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OF ITU

G.783

Amendment 1

(06/2002)

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

Digital terminal equipments – Principal characteristics of multiplexing equipment for the synchronous digital hierarchy

Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks

Amendment 1

ITU-T Recommendation G.783 (2000) – Amendment 1

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

ITU-T Recommendation G.783

Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks

Amendment 1

Source

Amendment 1 to ITU-T Recommendation G.783 (2000) 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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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, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation G.783

Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks

Amendment 1

1) Jitter generation for Option 2, Type A regenerators

1.1) Clause 9.3.1.1

Introduce the following changes:

9.3.1.1 STM-N Optical Section to Regenerator Section Adaptation Source OSn/RSn_A_So

Symbol

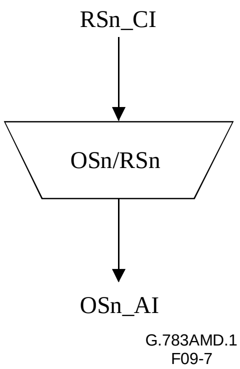

Figure 9-7/G.783 – OSn/RSn_A_So symbol

Interfaces

Table 9-5/G.783 – OSn/RSn_A_So input and output signals

Inputs	Outputs
RSn_CI_Data RSn_CI_Clock	OSn_AI_Data

Processes

This function provides line coding for STM-N signals according to ITU-T Rec.G.957 or ITU-T Rec. G.691.

This function~~s~~ limits the output jitter on the clock information in the OSn_AI_Data signal as given in Tables 9-6 and 9-7 ~~to less than 0.10 UIpp~~ measured over a 60-second interval. ~~with measurement filters according to Table 9-6.~~

~~Table 9-6/G.783 STM-N jitter measuring filters~~

~~Interface~~	~~Measuring filter~~
~~STM-1~~	~~65 kHz to 1.3 MHz~~
~~STM-4~~	~~250 kHz to 5 MHz~~
~~STM-16~~	~~1 MHz to 20 MHz~~

~~Table 9-6/G.783 – STM-N jitter measuring filters~~

~~Interface~~	~~Measuring filter~~
~~STM-64~~	~~4 MHz to 80 MHz~~
~~STM-256 (Note 2)~~	~~16 MHz to 320 MHz~~
~~For STM-1 1 UI = 6.43 ns~~ ~~For STM-4 1 UI = 1.61 ns~~ ~~For STM-16 1 UI = 0.40 ns~~ ~~For STM-64 1 UI = 0.10 ns~~ ~~For STM-256 1 UI = 0.025 ns~~	
~~NOTE 1 – The jitter and wander below the measuring filter is determined by the SETS, see ITU-T G.781 [9].~~ ~~NOTE 2 – Values for STM-256 are provisional and are not present in ITU-T G.825 [17] at the time of publication of this revision of this Recommendation.~~	

Jitter generation for SDH regenerator: A type A SDH regenerator, deployed in networks optimized for the 2048 kbit/s hierarchy, shall, on its STM-N output, not generate jitter in excess of the values in Table 9-~~7~~6.

Table 9-~~7~~6/G.783 – Jitter generation for STM-N type A regenerators in 2048 kbit/s based networks

Interface	Measurement band (–3 dB frequencies) (Notes 1 and 2)		Peak-peak amplitude (UI) (Notes ~~3~~ 2 and ~~4~~3)
	high-pass (kHz)	low-pass (MHz) –60 dB/dec	
STM-1 optical	0.5	1.3	0.30
	65	1.3	0.10
STM-4 optical	1	5	0.30
	250	5	0.10
STM-16 optical	5	20	0.30
	1000	20	0.10
STM-64 optical	20	80	0.30
	4000	80	0.10
STM-256 optical	~~80~~FFS	~~320~~FFS	~~0.30~~FFS
(Note ~~5~~4)	16 000	320	0.10

Table 9-~~7~~6/G.783 – Jitter generation for STM-N type A regenerators in 2048 kbit/s based networks

Interface	Measurement band (–3 dB frequencies) (Notes 1 and 2)		Peak-peak amplitude (UI) (Notes ~~3~~ 2 and ~~4~~3)
	high-pass (kHz)	low-pass (MHz) –60 dB/dec	

NOTE 1 – The high-pass and low-pass measurement filter transfer functions are defined in clause 3/G.825.

