International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.994.1

Amendment 5

(04/2010)

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Digital sections and digital line system – Access networks

Handshake procedures for digital subscriber line (DSL) transceivers

Amendment 5: Mandatory tone set for HPE17 and HPE30, and codepoints in support of Recommendations ITU-T G.993.5 and ITU-T G.998.4

Recommendation ITU-T G.994.1 (2007) – Amendment 5

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Recommendation ITU-T G.994.1

Handshake procedures for digital subscriber line (DSL) transceivers

Amendment 5

Mandatory tone set for HPE17 and HPE30, and codepoints in support of Recommendations ITU-T G.993.5 and ITU-T G.998.4

Summary

Amendment 5 to Recommendation ITU-T G.994.1 (2007) contains:

– The mandatory tone set for the HPE17 and HPE30 bandplan.

– Additional codepoints for the support of Recommendations ITU-T G.998.4 and ITU-T G.993.5.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.994.1	1999-07-02	15
1.1	ITU-T G.994.1 (1999) Cor. 1	2000-04-04	15
2.0	ITU-T G.994.1	2001-02-09	15
3.0	ITU-T G.994.1	2002-07-29	15
4.0	ITU-T G.994.1	2003-05-22	15
4.1	ITU-T G.994.1 (2003) Amend. 1	2004-02-22	15
4.2	ITU-T G.994.1 (2003) Amend. 2	2004-06-13	15
4.3	ITU-T G.994.1 (2003) Amend. 3	2005-01-13	15
4.4	ITU-T G.994.1 (2003) Amend. 4	2006-01-13	15
5.0	ITU-T G.994.1	2007-02-13	15
5.1	ITU-T G.994.1 (2007) Amend. 1	2007-11-22	15
5.2	ITU-T G.994.1 (2007) Amend. 2	2008-04-13	15
5.3	ITU-T G.994.1 (2007) Amend. 3	2009-03-22	15
5.4	ITU-T G.994.1 (2007) Amend. 4	2009-06-29	15
5.5	ITU-T G.994.1 (2007) Amend. 5	2010-04-22	15

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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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/.

Recommendation ITU-T G.994.1

Handshake procedures for digital subscriber line (DSL) transceivers

Amendment 5

Mandatory tone set for HPE17 and HPE30, and codepoints in support of Recommendations ITU-T G.993.5 and ITU-T G.998.4

1) Mandatory tone set for HPE17 and HPE30

Modify clause 6.1.1 as follows:

6.1.1 4.3125 kHz signalling family

Carrier frequencies within this signalling family are given by N × 4.3125 kHz, where N is a positive integer. The symbol rate shall be 4312.5/8 ≡ 539.0625 symbols per second.

Within this family, there are several upstream carrier sets, designated A43, B43, C43, J43, V43 and their variants. Each upstream carrier set has an associated downstream carrier set that carries the same designation. The carrier set frequencies and the maximum transmit power level per carrier for each carrier set are defined in Table 1 where frequency = N × 4.3125 kHz.

The carrier sets in this family are mandatory for the xDSL modes listed in Table 2. One or more carriers listed in Tables 1 or 3 may be transmitted in addition to the mandatory carrier set listed in Table 2. Carriers not listed in Tables 1 or 3 shall not be transmitted.

Table 1 – Carrier sets for the 4.3125 kHz signalling family

Carrier set designation	Upstream carrier sets		Downstream carrier sets		Transmission mode
	Frequency indices (N)	Maximum power level/carrier (dBm)	Frequency indices (N)	Maximum power level/carrier (dBm)	
A43 (Notes 1, 3, 4, 5)	9, 17, 25	–1.65	40, 56, 64	–3.65	Duplex only
A43c (Notes 1, 3, 4)	9, 17, 25	–1.65	257, 293, 337	–3.65	Duplex only
B43	37, 45, 53	–1.65	72, 88, 96	–3.65	Duplex only
B43c (Note 1)	37, 45, 53	–1.65	257, 293, 337	–3.65	Duplex only
C43	7, 9	–1.65	12, 14, 64	–3.65	Duplex only
J43	9, 17, 25	–1.65	72, 88, 96	–3.65	Duplex only
V43 (Notes 1, 2)	944, 972, 999	–16.65	257, 383, 511	–3.65	Duplex only
V43P (Note 1)	9, 17, 25	–1.65	257, 383, 511	–3.65	Duplex only
V43I (Note 1)	37, 45, 53	–1.65	257, 383, 511	–3.65	Duplex only

Table 1 – Carrier sets for the 4.3125 kHz signalling family

Carrier set designation	Upstream carrier sets		Downstream carrier sets		Transmission mode
	Frequency indices (N)	Maximum power level/carrier (dBm)	Frequency indices (N)	Maximum power level/carrier (dBm)	
V43-S (Notes 1, 2)	944, 999	–16.65	257, 383	–3.65	Duplex only
V43P-S (Note 1)	17, 25	–1.65	257, 383	–3.65	Duplex only
V43I-S (Note 1)	45, 53	–1.65	257, 383	–3.65	Duplex only

NOTE 1 – In some jurisdictions, it may be necessary to limit the maximum downstream power level, for example –23.65 dBm/carrier where the PSD is limited to –60 dBm/Hz.

