

Proposal of low frequency jitter specifications for 10G-EPON

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Current status and issue (1)

Currently, we don't have low frequency jitter specifications.
Because a receive circuit, clock and data recovery (CDR), can track it.

(1) But, can it track any large jitter at any point of frequency ?

-> The answer is no, obviously.

(2) The jitter specification is one of necessary interface rules between OLT and ONUs.

Then, why don't we have some rules for low frequency jitter ?

(1) Receiver side (jitter tolerance):

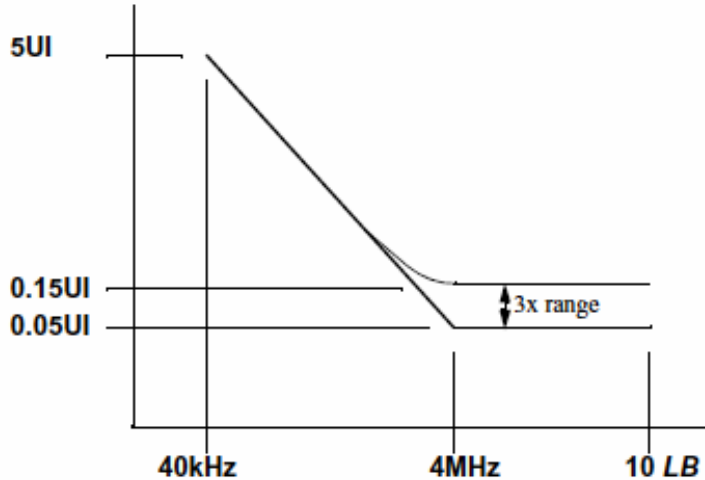
We already have a specifications for stressed receiver conformance test.

(2) Transmitter side (jitter generation):

Referring other standard, we already have specifications for transmitter.

(ex. ITU-T G.783)

Current status and issue (2)



Mask of the sinusoidal component of jitter tolerance

*: excerpted from Figure52-4 in 802.3 std.

Frequency Range	Sinusoidal Jitter (UI pk to pk)
$f < 40\text{kHz}$	NA
$4\text{ MHz} < f < 10\text{ LB}^a$	$0.05 \leq S \leq 0.15^b$
$40\text{ kHz} < f \leq 4\text{MHz}$	$2 \times 10^5 / f + S - 0.05^b$

^aLB = Loop Bandwidth; Upper frequency bound for added sine jitter should be at least 10 times the loop bandwidth of the receiver being tested.

^bS is the magnitude of sine jitter actually used in the calibration of the stressed eye per the methods of 52.9.10.2.

Applied Sinusoidal Jitter

*: excerpted from Table52-19 in 802.3 std.

Table 9-6/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 2 and 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 (Note 4)	FFS	FFS	FFS
	16 000	320	0.10

NOTE 1 – The high-pass and low-pass measurement filter transfer functions are defined in clause 5/G.825.

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.

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

*: excerpted from table9-6/G.783 in ITU-T Recommendation G.783

Proposal of low jitter specification(1)

(1) For receive side :

Define the “Mask of the sinusoidal component” as the jitter tolerance specification.

-> For modification of draft, we should add the following sentence to clause 91.7, and add new table as below Figure 91-xx.

“The jitter tolerance under the condition including lower band than corner frequency for 10GBASE-PR10/20/30 are specified in Table 91-xx.”

Table91-xx Jitter tolerance for 10G downstream and upstream

Component		Qty (UI) (p-p)	
		Downstream(TP3)	Upstream(TP7)
Sinusoidal Applied Jitter (S) Sweep from 40kHz to 10LB		See Figure 52-4 and Table 52-19	
Non-Sinusoidal Deterministic Jitter (DDJ)		J-S ^b	J-S ^b
Random Jitter	Bandwidth includes 40kHz to Fc/2 ^c	TBD	TBD
	Bandwidth includes 4MHz to Fc/2 ^c	0.55-J	0.50-J
For SINE > 4MHz the Total is: ^d		0.55	0.50

Note: a) J is stressed eye jitter, see Table91-6 and Table91-11.

b) Value of S for calculation of DDJ is in range of 0.05 to 0.15 .

c) Fc is signalling speed of 10.3125GHz.

d) This value assigned in accordance with the latest jitter budget table.

e) The value for parameters of S, J should be identical to the values used for stressed receiver conformance test.
The optical conditions also should be corresponding to the test.

The value for RJ including lower band can be specified by integral calculation using value for higher band.

Proposal of low jitter specification(2)

(2) For transmitter side :

Define an additional reference point for low frequency jitter generation as same as ITU-T. But the value should be modified to meet with the tolerance mask.

-> Value larger than 1.0 UI p-p is not good because it cannot be measured.

-> In accordance with tolerance mask,

0.5UI at 400kHz of sinusoidal component is reasonable.

(In the current jitter budget, 0.1 UI of sinusoidal jitter stress is assumed at the receiver.)

-> For modification of draft, we should add new table as below Figure91-yy to clause 91.7.

Table91-yy Jitter generation for 10G downstream and upstream

Interface	Measurement band (kHz) (high-pass)	Peak-peak amplitude (UI)
PR10,20,30 downstream (TP2)	400	0.75
	4000	0.35 ^a
PR10,20,30 upstream (TP6)	400	0.80
	4000	0.40 ^a

Note a) This value assigned in accordance with the latest jitter budget table.

Conclusion

We proposed the low frequency jitter specifications for 10G-EPON.

(1) For receive side, additional text and new table (91-xx) including jitter component is proposed.

(2) For transmitter side, additional new table (91-yy) including low frequency jitter generation is proposed.

*: All the values specified in new table should be modified if the values corresponding parameters in jitter budget table are updated.

Straw poll

Additional low frequency jitter specifications for 10G-EPON :

- (1) Should be specified for receive side**
- (2) Should be specified for transmit side**
- (3) Not necessary (receive side nor transmit side)**
- (4) Needs more investigations**
- (5) No opinion**