet in-force regulations or codes of conduct in the jurisdiction where they are deployed.

Frequencies other than those specified in Tables 1 and 3 shall not be transmitted simultaneously with ITU-T G.994.1 signals.

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2) Clause 6.1.1, 4.3125 kHz signalling family

To add tone set for ITU-T G.9701, modify Table 2 as follows:

Table 2 – Mandatory carrier sets

xDSL Recommendation(s)	Carrier set designation(s)
ITU-T G.992.1 – Annex A, ITU-T G.992.2 – Annexes A/B, ITU-T G.992.3 – Annexes A/I/L, ITU-T G.992.4 – Annexes A/I, ITU-T G.992.5 – Annexes A/I ITU-T G.993.2 where support of a profile requiring US0 (Note 4) ITU-T G.993.2 with support of Annex B bandplan HPE17 or HPE30	A43

Table 2 – Mandatory carrier sets

xDSL Recommendation(s)	Carrier set designation(s)
ITU-T G.992.5 – Annexes A/I (Note 1), ITU-T G.992.5 – Annexes J/M (Note 2) ITU-T G.993.2 where support of a profile requiring US0 (Notes 1, 4)	A43c
ITU-T G.992.1 – Annex B, ITU-T G.992.3 – Annex B, ITU-T G.992.5 – Annex B ITU-T G.993.2 where support of a profile requiring US0 (Note 4)	B43
ITU-T G.992.5 – Annex B (Note 3)	B43c
ITU-T G.992.1 – Annexes C/H/I, ITU-T G.992.2 – Annex C, ITU-T G.992.3 – Annex C, ITU-T G.992.5 – Annex C ITU-T G.993.2 where support of a profile requiring US0 (Note 4)	C43
ITU-T G.992.3 – Annexes J/M, ITU-T G.992.5 – Annexes J/M	J43 (Note 6)
ITU-T G.993.1 – Using multi-carrier modulation (except Annex C) ITU-T G.993.2 where support of a profile not requiring US0	V43
ITU-T G.993.1 – Annex C using multi-carrier modulation over POTS	V43P
ITU-T G.993.1 – Annex C using multi-carrier modulation over ISDN-BA	V43I
ITU-T G.993.1 – Using single-carrier modulation over POTS	V43P-S
ITU-T G.993.1 – Using single-carrier modulation over ISDN-BA	V43I-S
ITU-T G.993.1 – Using single-carrier modulation over TCM-ISDN	V43-S
ITU-T G.9701 (AB43)	A43,B43
ITU-T G.9701 (AA43c)	A43,A43c
NOTE 1 – To be used where spectrum management forbids use of the downstream carrier set A43, typically where ITU-T G.992.5 or ITU-T G.993.2 is deployed from a cabinet. NOTE 2 – To be used where spectrum management forbids use of the downstream carrier set J43, typically where ITU-T G.992.5 is deployed from a cabinet. NOTE 3 – To be used where spectrum management forbids use of the downstream carrier set B43, typically where ITU-T G.992.5 is deployed from a cabinet. NOTE 4 – At least one of the carrier sets A43, B43, and C43 shall be transmitted, depending on the US0 band supported. NOTE 5 – If multimode operation is supported, the HSTU shall transmit the carrier sets corresponding to all enabled modes simultaneously. NOTE 6 – If ITU-T G.992.3 or ITU-T G.992.5 Annex B is also supported by the HSTU-R, the upstream carrier set J43 shall be optional and it should not be transmitted as it can interfere with ISDN present on the same line. In this case the carrier set B43 shall be transmitted. In previous versions of Recommendation ITU-T G.994.1, the J43 carrier set was mandatory. Therefore, HSTU-C implementing a previous version of Recommendation ITU-T G.994.1 may not respond appropriately.	

3) Clause 9.4, Standard information field (S)

For additional codepoints for the support of ITU-T G.9701, modify Table 11.0.4 as follows:

Table 11.0.4 – Standard information field – SPar(1) coding – Octet 5

Bits								SPar(1)s – Octet 5
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	ITU-T G.992.5 – Annex M
x	x	x	x	x	x	1	x	ITU-T G.993.1/ANSI T1.424
x	x	x	x	x	1	x	x	ITU-T G.993.1 – Annex I/T1E1 TRQ 12
x	x	x	x	1	x	x	x	Variable silence period (Note)
x	x	x	1	x	x	x	x	ITU-T G.992.5 Annex C
x	x	1	x	x	x	x	x	ITU-T G.993.2
x	1	x	x	x	x	x	x	ITU-T G.9701
x	0	0	0	0	0	0	0	No parameters in this octet

NOTE – Setting the bit to binary ONE in an MS message requests a silence period of 10-640 seconds long, as specified by the variable silence period length field. The station that has invoked the silence period by transmitting MS may terminate the silence period prior to the requested length, by restarting the handshake session (sending activation tones).