NOTE 2 – It is expected that sufficient power back-off is applied to the upstream carriers of short lines to avoid excessive crosstalk into adjacent pairs during ITU-T G.994.1.

NOTE 3 – In some jurisdictions, it may be necessary to shape the power of the downstream carriers in order to be compliant with PSD masks enforced by regulation.

NOTE 4 – In some jurisdictions, it may be necessary to send either A43 or A43C carrier sets, or both simultaneously, with appropriate shaping, leaving the receiver to select which carrier set to use.

NOTE 5 – If the bandplan HPE17 or HPE30 is supported, the maximum power level of the subcarriers of the carrier set is reduced. Power level for downstream sub-carrier indices 40, 56, and 64 shall be less than –20.65 dBm, –27.95 dBm, and –30.85 dBm respectively. Power level for upstream sub-carriers indices 9, 17 and 25 shall be less than –3.65 dBm, –17.35 dBm, and –11.7 dBm respectively.

Table 2 – Mandatory carrier sets

xDSL Recommendation(s)	Carrier set designation
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
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

Table 2 – Mandatory carrier sets

xDSL Recommendation(s)	Carrier set designation
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

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 ITU-T G.994.1, the J43 carrier set was mandatory. Therefore, HSTU-C implementing a previous version of ITU-T G.994.1 may not respond appropriately.

2) Addition of codepoints for ITU-T G.993.5

Change existing Table 11.68.0.1 to:

Table 11.68.0.1 – Standard information field – ITU-T G.993.2 SPar(2) coding – Octet 2

Bits								ITU-T G.993.2 SPar(2)s – Octet 2
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Annex A US0
x	x	x	x	x	x	1	x	Annex B US0
x	x	x	x	x	1	x	x	Annex C US0
x	x	x	x	1	x	x	x	ITU-T G.993.5
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 new Table 11.68.10 as follows:

Table 11.68.10 – Standard information field – ITU-T G.993.2 ITU-T G.993.5 NPar(3) coding Octet 1

Bits								ITU-T G.993.2 Vectoring NPar(3)s – Octet 1
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Downstream vectoring
x	x	x	x	x	x	1	x	Upstream vectoring
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

3) Addition of codepoints for ITU-T G.998.4

Modify Table 11.x.0.3 with x=30,32,34,36,44,46,48,50,52,58 *as follows:*

Table 11.x.0.3 – Standard information field – ITU-T G.992.3/5 Annex XXX SPar(2) coding – Octet 4

Bits								ITU-T G.992.3/5 Annex XXX SPar(2)s – Octet 4
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	Downstream PMS-TC latency path #0 supported
x	x	x	x	x	x	1	x	Upstream PMS-TC latency path #0 supported
x	x	x	x	x	1	x	x	Downstream ATM TPS-TC #0 RETX
x	x	x	x	1	x	x	x	Downstream PTM TPS-TC #0 RETX
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 Tables 11.x.57 and 11.x.58 for the set x=*30,32,34,36,44,46,48,50,52,58 *as follows:*

Table 11.x.57 – Standard information field – ITU-T G.992.3/5 Annex XXX downstream ATM TPS-TC #0 RTX NPar(3) coding

Bits							ITU-T G.992.3/5 Annex XXX downstream ATM TPS-TC #0 RTX NPar(3)
8	7	6	5	4	3	2	1	
x	x						x	Reserved for allocation by ITU-T
x	x					x		Reserved for allocation by ITU-T
x	x				x			Reserved for allocation by ITU-T
x	x			x				Reserved for allocation by ITU-T
x	x		x					Reserved for allocation by ITU-T
x	x	x						Reserved for allocation by ITU-T

Table 11.x.58 – Standard information field – ITU-T G.992.3/5 Annex XXX downstream PTM TPS-TC #0 RTX NPar(3) coding

Bits							ITU-T G.992.3/5 Annex XXX downstream PTM TPS-TC #0 RTX NPar(3)
8	7	6	5	4	3	2	1	
x	x						x	64/65-octet encapsulation with short packets
x	x					x		64/65-octet encapsulation with pre-emption
x	x				x			Reserved for allocation by ITU-T
x	x			x				Reserved for allocation by ITU-T
x	x		x					Reserved for allocation by ITU-T
x	x	x						Reserved for allocation by ITU-T

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