International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.8251

Amendment 3

(10/2012)

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

Packet over Transport aspects – Quality and availability targets

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The control of jitter and wander within the optical transport network (OTN)

Amendment 3

Recommendation ITU-T G.8251 (2010) – Amendment 3

International Telecommunication Union

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Recommendation ITU-T G.8251

The control of jitter and wander within the optical transport network (OTN)

Amendment 3

Summary

Amendment 3 to Recommendation ITU-T G.8251 (2010) contains text additions to include support of a new client in the optical transport network (OTN)

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T G.8251	2001-11-29	15
1.1	ITU-T G.8251 (2001) Cor. 1	2002-06-13	15
1.2	ITU-T G.8251 (2001) Amd. 1	2002-06-13	15
1.3	ITU-T G.8251 (2001) Cor. 2	2008-05-22	15
1.4	ITU-T G.8251 (2001) Amd.2	2010-01-13	15
2.0	ITU-T G.8251	2010-09-22	15
2.1	ITU-T G.8251 (2010) Amd. 1	2011-04-13	15
2.2	ITU-T G.8251 (2010) Cor. 1	2012-02-13	15
2.3	ITU-T G.8251 (2010) Amd. 2	2012-02-13	15
2.4	ITU-T G.8251 (2010) Amd. 3	2012-10-29	15

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

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As of the date of approval of this Recommendation, ITU had not 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/.

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Recommendation ITU-T G.8251

The control of jitter and wander within the optical transport network (OTN)

Amendment 3

1) Scope

This amendment contains modified text to be added to Recommendation ITU-T G.8251, *The control of jitter and wander within the optical transport network (OTN).*

2) Clause 2, References

Add the following references to clause 2:

[EN 50083-9]	EN 50083-9:2002, European Committee for Electrotechnical Standardization (CENELEC), *Cable networks for television signals, sound signals and interactive services – Part 9: Interfaces for CATV/SMATV headends and similar professional equipment for DVB/MPEG-2 transport streams.*
[ETSI TR 101 290]	ETSI TR 101 290 V1.2.1 (2001), *Digital Video Broadcasting (DVB); Measurement guidelines for DVB systems*.
[ETSI TR 101 891]	ETSI TR 101 891 V1.1.1 (2001), *Digital Video Broadcasting (DVB); Professional Interfaces: Guidelines for the implementation and usage of the DVB Asynchronous Serial Interface (ASI).*

3) Clause 4, Abbreviations and acronyms

Add the following new abbreviations:

ASI	Asynchronous Serial Interface
DVB	Digital Video Broadcast

4) Clause 6.2, Jitter and wander tolerance of client interfaces

Add the following text underneath the existing text of clause 6.2:

The DVB_ASI client mapped into ODU0 according to clause 17.7.1 of [ITU-T G.709] shall support the parameters as given in the DVB_ASI specification contained in [ETSI TR 101 891 V1.1.1] and [EN 50083-9].

5) Clause A.1, Scope

Insert the changes indicated below into Table A.1-1, Summary of ODUk clock (ODC) types.

Table A.1-1 – Summary of ODUk clock (ODC) types

	ODCa (Note 4)	**ODCb (Note 4)**	**ODCr**	**ODCp (Note 4)**
Atomic function	ODUkP/CBRx-a_A_So ODUkP/GFP_A_So ODUkP/NULL_A_So ODUkP/PRBS_A_So ODUkP/RSn-a_A_So ODUkP/VP_A_So ODUkP/ODU[i]j_A_So ODUkP/ODUj_A_So ODUkP/ODUi[j]_A_Sk (AIS clock) OTUk/ODUk_A_Sk (AIS clock) OTUkV/ODUk_A_Sk (AIS clock) ODUk_C (OCI clock)	ODUkP/CBRx-b_A_So ODUkP/RSn-b_A_So	OTUk/ODUk_A_So and OTUk/ODUk_A_Sk (i.e., the clocks of these atomic functions are concentrated in a single ODCr; see [ITU-T G.798])	ODUkP/CBRx_A_Sk ODUkP/ODU[i]j_A_Sk ODUkP/ODUj_A_Sk
Frequency accuracy	±20 ppm	±20 ppm for ODUk (k = 0, 1, 2, 3, 4) ±20 ppm for CBRx (x = 2G5, 10G, 40G) ±100 ppm for ODU2e, ODUflex, 10GE, and FC-x (x = 100, 200, 400, 800, 1200), IB SDR; IB DDR, IB QDR	±20 ppm	±20 ppm for ODUk (k= 0, 1, 2, 3, 4) ±20 ppm for CBRx (x = 0G155, 0G622, 2G5, 10G, 40G) ±100 ppm for 1GE, 10GE, 40GE, 100GE, FC-x, IB SDR; IB DDR, IB QDR; DVB_ASI, ODUflex, and ODU2e ±200 ppm for SBCON
Free-run mode supported	Yes	Yes	Yes	Yes
Locked mode supported	No	Yes	Yes	Yes
Holdover mode supported	No	No	No	No