4) New clause 9.4.35

Add clause 9.4.35:

9.4.35 ITU-T G.9701 Par(2)/Par(3) parameters

Table 11.69 – Standard information field – ITU-T G.9701 NPar(2) coding – Octet 1

Bits								ITU-T G.9701 NPar(2)s – Octet 1
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Reserved for allocation by ITU-T
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	x	1	x	x	Support of special probe sequence
x	x	x	x	1	x	x	x	Default CE length
x	x	x	1	x	x	x	x	Default number of symbol periods in TDD frame.
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

Table 11.70 – Standard information field – ITU-T G.9701 SPar(2) coding – Octet 1

		Bits						ITU-T G.9701 SPar(2)s – Octet 1
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Profiles
x	x	x	x	x	x	1	x	Downstream Transmission band
x	x	x	x	x	1	x	x	Number of downstream symbol positions in TDD frame
x	x	x	x	1	x	x	x	RFI bands (Note)
x	x	x	1	x	x	x	x	Duration of Channel Discovery 1-1
x	x	1	x	x	x	x	x	CE lengths
x	x	0	0	0	0	0	0	No parameters in this octet

NOTE – The length of the corresponding NPar(3) field is variable and is a multiple of 4 octets (see Table 11.70.4). The length depends on the total number of bands "j" to be specified. "j" is the band index (starting from 1).

Table 11.70.0.1 – Standard information field – ITU-T G.9701 SPar(2) coding – Octet 2

		Bits						ITU-T G.9701 SPar(2)s – Octet 2
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Number of symbol periods in TDD frame
x	x	x	x	x	x	1	x	International amateur radio bands
x	x	x	x	x	1	x	x	Scrambler seed
x	x	x	x	1	x	x	x	Special probe sequence (Note 1)
x	x	x	1	x	x	x	x	IDS (Note 2)
x	x	1	x	x	x	x	x	Number of SOC symbol repetitions (R_s)
x	x	0	0	0	0	0	0	No parameters in this octet

NOTE 1 – The length of the corresponding NPar(3) field is variable (see Table 11.70.10). The length is 3 octets if the number of elements of the special probe sequence (N) is smaller or equal to 3; the length is 4 octets if $N \leq 8$; the length is $4 + \left\lceil \frac{N-8}{6} \right\rceil$ octets if $N > 8$.

NOTE 2 – The length of the corresponding NPar(3) field is variable (see Table 11.70.11). The length is $\left\lceil \frac{L}{6} \right\rceil$ where L is the length of the IDS.

Table 11.70.0.2 – Standard information field – ITU-T G.9701 SPar(2) coding – Octet 3

		Bits						ITU-T G.9701 SPar(2)s – Octet 2
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Number of DS initialization data symbols (s_{ds})
x	x	x	x	x	x	1	x	Downstream RMC offset
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

**Table 11.70.1 – Standard information field – ITU-T G.9701
profiles NPar(3) coding – Octet 1**

Bits								ITU-T G.9701 profiles NPar(3)s – Octet 1
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Profile 106-MHz
x	x	x	x	x	x	1	x	Profile 212-MHz
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

**Table 11.70.2.0 – Standard information field – ITU-T G.9701 downstream transmission
band NPar(3) coding – Octet 1**

Bits								ITU-T G.9701 transmission band NPar(3)s
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	x	Stop sub-carrier index (bits 12 to 7)

**Table 11.70.2.1 – Standard information field – ITU-T G.9701
downstream transmission band NPar(3) coding – Octet 2**

Bits								ITU-T G.9701 transmission band NPar(3)s
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	x	Stop sub-carrier index (bits 6 to 1)

**Table 11.70.2.2 – Standard information field – ITU-T G.9701
downstream transmission band NPar(3) coding – Octet 3**

Bits								ITU-T G.9701 transmission band NPar(3)s
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	x	Start sub-carrier index (bits 12 to 7)

**Table 11.70.2.3 – Standard information field – ITU-T G.9701
downstream transmission band NPar(3) coding – Octet 4**

Bits								ITU-T G.9701 transmission band NPar(3)s
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	x	Start sub-carrier index (bits 6 to 1)

