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G.983.3

Amendment 1
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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

Digital sections and digital line system – Optical line
systems for local and access networks

A broadband optical access system with increased
service capability by wavelength allocation

Amendment 1

ITU-T Recommendation G.983.3 (2001) – Amendment 1

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ITU-T Recommendation G.983.3

A broadband optical access system with increased service capability by wavelength allocation

Amendment 1

Summary

ITU-T Rec. G.983.1 on "Broadband optical access systems based on passive optical networks (PON)" describes systems with transmission rates of 155.52 or 622.08 Mbit/s downstream and 155.52 Mbit/s upstream. G.983.1 Amendment 1 allows enhancement to include 622.08 Mbit/s upstream. ITU-T Rec. G.983.3 which describes "Broadband Passive Optical Network (B-PON) systems with increased service capability by wavelength allocation" could not take account of Amendment 1/G.983.1. This Amendment describes modifications to the requirements for isolation and return loss in G.983.3 made necessary because of the power budget changes needed for 622.08 Mbit/s upstream rate.

Source

Amendment 1 to ITU-T Recommendation G.983.3 was prepared by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 June 2002.

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.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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ITU-T Recommendation G.983.3

A broadband optical access system with increased service capability by wavelength allocation

AMENDMENT 1

1) Introduction

This amendment describes modifications to the requirements for isolation and return loss in ITU-T Rec. G.983.3 to align with ITU-T Rec. G.983.1 Amendment 1 on 622.08 Mbit/s upstream bit rate operation.

2) Modifications to ITU-T Rec. G.983.3

2.1) Scope

All words of "G.983.1" in Scope should be replaced by "G.983.1 and G.983.1 Amendment 1".

2.2) References

Change the reference [2] as follows:

[2] ITU-T Recommendation G.983.1 (1998), *Broadband optical access systems based on Passive Optical Networks (PON)*. Also refer to the Corrigendum 1 (July, 1999) and Amendment 1 (Nov., 2001).

2.3) Clause 8.3.1

The list of options in 8.3.1 should be updated to include the following items:

- Option 1: Symmetric 155.52 Mbit/s.
- Option 2: Asymmetric 155.52 Mbit/s upstream / 622.08 Mbit/s downstream.
- Option 3: Symmetric 622.08 Mbit/s.

Table 3 and its associated texts are modified to include the following items:

Table 3/G.983.3 – Relation between parameter categories and tables

Transmission direction	Nominal bit rate	Table
Downstream	155.52 Mbit/s	Table 4b (downstream, 155 Mbit/s)
	622.08 Mbit/s	Table 4c (downstream, 622 Mbit/s)
Upstream	155.52 Mbit/s	Table 4d (upstream, 155 Mbit/s)
	622.08 Mbit/s	Table 4e (upstream, 622 Mbit/s)

All parameters are specified as follows, and shall be in accordance with Table 4a (ODN), Table 4b (downstream, 155 Mbit/s), Table 4c (downstream, 622 Mbit/s), Table 4d (upstream, 155 Mbit/s), and Table 4e (upstream 622 Mbit/s). These tables are generally called Table 4 in this Recommendation, if no confusion is possible. There are 9 kinds of ONUs. They are distinguished by downstream and upstream bit rates of 155.52 Mbit/s and 622.08 Mbit/s and by optical path loss of Class A, Class B, and Class C (defined in ITU-T Rec. G.982). Some parameters described in Table 4 are described in Appendix I as examples for implementation.

Add Table 4e/G.983.3 as follows:

Table 4e/G.983.3 – Optical interface parameters of 622 Mbit/s upstream direction

Items	Unit	Specifications		
ONU Transmitter (optical interface O_{ru})				
Nominal bit rate	Mbit/s	622.08		
Operating wavelength	nm	1260-1360		
Line code	–	Scrambled NRZ		
Mask of the transmitter eye diagram	–	See Figure 7/G.983.1		
Maximum reflectance of equipment, measured at transmitter wavelength	dB	Less than –6		
Minimum ORL of ODN at O _{ru} and O _{rd} (Notes 1 and 2)	dB	More than 32		
ODN Class		Class A	Class B	Class C
Mean launched power MIN	dBm	(Note 5)	(Note 5)	(Note 5)
Mean launched power MAX	dBm	(Note 5)	(Note 5)	(Note 5)
Launched optical power without input to the transmitter	dBm	less than Min sensitivity –10		
Extinction ratio	dB	More than 10		
Tolerance to the transmitter incident light power	dB	More than –15		
If MLM Laser – Maximum RMS width (Note 3)	nm	MLM type 1: 1.4 MLM type 2: 2.1 MLM type 3: 2.7		
If SLM Laser – Maximum –20 dB width (Note 4)	nm	1		
If SLM Laser – Minimum side mode suppression ratio	dB	30		
Jitter transfer	–	See Figure 8/G.983.1		
Jitter generation from 0.5 kHz to 1.3 MHz	UI p-p	0.2		
OLT Receiver (optical interface O_{lu})				
Maximum reflectance of equipment, measured at receiver wavelength	dB	Less than –20		
Bit error ratio	–	Less than 10 ⁻¹⁰		
ODN Class		Class A	Class B	Class C
Minimum sensitivity	dBm	(Note 5)	(Note 5)	(Note 5)
Minimum overload	dBm	(Note 5)	(Note 5)	(Note 5)
Consecutive identical digit immunity	bit	More than 72		
Jitter tolerance	–	NA		
Tolerance to the reflected optical power	dB	Less than 10		

Table 4e/G.983.3 – Optical interface parameters of 622 Mbit/s upstream direction

NOTE 1 – The value of "minimum ORL of ODN at point O_{ru} and O_{rd} , and O_{lu} and O_{ld} " should be more than 20 dB in optional cases which are described in Appendix I/G.983.1.

NOTE 2 – The values of ONU transmitter reflectance for the case that the value of "minimum ORL of ODN at point O_{ru} and O_{rd} , and O_{lu} and O_{ld} " is 20 dB are described in Appendix IV.

NOTE 3 – Transmitter types meeting narrower spectral width specifications are allowed wider central wavelength ranges. The specified laser types produce less than 1 dB of optical path penalty over the ODN. Lasers with different optical parameters may be substituted provided that:

- 1) the total wavelength range does not exceed 1260 nm to 1360 nm; and
- 2) any increase in optical path penalty over 1 dB is compensated by an increase of the minimum transmitted launch power or a decrease of the minimum receiver sensitivity.

For interoperability, the specified laser types with less than 1 dB optical path penalty are recommended.

NOTE 4 – Values of maximum –20 dB width, and minimum side mode suppression ratio are referred to in ITU-T Rec. G.957.

NOTE 5 – Tentative parameters are described in Appendix I

2.4) Clause I.2

Change the description as follows:

Specified numerical values described in the following tables indicate tentative values for items described in Table 4 of Recommendation G.983.3. Tables I.1 to I.4 are based on case 2 described in Appendix II of Recommendation G.983.3. Table I.5 is based on case 4 because the upstream signals pass through fewer WDM filters than case 2 and can be relaxed on their ODN attenuation.

Add Table I.4/G.983.3 and Table I.5/G.983.3 as follows:

Table I.4/G.983.3 – Optical interface parameters of 622 Mbit/s upstream direction

Items	Unit	ODN Class		
		Class A	Class B	Class C ^{a)}
ONU Transmitter (optical interface O_{ru})				
Mean launched power MIN	dBm	-7.5	-2.5	-2.5
Mean launched power MAX	dBm	-1	+4	+4
OLT Receiver (optical interface O_{lu})				
Minimum sensitivity	dBm	-28.5	-28.5	-33.5
Minimum overload	dBm	-6	-6	-11
a) The values proposed for upstream Class C are best estimates. They are therefore subject to change in the future.				