Table A.1-1 – Summary of ODUk clock (ODC) types

	ODCa (Note 4)	ODCb (Note 4)	ODCr	ODCp (Note 4)
Pull-in range	NA	±20 ppm (SDH clients) ±100 ppm (Ethernet and FC-x (x = 100, 200, 400, 800, 1200), IB SDR; IB DDR, IB QDR clients)	±20 ppm	±20 ppm (SDH clients) ±100 ppm (Ethernet and FC-x (x = 100, 200, 400, 800, 1200), IB SDR; IB DDR, IB QDR clients) ±200 ppm for SBCON clients
Pull-out range	NA	±20 ppm (SDH clients) ±100 ppm (Ethernet and FC-x (x = 400, 800, 1200), IB SDR; IB DDR, IB QDR clients)	±20 ppm	±20 ppm (SDH clients) ±100 ppm (Ethernet and FC-x (x = 100, 200, 400, 800, 1200), IB SDR; IB DDR, IB QDR clients) ±200 ppm for SBCON clients
Jitter generation	Table A.5-1	Table A.5-1	Table A.5-1	Table A.5-2
Wander generation	NA	NA (Note 1)	NA	NA (Note 2)
Jitter tolerance	NA	[ITU-T G.825] for SDH clients [IEEE 802.3] for Ethernet clients	Table 6.1-1, Figure 6.1-1 (OTU1) Table 6.1-2, Figure 6.1-2 (OTU2) Table 6.1-3, Figure 6.1-3 (OTU3) Table 6.1-4, Figure 6.1-4 (OTU3/ OTL3.4) Table 6.1-5, Figure 6.1-5 (OTU4/ OTL4.4)	Table 6.1-1, Figure 6.1-1 (OTU1) Table 6.1-2, Figure 6.1-2 (OTU2) Table 6.1-3, Figure 6.1-3 (OTU3) Table 6.1-4, Figure 6.1-4 (OTU3/OTL3.4) [IEEE 802.3] for Ethernet clients
Wander tolerance	NA	[ITU-T G.825]	Clause 6.1	Clause 6.1

Table A.1-1 – Summary of ODUk clock (ODC) types

	ODCa (Note 4)	**ODCb (Note 4)**	**ODCr**	**ODCp (Note 4)**
Jitter transfer	NA	Maximum bandwidth: ODU0: 0.5 kHz ODU1: 1 kHz ODU2: 4 kHz ODU2e: 4 kHz ODU3: 16 kHz ODUflex: FFS Maximum gain peaking: 0.1 dB for ODU0, 1, 2, 2e, and 3 FFS for ODUflex (see Table A.7-1 and Figure A.7-1)	Maximum bandwidth: OTU1: 250 kHz OTU2: 1000 kHz OTU3: 4000 kHz OTU4: 10000 kHz Maximum gain peaking: 0.1 dB for OTU1, 2, 3 and 4 (see Table A.7-2 and Figure A.7-1)	Maximum bandwidth: 300 Hz for ODUk (k=0, 1, 2, 2e, 3, flex) 300 Hz for CBRx (x = 0G155, 0G622, 2G5, 10G, 40G), 10GE, 40GE, 100GE, FC-x (x =100, 200, 400, 800, 1200), IB SDR; IB DDR, IB QDR; SBCON 100 Hz for 1GE 200 Hz for DVB_ASI Maximum gain peaking: 0.1 dB (see clause A.7.3)
Output when input signal is lost	AIS (CBRx client) OTUk: no frame hit OTUk frequency unchanged	AIS (CBRx client) Local Fault (Ethernet and FC-x (x = 100, 200, 400, 800, 1200) clients) OTUk: no frame hit OTUk initial frequency change ≤ 9 ppm (See clause A.8)	AIS (OTUk) OTUk: frame hit allowed Temporary OTUk frequency offset > 20 ppm allowed	AIS (CBRx client), AIS (ODUj[/i] client) Frequency offset ≤ 20 ppm Local Fault (Ethernet and FC-x (x = 100, 200, 400, 800, 1200) clients) Frequency offset ≤ 100 ppm NOS for SBCON Frequency offset ≤ 200 ppm