Table 11.70.3 – Standard information field – ITU-T G.9701
Number of downstream symbol positions in TDD frame NPar(3) coding – Octet 1

Bits							ITU-T G.9701 Number of downstream symbol positions in TDD frame NPar(3)s
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	M_{ds} value

Table 11.70.4.4j-4 – Standard information field – ITU-T G.9701
RFI bands NPar(3) coding – Octet 4j – 3 (j = 1 to 16)

Bits							ITU-T G.9701 RFI bands NPar(3)s – Octet 4j – 3 (j = 1 to 16)
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	End sub-carrier index of band j (bits 12 to 7)

Table 11.70.4.4j-3 – Standard information field – ITU-T G.9701
RFI bands NPar(3) coding – Octet 4j – 2 (j = 1 to 16)

Bits							ITU-T G.9701 RFI bands NPar(3)s – Octet 4j – 2 (j = 1 to 16)
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	End sub-carrier index of band j (bits 6 to 1)

Table 11.70.4.4j-2 – Standard information field – ITU-T G.9701
RFI bands NPar(3) coding – Octet 4j – 1 (j = 1 to 16)

Bits							ITU-T G.9701 RFI bands NPar(3)s – Octet 4j – 1 (j = 1 to 16)
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	Start sub-carrier index of band j (bits 12 to 7)

Table 11.70.4.4j-1 – Standard information field – ITU-T G.9701
RFI bands NPar(3) coding – Octet 4j (j = 1 to 16)

Bits							ITU-T G.9701 RFI bands NPar(3)s – Octet 4j (j = 1 to 16)
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	Start sub-carrier index of band j (bits 6 to 1)

Table 11.70.5 – Standard information field – ITU-T G.9701
Duration of Channel Discovery 1-1 NPar(3) coding – Octet 1

Bits							ITU-T G.9701 duration of Channel Discovery 1-1 NPar(3)s – Octet 1
8	7	6	5	4	3	2 1	
x	x	0	0	x	x	x	Duration of Channel Discovery 1-1 coded as $(i+1) \times 8192$ symbols

**Table 11.70.6 – Standard information field – ITU-T G.9701
CE length NPar(3) coding – Octet 1**

Bits							ITU-T G.9701 CE length NPar(3)s – Octet 1
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	1	Length of CE ($m = 4$)
x	x	x	x	x	1	x	Length of CE ($m = 8$)
x	x	x	x	1	x	x	Length of CE ($m = 12$)
x	x	x	1	x	x	x	Length of CE ($m = 14$)
x	x	x	1	x	x	x	Length of CE ($m = 16$)
x	x	1	x	x	x	x	Length of CE ($m = 20$)
x	x	0	0	0	0	0	No parameters in this octet

**Table 11.70.6.1 – Standard information field – ITU-T G.9701
CE length NPar(3) coding – Octet 2**

Bits							ITU-T G.9701 CE length NPar(3)s – Octet 2
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	1	Length of CE ($m = 24$)
x	x	x	x	x	1	x	Length of CE ($m = 30$)
x	x	x	x	1	x	x	Length of CE ($m = 33$)
x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	No parameters in this octet

**Table 11.70.7 – Standard information field – ITU-T G.9701
Number of symbol periods in TDD frame NPar(3) coding – Octet 1**

Bits							ITU-T G.9701 number of symbol periods in TDD frame NPar(3)s – Octet 1
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	1	$M_F = 23$
x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	No parameters in this octet

**Table 11.70.8 – Standard information field – ITU-T G.9701
International amateur radio bands NPar(3) coding – Octet 1**

		Bits						
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	International amateur radio band 1800-2000 kHz
x	x	x	x	x	x	1	x	International amateur radio band 3500-4000 kHz
x	x	x	x	x	1	x	x	International amateur radio band 7000-7300 kHz
x	x	x	x	1	x	x	x	International amateur radio band 10100-10150 kHz
x	x	x	1	x	x	x	x	International amateur radio band 14000-14350 kHz
x	x	1	x	x	x	x	x	International amateur radio band 18068-18168 kHz
x	x	0	0	0	0	0	0	No parameters in this octet

**Table 11.70.8.1 – Standard information field – ITU-T G.9701
International amateur radio bands NPar(3) coding – Octet 2**

