International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.994.1

Amendment 8

(04/2017)

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

Digital sections and digital line system – Metallic access networks

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Handshake procedures for digital subscriber line transceivers

Amendment 8

Recommendation ITU-T G.994.1 (2012) – Amendment 8

International Telecommunication Union

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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 8

Summary

Amendment 8 to Recommendation ITU-T G.994.1 (2012) includes:

– New handshake carrier set (F43) for the support of G.9701 over coaxial cable

– Add codepoints for the support of Annex X of [ITU-T G.9701]

– Add codepoints for profiles 106c and 212c of [ITU-T G.9701]

– Add codepoint for additional international amateur radio band.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.994.1	1999-07-02	15	11.1002/1000/4720
1.1	ITU-T G.994.1 (1999) Cor. 1	2000-04-04	15	11.1002/1000/5139
2.0	ITU-T G.994.1	2001-02-09	15	11.1002/1000/5364
3.0	ITU-T G.994.1	2002-07-29	15	11.1002/1000/6119
4.0	ITU-T G.994.1	2003-05-22	15	11.1002/1000/6281
4.1	ITU-T G.994.1 (2003) Amd. 1	2004-02-22	15	11.1002/1000/7080
4.2	ITU-T G.994.1 (2003) Amd. 2	2004-06-13	15	11.1002/1000/7351
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5.2	ITU-T G.994.1 (2007) Amd. 2	2008-04-13	15	11.1002/1000/9388
5.3	ITU-T G.994.1 (2007) Amd. 3	2009-03-22	15	11.1002/1000/9675
5.4	ITU-T G.994.1 (2007) Amd. 4	2009-06-29	15	11.1002/1000/9891
5.5	ITU-T G.994.1 (2007) Amd. 5	2010-04-22	15	11.1002/1000/10415
5.6	ITU-T G.994.1 (2007) Amd. 6	2010-11-29	15	11.1002/1000/11018
5.7	ITU-T G.994.1 (2007) Amd. 7	2011-04-13	15	11.1002/1000/11129
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5.9	ITU-T G.994.1 (2007) Amd. 8	2011-12-16	15	11.1002/1000/11416
6.0	ITU-T G.994.1	2012-06-13	15	11.1002/1000/11644
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6.2	ITU-T G.994.1 (2012) Amd. 2	2013-08-29	15	11.1002/1000/11994
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6.5	ITU-T G.994.1 (2012) Amd. 5	2015-02-13	15	11.1002/1000/12373
6.6	ITU-T G.994.1 (2012) Amd. 6	2015-08-29	15	11.1002/1000/12564
6.7	ITU-T G.994.1 (2012) Amd. 7	2016-06-13	15	11.1002/1000/12797
6.8	ITU-T G.994.1 (2012) Cor. 1	2016-10-29	15	11.1002/1000/13063
6.9	ITU-T G.994.1 (2012) Amd. 8	2017-04-06	15	11.1002/1000/13062

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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 transceivers

Amendment 8

1) New handshake carrier set (F43) for the support of G.9701 over coaxial cable

Modify Table 1 as follows:

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~~)	9; 17; 25	–1.65	40; 56; 64	–3.65	Duplex only
A43c (Notes 1, 3)	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
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
F43 (Note 4)	4176; 4224; 4272	–28.65	4368; 4440; 4488	–28.65	Duplex only

Table 1 – Carrier sets for the 4.3125 kHz signalling family

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 send either A43 or A43C carrier sets, or both simultaneously, with appropriate shaping, leaving the receiver to select which carrier set to use. ~~NOTE 4 – 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.~~ NOTE 4 – This carrier set shall only be used in the coax environment.

2) 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
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

Table 2 – Mandatory carrier sets

xDSL Recommendation(s)	Carrier set designation(s)
ITU-T G.9701 (AB43)	A43,B43
ITU-T G.9701 (AA43c)	A43,A43c
ITU-T G.9701 Annex X with operation over coax	F43
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) Add codepoints for the support of Annex X of [ITU-T G.9701]

Modify Table 11.69 as follows:

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	Annex X operation (Operation in a crosstalk-free environment)~~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

4) Modify Table 11.70.0.2 as follows

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 3
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	CD timeout
x	x	x	x	1	x	x	x	Minimum number of symbols between Downstream RMC to Upstream RMC (min_DRMCds2us)~~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

5) Add Table 11.70.16

Table 11.70.16 – Standard information field – ITU-T G.9701 min_DRMCds2us NPar(3) coding – Octet 1

Bits								ITU-T G.9701 min_DRMCds2us NPar(3)s – Octet 1
8	7	6	5	4	3	2	1	
x	x	0	0	0	x	x	x	Minimum number of symbols between Downstream RMC to Upstream RMC (min_DRMCds2us) (bits 3 to 1). Valid values are 4 and 5.

6) Add codepoints for profiles 106c and 212c of [ITU-T G.9701]

Modify Table 11.70.1 as follows:

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 106a
x	x	x	x	x	x	1	x	Profile 212a
x	x	x	x	x	1	x	x	Profile 106b
x	x	x	x	1	x	x	x	~~Reserved for allocation by ITU-T~~Profile 106c
x	x	x	1	x	x	x	x	~~Reserved for allocation by ITU-T~~Profile 212c
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

7) Add codepoint for additional international amateur radio band

Modify Table 11.70.8.1

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

Bits								ITU-T G.9701 International amateur radio bands NPar(3)s – Octet 2
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 ~~7000069900~~-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

8) Add Table 11.70.8.2

Table 11.70.8.2 – Standard information field – ITU-T G.9701 International amateur radio bands NPar(3) coding – Octet 3

Bits								ITU-T G.9701 International amateur radio bands NPar(3)s – Octet 3
8	7	6	5	4	3	2	1	
x	x	x	x	x	x	x	1	International amateur radio band 5351.5-5366.5 kHz
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

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