Table A.1-1 – Summary of ODUk clock (ODC) types

	ODCa (Note 4)	ODCb (Note 4)	ODCr	ODCp (Note 4)
NA No requirement because not applicable NOTE 1 – The wander generation of ODCb is expected to be negligible compared to the wander on the input CBR (e.g., SDH) client signal, because the ODCb bandwidth is relatively wideband. NOTE 2 – The intrinsic wander generation of the ODCp is negligible compared to the wander generated by the demapping process. NOTE 3 – To achieve the compliance of STM-1 and STM-4 signals mapped with GMP into ODU0 with SDH jitter wander specification in addition to the ODCp clock filtering, the use of one bit additional phase information as specified in [ITU-T G.709] and [ITU-T G.798] is required. NOTE 4 – An ODCa, ODCb, or ODCp for one client is not required to support another client simultaneously.				

6) Clause A.3, Frequency accuracy

Modify clause A.3 as indicated below:

A.3 Frequency accuracy

Under free-running conditions, the output frequency accuracy of ODCa and ODCr shall not be worse than 20 ppm with respect to a reference traceable to an [ITU-T G.811] clock. Under free-running conditions, the output frequency accuracy of ODCb shall not be worse than 100 ppm for 1GE, 10GE, 40GE, 100GE, FC-x, and InfiniBand clients and ODU2e, and shall not be worse than 20 ppm for all other respective clients and ODUs (see Table A.1-1). Under free-running conditions, the output frequency accuracy of ODCp shall not be worse than 100 ppm for 1GE, 10GE, 40GE, 100GE, ~~and~~ FC-x, and DVB_ASI clients and ODU2e, shall not be worse than 200 ppm for SBCON client, and shall not be worse than 20 ppm for all other respective clients and ODUs (see Table A.1-1).

7) Clause A.4, Pull-in and pull-out ranges

Modify clauses A.4.1 and A.4.2 as indicated below:

A.4.1 Pull-in range

The minimum pull-in range of ODCb, ODCr, and ODCp shall be ±100 ppm for 1GE, 10GE, 40GE, 100GE, ~~and~~ FC-x, ~~and~~ InfiniBand, and DVB_ASI clients and ODU2e. The minimum pull-in range of ODCp shall be ±200 ppm for SBCON client. The minimum pull-in range of ODCb, ODCr, and ODCp shall be ~~, and~~ ±20 ppm for all other clients and ODUs (see Table A.1-1), whatever the internal oscillator frequency offset may be. There is no requirement for the pull-in range of ODCa because it is free-running.

A.4.2 Pull-out range

The minimum pull-out range of ODCb, ODCr, and ODCp shall be ±100 ppm for 1GE, 10GE, 40GE, 100GE, ~~and~~ FC-x, InfiniBand, and DVB_ASI clients and ODU2e. The minimum pull-out range of ODCp shall be ±200 ppm for SBCON client. The minimum pull-out range of ODCb, ODCr, and ODCp shall be~~and~~ ±20 ppm for all other clients and ODUs (see Table A.1-1), whatever the internal oscillator frequency offset may be. There is no requirement for the pull-out range of ODCa because it is free-running.