		Bits						
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	International amateur radio band 21000-21450 kHz
x	x	x	x	x	x	1	x	International amateur radio band 24890-24990 kHz
x	x	x	x	x	1	x	x	International amateur radio band 28000-29700 kHz
x	x	x	x	1	x	x	x	International amateur radio band 50000-54000 kHz
x	x	x	1	x	x	x	x	International amateur radio band 70000-70500 kHz
x	x	1	x	x	x	x	x	International amateur radio band 144000-148000 kHz
x	x	0	0	0	0	0	0	No parameters in this octet

**Table 11.70.9 – Standard information field – ITU-T G.9701
scrambler seed NPar(3) coding – Octet 1**

		Bits						
8	7	6	5	4	3	2	1	
x	x	0	x	x	x	x	x	ITU-T G.9701 scrambler seed NPar(3)s – Octet 1 Scrambler seed (bits d_{11} to d_7)

**Table 11.70.9.1 – Standard information field – ITU-T G.9701
scrambler seed NPar(3) coding – Octet 2**

		Bits						
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	x	ITU-T G.9701 scrambler seed NPar(3)s – Octet 2 Scrambler seed (bits d_6 to d_1)

**Table 11.70.10 – Standard information field – ITU-T G.9701
Special probe sequence NPar(3) coding – Octet 1**

		Bits						
8	7	6	5	4	3	2	1	
x	x	0	0	0	0	x	x	ITU-T G.9701 Special probe sequence NPar(3)s – Octet 1 Length of the probe sequence (bits 8 to 7)

**Table 11.70.10.1 – Standard information field – ITU-T G.9701
Special probe sequence NPar(3) coding – Octet 2**

Bits							ITU-T G.9701 Special probe sequence NPar(3)s – Octet 2
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	

Length of the probe sequence (bits 6 to 1)

**Table 11.70.10.2 – Standard information field – ITU-T G.9701
Special probe sequence NPar(3) coding – Octet 3**

Bits							ITU-T G.9701 Special probe sequence NPar(3)s – Octet 3
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	

Probe sequence elements (with index 2 to 0)

**Table 11.70.10.3 – Standard information field – ITU-T G.9701
Special probe sequence NPar(3) coding – Octet 4**

Bits							ITU-T G.9701 Special probe sequence NPar(3)s – Octet 4
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	

Probe sequence elements (with index 7 to 3)

**Table 11.70.10.(3+j) – Standard information field – ITU-T G.9701
Special probe sequence NPar(3) coding – Octet 4 + j (j=1 to 20)**

Bits							ITU-T G.9701 Special probe sequence NPar(3)s – Octet 4
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	

Probe sequence elements (with index (6j+7) to (6j+2))

**Table 11.70.11 – Standard information field – ITU-T G.9701
IDS NPar(3) coding – Octet 1**

Bits							ITU-T G.9701 IDS NPar(3)s – Octet 1
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	

Length of the IDS (bits 6 to 1)

**Table 11.70.11.j – Standard information field – ITU-T G.9701
IDS NPar(3) coding – Octet 1 + j (with j=1 to 6)**

Bits							ITU-T G.9701 IDS NPar(3)s – Octet 1+j
8	7	6	5	4	3	2 1	
x	x	x	x	x	x	x	

IDS (bits (6j) to (6j-5))

**Table 11.70.12 – Standard information field – ITU-T G.9701
Number of SOC symbol repetitions NPar(3) coding – Octet 1**

Bits							ITU-T G.9701 number of SOC repetitions NPar(3)s – Octet 1
8	7	6	5	4	3	2 1	
x	x	0	x	x	x	x x	Number of SOC symbol repetitions (R_{ds}) (bits 5 to 1)

**Table 11.70.13 – Standard information field – ITU-T G.9701
Number DS initialization data symbols NPar(3) coding – Octet 1**

Bits							ITU-T G.9701 number DS data symbols during initialization NPar(3)s – Octet 1
8	7	6	5	4	3	2 1	
x	x	0	x	x	x	x x	Number of data symbols (s_{ds}) during initialization 1 (bits 5 to 1, coded as $s_{ds}-1$)

**Table 11.70.14 – Standard information field – ITU-T G.9701
Downstream RMC offset NPar(3) coding – Octet 1**

Bits							ITU-T G.9701 Downstream RMC offset NPar(3)s – Octet 1
8	7	6	5	4	3	2 1	
x	x	0	x	x	x	x x	Number of offset symbols ($D_{RMC,ds}$) (bits 5 to 1 coded as $D_{RMC,ds}-1$)

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