~~NOTE 2 – The measurement configuration is shown in Figure 1/ G.825.~~

NOTE ~~3~~ 2 – For STM-1: 1 UI = 6.43 ns
For STM-4: 1 UI = 1.61 ns
For STM-16: 1 UI = 0.40 ns
For STM-64: 1 UI = 0.10 ns
For STM-256: 1 UI = 0.025 ns

NOTE ~~4~~ 3 – The measurement time and pass/fail criteria are defined in clause ~~3~~5/G.825.

NOTE ~~5~~ 4 – Values for STM-256 are provisional and are not present in ITU-T Rec. G.825 at the time of publication of this revision of this Recommendation.

An ~~type A~~ STM-N (N = 1, 4, 16, 64) regenerator deployed in networks optimized for the particular 1544 kbit/s hierarchy that includes the rates 1544 kbit/s, 6312 kbit/s and 44 736 kbit/s shall, on its STM-N output, not generate jitter in excess of the values in Table 9-7.~~, as well as a~~

Table 9-7/G.783 – Jitter generation for STM-N regenerators in 1544 kbit/s based networks

Interface	Measurement band (–3 dB frequencies)		Limit (Notes 1, 2, and 3)
	high-pass (kHz)	low-pass (MHz) –60 dB/dec	
STM-1 optical	12	1.3	0.1 UIpp/0.01 UIrms
STM-4 optical	12	5	0.1 UIpp/0.01 UIrms
STM-16 optical	12	20	0.1 UIpp/0.01 UIrms
STM-64 optical	20	80	0.30 UIpp
	4000	80	0.10 UIpp
STM-256 optical	FFS	FFS	FFS

NOTE 1 – Both peak-to-peak and rms jitter limits are to be met simultaneously for the rates STM-1, STM-4, and STM-16 (not applicable for STM-64)

NOTE 2 – For STM-1: 1 UI = 6.43 ns
For STM-4: 1 UI = 1.61 ns
For STM-16: 1 UI = 0.40 ns
For STM-64: 1 UI = 0.10 ns
For STM-256: 1 UI = 0.025 ns

NOTE 3 – The measurement time and pass/fail criteria are defined in clause 5/G.825.

~~A type B SDH regenerator, shall not generate more than 0.01 UI rms jitter. The measurement bandwidth and technique are under study.~~

Defects

None.

Consequent actions

None.

Defect correlations

None.

Performance monitoring

None.

2) Changes in TIM and TIMAISdis behaviour in Consequent actions, Defect Correlation and Performance monitoring

2.2) Clause 10.2.1.2

Make the following change under the heading **Performance monitoring***:*

pN_DS ← CI_SSF or dTIM~~aTSF~~ or dEQ

2.3) Clause 12.2.1.2

2.3.1) *Make the following changes under the heading* **Defect correlations***:*

cEXC ← dEXC and (not dTIM or TIMAISdis~~dTIM~~) and MON

cDEG ← dDEG and (not dTIM or TIMAISdis~~dTIM~~) and MON

cRDI ← dRDI and (not dUNEQ) and (not dTIM or TIMAISdis~~dTIM~~) and MON and RDI_Reported

2.3.2) *Make the following change under the heading* **Performance monitoring***:*

pN_DS ← CI_SSF or dUNEQ or dTIM~~aTSF~~ or dEQ

2.4) Clause 12.2.2.1

2.4.1) *Make the following change under the heading* **Consequent actions***:*

aTSF ← CI_SSF or dAIS or dUNEQ or (dTIM and not TIMAISdis)~~dTIM~~

2.4.2) *Make the following changes under the heading* **Defect correlations***:*

cEXC ← dEXC and (not dTIM or TIMAISdis~~dTIM~~) and MON

cDEG ← dDEG and (not dTIM or TIMAISdis~~dTIM~~) and MON

cRDI ← dRDI and (not dUNEQ) and (not dTIM or TIMAISdis~~dTIM~~) and MON and RDI_Reported

2.4.3) *Make the following change under the heading* **Performance monitoring***:*

pN_DS ← CI_SSF or dAIS or dUNEQ or dTIM~~aTSF~~ or dEQ

2.5) Clause 12.2.2.2

2.5.1) *Make the following change under the heading* **Consequent actions***:*

aTSF ← CI_SSF or dAIS or (dUNEQ and (AcTI = all "0"s)) or (dTIM and not TIMAISdis)~~dTIM~~

2.5.2) *Make the following changes under the heading* **Defect correlations***:*

cEXC ← dEXC and (not dTIM or TIMAISdis~~dTIM~~) and MON

cDEG ← dDEG and (not dTIM or TIMAISdis~~dTIM~~) and MON

cRDI ← dRDI and not (dUNEQ and (AcTI = all "0"s)) and (not dTIM or TIMAISdis~~dTIM~~) and MON and RDI_Reported