Table I.5/G.983.3 – Optical interface parameters of 622 Mbit/s downstream and upstream directions based on case 4 described in Appendix II

Items	Unit	ODN Class		
		Class A	Class B	Class C
OLT Transmitter				
Mean Launched Power MIN	dBm	-5.5	-0.5	-0.5
Mean Launched Power MAX	dBm	-1	+4	+4
ONU Receiver				
Minimum Sensitivity	dBm	-26.5	-26.5	-31.5
Minimum Overload	dBm	-6	-6	-11
ONU Transmitter				
Mean Launched Power MIN	dBm	-6	-1	-1
Mean Launched Power MAX	dBm	-1	+4	+4
OLT Receiver				
Minimum Sensitivity	dBm	-27	-27	-32
Minimum Overload	dBm	-6	-6	-11

2.5) Clause IV.2.5

Modify Table IV.1/G.983.3 as follows:

Table IV.1/G.983.3 – Values for ONU transmitter equipment reflectance

Min ORL of ODN	Class	Optical parameters	Required characteristics						
			A ^{a)}	B ^{a)}	C ^{a)}	D ^{a)}	E ^{a)}	F ^{a)}	Option
32 dB	A	WDM isolation for ONU receiver	6.5						1
		WDM isolation for ONU transmitter							
		WDM isolation for OLT receiver				5.5		5.5	2, 3
		WDM isolation for OLT transmitter			NA				1
		Equipment reflectance for ONU transmitter		0.5			1.5		1, 2
	B	WDM isolation for ONU receiver	8.5						1, 3
		WDM isolation for ONU transmitter							
		WDM isolation for OLT receiver				13.5		13.5	2
		WDM isolation for OLT transmitter			NA				1
		Equipment reflectance for ONU transmitter		0.5			1.5		1, 2
	C	WDM isolation for ONU receiver	13.5						1, 2, 3
		WDM isolation for ONU transmitter							
		WDM isolation for OLT receiver				16.5		16.5	1, 2
		WDM isolation for OLT transmitter			NA				1
		Equipment reflectance for ONU transmitter		0.5			1.5		1, 2

Table IV.1/G.983.3 – Values for ONU transmitter equipment reflectance

Min ORL of ODN	Class	Optical parameters	Required characteristics						
			A ^{a)}	B ^{a)}	C ^{a)}	D ^{a)}	E ^{a)}	F ^{a)}	Option
20 dB	A	WDM isolation for ONU receiver	18.5						1
		WDM isolation for ONU transmitter							
		WDM isolation for OLT receiver				17.5		17.5	2, 3
		WDM isolation for OLT transmitter			3.3				1
		Equipment reflectance for ONU transmitter		12.5			13.5		1, 2
	B	WDM isolation for ONU receiver	20.5						1, 3
		WDM isolation for ONU transmitter							
		WDM isolation for OLT receiver				25.5		25.5	2
		WDM isolation for OLT transmitter			3.3				1
		Equipment reflectance for ONU transmitter		12.5			13.5		1, 2
	C	WDM isolation for ONU receiver	25.5						1, 2, 3
		WDM isolation for ONU transmitter							
		WDM isolation for OLT receiver				28.5		28.5	1, 2
		WDM isolation for OLT transmitter			3.3				1
		Equipment reflectance for ONU transmitter		12.5			13.5		1, 2

^{a)} A, B, C, D, E and F represent Equation A, Equation B, Equation C, Equation D, Equation E and Equation F, respectively.

2.6) Clause IV.3.1

Add the following sentence at the end of the clause:

I_{WF1} is defined by the worst value of options described in 8.3.1.

2.7) Subclause IV.3.1.1

Modify Table IV.2/G.983.3 as follows:

Table IV.2/G.983.3 – ORL versus Isolation at WF1

Min ORL of ODN	Class	Example conditions			Required I_{WF1} (dB)	Option
		P_{Eold} (dBm)	I_{olt_r} (dB)	P_{min} (dBm)		
32 dB	A	+16	3.5	-28.5	19	1
	B		11.5	-31.5	14	1
	C		16.5	-34.5	12	1, 2, 3
20 dB	A		15.5	-28.5	19	1
	B		23.5	-31.5	14	1
	C		28.5	-34.5	12	1, 2, 3

2.8) Subclause IV.3.1.2

Modify Table IV.3/G.983.3 as follows:

Table IV.3/G.983.3 – ORL versus Isolation at WF1

Min ORL of ODN	Assumption conditions							Required I_{WF1} (dB)	Option
	ODN Class	Loss of ODN (dB)	No. of E-ONU N	P_{Eold} (dBm)	I_{olt_r} (dB)	P_{min} (dBm)	$Reonu_r$ (dB)		
32 dB	A	5	2	+16	3.5	-28.5	20	24	1
	B	10	8		11.5	-31.5		15	1
	C	15	32		16.5	-34.5		9	1, 2, 3
20 dB	A	5	2		15.5	-28.5		12	1
	B	10	8		23.5	-31.5		3	1
	C	15	32		28.5	-34.5		NA	1, 2, 3