8) Clause A.7.3, Jitter transfer for ODCp

Modify clause A.7.3 as indicated below:

A.7.3 Jitter transfer for ODCp

The jitter transfer requirements for ODCp are, essentially, the transfer requirements for a CBR (e.g., SDH) demapper (i.e., a desynchronizer) or ODU[i]j demultiplexer. The demapper function, including the ODCp, is contained in the ODUkP/CBRx_A_Sk and ODUkP/RSn_A_Sk atomic functions. The demultiplexer functions, including the ODCp, are contained in the ODUkP/ODU[i]j_A_Sk atomic function. The ODCp performs filtering, which is necessary to control the mapping/demapping jitter and wander accumulation over multiple OTN islands.

The 3 dB bandwidth of the desynchronizer shall not exceed 300 Hz for:

– ODUk (k=0, 1, 2, 2e, 3, flex);

– CBRx (x = 0G155, 0G622, 2G5, 10G, 40G);

– 10GE, 40GE, 100GE;

– FC-x (x = 100, 200, 400, 800, 1200);

– IB SDR, IB DDR, IB QDR;

– SBCON.

The 3 dB bandwidth of the desynchronizer shall not exceed 200 Hz for DVB_ASI.

The 3 dB bandwidth of the desynchronizer shall not exceed 100 Hz for 1GE.

The maximum gain peaking of the desynchronizer shall be 0.1 dB. These requirements apply to all ODUk rates. Additional information, on demapper phase error, is given in Appendix V.

9) Clause A.8, Jitter transfer for ODCp

Modify clause A.8 as indicated below:

A.8 Transient response

When a CBR client signal is lost and AIS is inserted, or when the CBR client is restored and AIS is removed, the ODUk and OTUk timing must be maintained. This requirement is met automatically for asynchronous mappings because the ODCa is free-running and therefore independent of the client signal clock. However for bit-synchronous mapping, the ODCb takes its timing from the client. Specifically, the client signal timing is recovered by the clock recovery circuit that resides in the OS/CBR_A_Sk atomic function; the output of this clock recovery circuit is input to the ODCb (see Appendix VI for a summary of the atomic functions). Loss of the client signal results in the ODCb either entering free-run or switching to a free-running AIS clock or Ethernet local fault clock; restoration of the client signal results in the ODCb switching from free-run condition or from a free-running AIS clock to an independent client-signal clock. In addition, there may be a short period between the instant the client input to the clock recovery circuit is lost and the detection of this loss; during this period, the clock recovery circuit output may be off frequency and still be input to the ODCb. In all these cases, [ITU-T G.798] requires that the ODUk clock shall stay within its limits and no frame phase discontinuity shall be introduced. The maximum possible frequency difference between a ±20 ppm CBRx (e.g., SDH) client and free-running ODCb or free-running AIS clock is 40 ppm (because the largest possible offset for each signal is ±20 ppm). The maximum possible frequency difference between a ±100 ppm 1GE, 10GE, 40GE, 100GE, ~~or~~ FC-x, ~~or~~ InfiniBand, or DVB_ASI client and free-running replacement signal (local fault) clock is 200 ppm. The maximum possible frequency difference between a ±200 ppm SBCON client and free-running replacement signal NOS clock is 400 ppm.

The above requirements mean that the ODCb must adequately filter a frequency step whose size is the maximum possible frequency difference, as indicated above, between the client and either AIS clock or replacement signal (local fault) clock, such that downstream equipment in the OTN, i.e., 3R regenerators, can tolerate the resulting filtered phase transient. Specifically, this means that the phase transient shall not cause buffer overflow in an ODCr that meets the jitter and wander tolerance requirements of clause 6.2. In addition, the ODCb must adequately filter the clock recovery circuit output during the short period between the loss of the client input to the clock recovery circuit and the removal of the clock recovery circuit output from the ODCb input.

If:

1) the clock recovery circuit in the OS/CBR_A_So atomic function loses its input and/or the ODCb loses its input and either enters free-run or switches to an AIS clock; or

2) the ODCb recovers from AIS to the output of the clock recovery circuit,

the ODCb output shall meet the following requirements:

a) Any initial frequency step shall not exceed 9 ppm.

b) Any frequency drift rate following the initial frequency step shall not exceed 200 ppm/s.

c) The total change in frequency shall not exceed the maximum possible frequency difference between the client signal and either the AIS clock or the replacement signal (local fault) clock.

Then, the ODCb is allowed to lose synchronization for a period up to 600 ms.

NOTE – An ODCb, for one client is not required to support another client simultaneously.

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