2.5.3) *Make the following change under the heading* **Performance monitoring***:*

pN_DS ← CI_SSF or dAIS or (dUNEQ and (AcTI = all "0"s)) or dTIM~~aTSF~~ or dEQ

2.6) Clause 12.2.3.2

2.6.1) *Make the following change under the heading* **Consequent actions***:*

aTSF ← CI_SSF or (dTIM and not TIMAISdis)~~dTIM~~

2.6.2) *Make the following changes under the heading* **Defect correlations***:*

cEXC ← dEXC and (not dTIM or TIMAISdis~~dTIM~~) and MON

cDEG ← dDEG and (not dTIM or TIMAISdis~~dTIM~~) and MON

cRDI ← dRDI and (not dTIM or TIMAISdis~~dTIM~~) and MON and RDI_Reported

2.6.3) *Make the following change under the heading* **Performance monitoring***:*

pN_DS ← CI_SSF or dTIM~~aTSF~~ or dEQ

2.7) Clause 13.2.1.2

2.7.1) *Make the following changes under the heading* **Defect correlations***:*

cEXC ← dEXC and (not dTIM or TIMAISdis~~dTIM~~) and MON

cDEG ← dDEG and (not dTIM or TIMAISdis~~dTIM~~) and MON

cRDI ← dRDI and (not dUNEQ) and (not dTIM or TIMAISdis~~dTIM~~) and MON and RDI_Reported

2.7.2) *Make the following change under the heading* **Performance monitoring***:*

pN_DS ← CI_SSF or dUNEQ or dTIM~~aTSF~~ or dEQ

2.8) Clause 13.2.2.1

2.8.1) *Make the following change under the heading* **Consequent actions***:*

aTSF ← CI_SSF or dAIS or dUNEQ or (dTIM and not TIMAISdis)~~dTIM~~

2.8.2) *Make the following changes under the heading* **Defect correlations***:*

cEXC ← dEXC and (not dTIM or TIMAISdis~~dTIM~~) and MON

cDEG ← dDEG and (not dTIM or TIMAISdis~~dTIM~~) and MON

cRDI ← dRDI and (not dUNEQ) and (not dTIM or TIMAISdis~~dTIM~~) and MON and

RDI_Reported

2.8.3) *Make the following change under the heading* **Performance monitoring***:*

pN_DS ← CI_SSF or dAIS or dUNEQ or dTIM~~aTSF~~ or dEQ

2.9) Clause 13.2.2.2

2.9.1) *Make the following change under the heading* **Consequent actions***:*

aTSF ← CI_SSF or dAIS or (dUNEQ and (AcTI = all "0"s)) or (dTIM and not TIMAISdis)~~dTIM~~

2.9.2) *Make the following changes under the heading* **Defect correlations***:*

cEXC ← dEXC and (not dTIM or TIMAISdis~~dTIM~~) and MON

cDEG ← dDEG and (not dTIM or TIMAISdis~~dTIM~~) and MON

cRDI ← dRDI and not (dUNEQ and (AcTI = all "0"s)) and (not dTIM or TIMAISdis~~dTIM~~) and MON and RDI_Reported

2.9.3) *Make the following change under the heading* **Performance monitoring***:*

pN_DS ← CI_SSF or dAIS or (dUNEQ and (AcTI = all "0"s)) or dTIM~~aTSF~~ or dEQ

2.10) Clause 13.2.3.2

2.10.1) *Make the following change under the heading* **Consequent actions***:*

aTSF ← CI_SSF or (dTIM and not TIMAISdis)~~dTIM~~

2.10.2) *Make the following changes under the heading* **Defect correlations***:*

cEXC ← dEXC and (not dTIM or TIMAISdis~~dTIM~~) and MON

cDEG ← dDEG and (not dTIM or TIMAISdis~~dTIM~~) and MON

cRDI ← dRDI and (not dTIM or TIMAISdis~~dTIM~~) and MON and RDI_Reported

2.10.3) *Make the following change under the heading* **Performance monitoring***:*

pN_DS ← CI_SSF or dTIM~~aTSF~~ or dEQ

3) Clause 15.1.3

Add the following paragraph to the end of clause 15.1.3:

In Figure 15-1 and Table 15-2, the jitter transfer measurement is made over the frequency range f_L to f_H. The lower frequency f_L is set to $f_C/100$ (where f_C is the corner frequency), and f_H is defined as the lower of either $100 \times f_C$ or the maximum frequency specified for the low pass filter function for measurement of jitter at each of the defined rates (Upper –3 dB frequency in Measurement band column of Table 9-6 – Jitter Generation for STM-N type A Regenerators in 2048 kbit/s based networks, and Table 9-7 – Jitter Generation for STM-N Regenerators in 1544 kbit/s based networks). Jitter above f_H is generally agreed to be insignificant relative to regenerator jitter accumulation, and low levels of in-spec jitter generation can easily be confused with an out-of-spec jitter transfer measurement when attempting to measure jitter transfer at high input/output attenuation levels (i.e. below –40 dB). The limits set for f_L at $f_C/100$ will always include the frequency at which maximum gain peaking occurs, and limiting jitter transfer measurements to frequencies between f_L and f_H will help limit testing time.

4) Clause 15.1.3

4.1) *Replace Figure 15-1/G.783 with the following:*

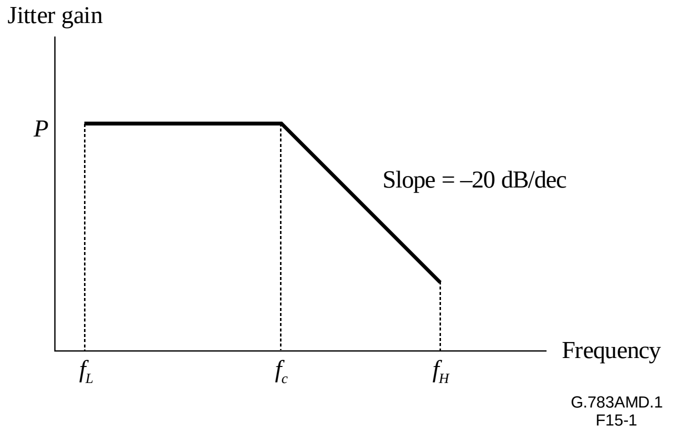

Figure 15-1/G.783 – Jitter transfer

4.2) *Replace Table 15-2/G.783 with the following:*

Table 15-2/G.783 – Jitter transfer parameters

STM-N level (type)	**f_L (kHz)**	**f_C (kHz)**	**f_H (kHz)**	**P (dB)**
STM-1 (A)	1.3	130	1 300	0.1
STM-1 (B)	0.3	30	1 300	0.1
STM-4 (A)	5	500	5 000	0.1
STM-4 (B)	0.3	30	3 000	0.1
STM-16 (A)	20	2 000	20 000	0.1
STM-16 (B)	0.3	30	3 000	0.1
STM-64 (A)	10	1 000	80 000	0.1
STM-64 (B)	tbd	tbd	tbd	tbd
STM-256 (A)	tbd	tbd	tbd	tbd
STM-256 (B)	tbd	tbd	tbd	tbd

5) Appendix VII

Add the following new Appendix VII:

Appendix VII

STM-64 regenerator jitter accumulation analyses and hypothetical reference model (HRM)

VII.1 Introduction

This appendix describes the details of the Hypothetical Reference Model (HRM) and jitter accumulation analyses that led to the STM-64 (Type A) jitter generation requirements in Tables 9-6 and 9-7 and to the STM-64 (Type A) jitter transfer requirements in Table 15-2. The analyses show that these jitter generation and transfer requirements and this HRM are consistent with the STM-64 output jitter (i.e. network interface jitter) specifications in Table 1/G.825.

The jitter accumulation analyses were actually performed for chains of OTU2 3R regenerators of the OTN (see ITU-T Rec. G.8251). The simulation models and jitter accumulation analyses are documented extensively in Appendix IV/G.8251. The results for chains of OTU2 3R regenerators can be applied to chains of STM-64 regenerators because:

1) the OTU2 and STM-64 rates are very similar, i.e. they differ by approximately 7.6%; and
2) the relevant jitter measurement filter bandwidths, jitter transfer bandwidth and gain peaking, other frequency breakpoints in the simulation model and jitter limits are the same for the two cases.

In view of this, it is not necessary to repeat the details of the simulation model and analyses in Appendix IV/G.8251 here. Instead, the simulation model is summarized and the relevant results of Appendix IV/G.8251 are referenced; the focus here is on the application of the results to the STM-64 case.

The STM-64 regenerator HRM is described in VII.2, and the simulation model, analyses, and results are described in VII.3.