2.9) Sublause IV.3.1.3

Modify Table IV.4/G.983.3 as follows:

Table IV.4/G.983.3 – ORL versus Isolation at WF1

Min ORL of ODN	Assumption conditions							Required R_{WF2_r} (dB)	Option
	ODN Class	Loss of ODN (dB)	No. of E-ONU N	P_{Eold} (dBm)	I_{olt_r} (dB)	P_{min} (dBm)	I_{WF1} (dB)		
32 dB	A	5	2	+16	3.5	-28.5	24	20	1, 2, 3
	B	10	8		11.5	-31.5	15	20	1, 2, 3
	C	15	32		16.5	-34.5	12	17	1, 2, 3
20 dB	A	5	2		15.5	-28.5	19	13	1, 2, 3
	B	10	8		23.5	-31.5	14	9	1, 2, 3
	C	15	32		28.5	-34.5	12	5	1, 2, 3

2.10) Clause V.2.1

Modify Table V.1/G.983.3 as follows:

Table V.1/G.983.3 – Optical power level diagram (example)

	Ref. (e)		IFP _{ON} (O _{ru} , O _{rd})		ODN loss		IFP _{ON} (O _{lu} , O _{ld})		Ref.(c)	
Unit	dBm		dBm		dB		dBm		dBm	
Range	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Downstream										
155M Class A	-30	-8	-28.5	-8	5	20	-7.5	-3	-6	-3
155M Class B	-30	-8	-28.5	-8	10	25	-2.5	2	-1	2
155M Class C	-33	-11	-31.5	-11	15	30	-0.5	4	1	4
622M Class A	-28	-6	-26.5	-6	5	20	-5.5	-1	-4	-1
622M Class B	-28	-6	-26.5	-6	10	25	-0.5	4	1	4
622M Class C	-33	-11	-31.5	-11	15	30	-0.5	4	1	4
Upstream										
155M Class A	-6	0	-7.5	0	5	20	-28.5	-5	-30	-5
155M Class B	-4	2	-5.5	2	10	25	-31.5	-8	-33	-8
155M Class C	-2	4	-3.5	4	15	30	-34.5	-11	-36	-11
622M Class A	-6	-1	-7.5	-1	5	20	-28.5	-6	-30	-6
622M Class B	-1	4	-2.5	4	10	25	-28.5	-6	-30	-6
622M Class C	-1	4	-2.5	4	15	30	-33.5	-11	-35	-11

2.11) Clause V.2.2

Modify the third paragraph as follows:

With regards to ODN Class A of 155M, optical parameters are not specified in ITU-T Rec. G.983.1, thus the case of Class A is not described for 155M.

Modify Table V.3/G.983.3 as follows:

Table V.3/G.983.3 – Optical power level diagram (example)

	Ref. (e)		IFP _{ON} (O _{ru} , O _{rd})		ODN loss		IFP _{ON} (O _{lu} , O _{ld})		Ref.(c)	
Unit	dBm		dBm		dB		dBm		dBm	
Range	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Downstream										
155M reduced Class B	-30	-8	-28.5	-8	10	22	-5.5	2	-4	2
155M reduced Class C	-33	-11	-31.5	-11	15	27	-3.5	4	-2	4
622M reduced Class A	-28	-6	-26.5	-6	5	17	-8.5	-1	-7	-1
622M reduced Class B	-28	-6	-26.5	-6	10	22	-3.5	4	-2	4
622M reduced Class C	-33	-11	-31.5	-11	15	27	-3.5	4	-2	4
Upstream										
155M reduced Class B	-4	2	-5.5	2	10	22	-28.5	-8	-30	-8
155M reduced Class C	-2	4	-3.5	4	15	27	-31.5	-11	-33	-11
622M reduced Class A	-6	-1	-7.5	-1	5	17	-25.5	-6	-27	-6
622M reduced Class B	-1	4	-2.5	4	10	22	-25.5	-6	-27	-6
622M reduced Class C	-1	4	-2.5	4	15	27	-30.5	-11	-32	-11

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