VII.2 STM-64 regenerator hypothetical reference model

The Hypothetical Reference Model (HRM) for STM-64 (Type A) regenerator jitter accumulation is given in Figure VII.1. The HRM consists of 50 cascaded regenerators, each assumed to meet the STM-64 (Type A) jitter generation requirements of Tables 9-6 and 9-7 (the jitter generation requirements for STM-64 (Type A) are the same in both tables) and the STM-64 (Type A) jitter transfer requirements of Table 15-2. The 50 regenerators are preceded by an SDH Equipment Clock (SEC; see ITU-T Rec. G.813), which is also assumed to meet the jitter generation requirements of Tables 9-6 and 9-7.

NOTE – SEC jitter generation requirements for STM-64 are not specified in ITU-T Rec. G.813; the highest rate for which SEC jitter generation requirements are specified in ITU-T Rec. G.813 is STM-16.

Under these conditions, the output jitter at the end of the chain of 50 regenerators is expected to be within the STM-64 output jitter limits (i.e. jitter network limits) of Table 1/G.825.

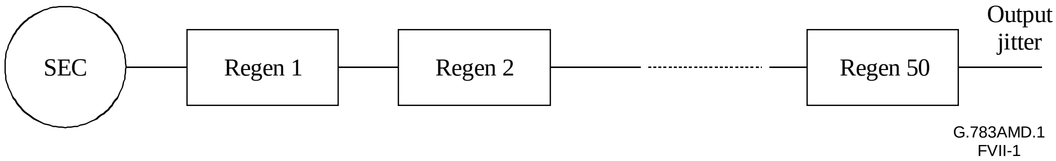

Figure VII.1/G.783 – Hypothetical reference model for STM-64 (Type A) regenerator jitter accumulation

VII.3 STM-64 (Type A) regenerator jitter accumulation simulation model, analyses, and results

The jitter generation requirement for STM-64 (Type A) is (see Tables 9-6 and 9-7):

1) 0.3 UIpp measured from 20 kHz to 80 MHz (wide-band); and

2) 0.1 UIpp measured from 4 MHz to 80 MHz (high-band) (see Table 9-6).

This is identical to the jitter generation requirement for OTU2 3R regenerators for OTN in ITU-T Rec. G.8251 (see Table A.2/G.8251). The network interface output jitter requirement for STM-64 in ITU-T Rec. G.825 is (see Table 1/G.825):

1) 1.5 UIpp measured from 20 kHz to 80 MHz (wide-band); and

2) 0.15 UIpp measured from 4 MHz to 80 MHz (high-band).

This is identical to the network interface output jitter requirement for OTU2 for OTN in ITU-T Rec. G.8251 (see Table 1/G.8251).

The STM-64 and OTU2 line rates are very similar (the latter exceeds the former by a factor of 255/237 = 1.076 (see Table 7-1/G.709/Y.133). Therefore, the jitter accumulation over chains of STM-64 regenerators and OTU2 3R regenerators that have the same jitter transfer bandwidth and gain peaking should be the same (because all the other relevant parameters are the same).

Jitter accumulation analyses for chains of 3R regenerators in OTN have been performed, and are documented in Appendix IV/G.8251. The analyses, done using two independent (but consistent) models which gave similar results, are also documented in Appendix IV/G.8251. Both models are based on a chain of phase-locked loops (PLLs). The first of the two models (see clause IV.2/G.8251), for which more detail is provided, considers noise generation in the phase-detector (PD), voltage-controlled oscillator (VCO), and optical receiver just prior to the PLL input. The VCO noise is modeled as a combination of white phase modulation (WPM) and white frequency modulation (WFM) using the Leeson model (see reference [5] of Appendix IV/G.8251). The other noise sources are modeled as WPM. Models were developed for both systematic and random jitter accumulation; however, the jitter accumulation for the OTUk 3R regenerators in ITU-T Rec. G.8251 (and also for STM-64 regenerators) is random because the buffer fills in the successive regenerators are uncorrelated with each other (each regenerator is assumed to include a wide-band clock recovery circuit, followed by a narrower band filter, and there is some data buffering for overhead processing). The models are implemented in the frequency domain, and therefore produce rms jitter rather than peak-to-peak jitter; however, it is assumed that the ratio of peak-to-peak to rms jitter is a constant. While the model assumes a constant ratio, it is not necessary to know the value of this constant to assess the jitter accumulation. Since the requirements provide the ratio of output jitter to jitter generation (1.5/0.3 = 5 for wide-band and 0.15/0.1 = 1.5 for high-band), it is only necessary to verify that the jitter accumulation does not exceed this.

Define the normalized jitter accumulation as the ratio of the output peak-to-peak (or rms, since we assume a constant ratio of peak-to-peak to rms jitter) jitter after N regenerators to the output peak-to-peak jitter after one regenerator (the latter is the jitter generation, and the former is the network limit). The results in ITU-T Rec. G.8251 show that the normalized jitter accumulation is largest for the cases of:

1) VCO noise with low oscillator Q, and therefore large WFM noise component; and

2) optical receiver WPM noise.

The reason these two cases are similar is that the VCO noise sees a high-pass filter transfer function with corner frequency equal to the PLL bandwidth. If the noise input is WFM, this is equivalent to having WPM with an integrator; the integrator converts the high-pass transfer function to a low-pass transfer function. The result resembles the optical receiver noise case, namely WPM that sees a low-pass transfer function. The noise accumulation for these cases is greater than for the other cases because, in the other cases, the noise generation is more nearly WPM with a high-pass transfer function; noise generated in one regenerator is effectively filtered by the low-pass transfer functions of subsequent regenerators.

Jitter accumulation results for VCO noise, for Q equal to 30, 100, and 535, are given in Figure IV.2-4b/G.8251 for a regenerator bandwidth of 8 MHz and Figure IV.2-6b/G.8251 for a regenerator bandwidth of 1 MHz. For a regenerator bandwidth of 8 MHz, Figure IV.2-4b indicates that the normalized jitter accumulation of 1.5 is reached after approximately 10 regenerators for $Q = 30$ and after approximately 15 regenerators for $Q = 100$. The OTN hypothetical reference model (HRM) for regenerator jitter accumulation consists of 50 3R regenerators (see Appendix III/G.8251). The jitter accumulation for 8 MHz bandwidth and $Q = 30$ or 100 is between 1.5 and 2 after 50 regenerators. Therefore, the high-band jitter network limit for OTU2 is not met for the OTN HRM and regenerator bandwidth of 8 MHz. It was found for OTN that choosing the OTU2 bandwidth to be 1 MHz would provide for acceptable jitter accumulation. These results are shown in Figure IV.2-6b/G.8251; for regenerator bandwidth of 1 MHz the normalized jitter accumulation is very close to 1.0 after 50 regenerators (in fact, the normalized jitter accumulation is approximately 1.2 after 200 regenerators for $Q = 30$, and less for the higher values of Q). In addition, Figure IV.2-6b shows that the normalized wide-band jitter accumulation is approximately 3.2 after 50 3R regenerators for $Q = 30$ and 100, and approximately 4.8 after 100 3R regenerators for $Q = 30$ and 100. This means that the wide-band jitter network limit requirements are also met for the 50 regenerator HRM. The actual wide-band jitter will be somewhat lower, because the results in Appendix IV/G.8251 show that if the high-band jitter generation requirement is just met, the worst-case ratio of wide-band to high-band jitter generation (worst-case among all the noise models considered here) is approximately 1.25. The actual wide-band jitter generation is allowed to be 3 times the high-band jitter generation (0.3 versus 0.1); therefore, the wide-band jitter accumulation will be below the network limit by an additional factor of 1.25/3.0.

The above results indicated that, while a jitter transfer bandwidth of 8 MHz for OTU2 regenerators would not provide for acceptable jitter accumulation, a bandwidth of 1 MHz would provide for acceptable accumulation. On this basis, the OTU2 jitter transfer bandwidth (specifically, the ODCr bandwidth for OTU2) was specified as 1 MHz in Table A.5/G.8251.

The rate for STM-64 is very close to the OTU2 rate (the latter exceeds the former by approximately 7.6%; see above). Also, the jitter generation requirements for STM-64 (Type A), Options 1 and 2, and OTU2 regenerators are the same. In addition, the jitter network limits for STM-64 and OTU2 are the same. Then, if the jitter transfer bandwidth and gain peaking for STM-64 (Type A) regenerators are chosen to be the same as for OTU2 3R regenerators (i.e. 1 MHz and 0.1 dB, respectively), the jitter accumulation over respective HRMs consisting of the same number of regenerators should be approximately the same in both cases. Since the OTU2 jitter accumulation over an HRM of 50 regenerators is acceptable with the above parameters, the STM-64 (Type A) jitter accumulation over an HRM of 50 regenerators will also be acceptable with the above parameters.

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