CL163 Comment Discussion

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Comments Overview

- CL163 COM parameters: 53, 206, 262, 263, 264
- [*156, 38] [157]

Comment #53

Cl **163** *SC* **163.10** *P* **184** *L* **4** # 53

Mellitz, Richard Samtec

Comment Type **TR** *Comment Status* **D** *package parameter*

Much work has been done on 100G package model. Parameters in table 163-10 were based on package transmission line losses different the specified in table 93A-3. The table 93A-3 values were suggested in benartsi_3ck_adhoc_01_121218 and benartsi_3ck_01_0119.

SuggestedRemedy

Add line: The package transmission line, s^(l)(f), uses table 93A-3 but replaces values for a_1 and a_2 with 0.0009909 and 0.0002772 respectively.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Table 93A–3—Transmission line model parameters and values

Parameter	Value	Units
γ_0	0	1/mm
a_1	1.734×10^{-3}	$ns^{1/2}/mm$
a_2	1.455×10^{-4}	ns/mm
τ	6.141×10^{-3}	ns/mm

References:

benartsi_3ck_01_0119

Spec under discussion

163.10 Channel characteristics

The Channel Operating Margin (COM) is computed using the procedure in 93A.1 with the values in Table 163–10, where T_r is TBD ps for $H_t(f)$ as used in Equation (93A–19). COM shall be greater than or equal to 3 dB.

package_tl_gamma0_a1_a2	[0 0.0009909 0.0002772]	
package_tl_tau	6.14E-03	ns/mm
package_Z_c	[87.5 87.5 ; 92.5 92.5; 100 100 ; 100 100]	Ohm (tdr sel)

Comment #206

Cl **163** *SC* **163.10** *P* **184** *L* **14** # 206

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type **TR** *Comment Status* **D** *COM parameter*

COM receiver reference model does not excite common mode and model is fully symmetrical between P/N. Unless COM reference model has common mode excitation only differential aspect of the S4P exercised.

SuggestedRemedy

Non-idealities in COM can be introduced by following:
-Termination mismatch P/N 3%
- Package P +/- 10%
-Package N +/- 10%
But the total RLM should still be 95%.

Proposed Response *Response Status* **W**

PROPOSED REJECT

COM mode impairment is indeed not fully considered in COM. However the suggested remedy does not provide clear information to implement.

Spec under discussion

Device package model			
Single-ended device pad capacitance	C_d	1.2×10^{-4}	nF
Single-ended device series inductance	L_s	0.12	nH
Single-ended device bump capacitance	C_b	3e-5	nF
Transmission line length, Test 1	z_p	12	mm
Transmission line length, Tx Test 2	z_p	31	mm
Transmission line length, Rx Test 2	z_p	29	mm
Single-ended package capacitance at package-to-board interface	C_p	8.7×10^{-5}	nF
Transmission line characteristic impedance	Z_c	87.5	Ω
Transmission line 2 length	z_{p2}	1.8	mm
Transmission line 2 characteristic impedance	Z_{c2}	92.5	Ω
Single-ended reference resistance	R_0	50	Ω
Single-ended termination resistance	R_d	50	Ω

Comment #262

Cl **163** *SC* **163.10** *P* **185** *L* **33** # 262

Dawe, Piers Nvidia

Comment Type **TR** *Comment Status* **D** *COM parameter*

The analysis that led to the equalizer length choice needs to be revisited with the new COM.

SuggestedRemedy

If there is a significant improvement with the latest COM, remove positions 25-40 and define positions 13-24 as the tail, with 2 or 3 floating groups of 3 taps and an RSS limit.

Proposed Response *Response Status* **W**

PROPOSED REJECT

This comment does not provide sufficient evidence the suggested remedy will not disqualify channels the task force has agreed to pass.

For task force discussion.

Spec under discussion

Decision feedback equalizer (DFE) length	N_b	12	UI
Normalized DFE coefficient magnitude limit $n = 1$ $n = 2$ $n = 3$ to N_b	$b_{max}(n)$	 0.85 0.3 0.2	—
Number of DFE floating tap banks	N_{bg}	3	—
Number of DFE floating taps per bank	N_{bf}	3	—
DFE maximum span including floating taps	N_f	40	UI
Normalized coefficient magnitude limit for DFE floating taps	b_{gmax}	0.05	—
DFE floating tap tail root-sum-of-squares limit	σ_{tmax}	0.02	—
DFE floating tap tail starting position	N_{ts}	25	—

Comment #263

Cl **163** *SC* **163.10** *P* **185** *L* **34** # 263

Dawe, Piers Nvidia

Comment Type **TR** *Comment Status* **D** *COM parameter*

The spec allows a channel to have its COM calculated with 9 taps in the range 13 to 24 clipped at +/-0.05 - which means that the channel's pulse response could be a little worse than +/-0.05 for these taps. That's a very bad channel! We don't need to provide all the receiver power and complexity to cope with it.

SuggestedRemedy

Use another DFE root-sum-of-squares limit for positions 13-24.

Proposed Response *Response Status* **W**

PROPOSED REJECT

The suggested remedy does not provide clear information to implement. Study results are needed to determine a threhsold.

Spec under discussion

Decision feedback equalizer (DFE) length	N_b	12	UI
Normalized DFE coefficient magnitude limit $n = 1$ $n = 2$ $n = 3$ to N_b	$b_{max}(n)$	 0.85 0.3 0.2	—
Number of DFE floating tap banks	N_{bg}	3	—
Number of DFE floating taps per bank	N_{bf}	3	—
DFE maximum span including floating taps	N_f	40	UI
Normalized coefficient magnitude limit for DFE floating taps	b_{gmax}	0.05	—
DFE floating tap tail root-sum-of-squares limit	σ_{tmax}	0.02	—
DFE floating tap tail starting position	N_{ts}	25	—

Comment #264

Cl **163** *SC* **163.10** *P* **185** *L* **36** # 264

Dawe, Piers Nvidia

Comment Type **TR** *Comment Status* **D** *COM parameter*

As the effect of exceeding the DFE floating tap tail root-sum-of-squares limit increases parabolically as the channel exceeds the limit, the limit must be set a little lower than the worst channel we wish to allow to have an effect at the right point. OAch4 with COM 2.75 gave an unconstrained RSS_tail of 0.022. Setting the limit 0.01 lower than that might affect its COM by 0.1 dB (vs. no limit) which seems like a gentle effect. However, it seems that the latest COM gives a more optimistic result anyway; this channel may not need the tail taps at all.

SuggestedRemedy

If there is no improvement with the latest COM, change the DFE floating tap tail root-sum-of-squares limit to 0.012.
If there is a small improvement with the latest COM, further reduce the limit accordingly.
If there is a significant improvement with the latest COM, remove taps 25-40 and apply a tail tap RSS limit to positions 13-24.

Proposed Response *Response Status* **W**

PROPOSED REJECT

The simulations to make the determinations in the suggested remedy are not available.

Spec under discussion

Decision feedback equalizer (DFE) length	N_b	12	UI
Normalized DFE coefficient magnitude limit $n = 1$ $n = 2$ $n = 3$ to N_b	$b_{max}(n)$	 0.85 0.3 0.2	—
Number of DFE floating tap banks	N_{bg}	3	—
Number of DFE floating taps per bank	N_{bf}	3	—
DFE maximum span including floating taps	N_f	40	UI
Normalized coefficient magnitude limit for DFE floating taps	b_{gmax}	0.05	—
DFE floating tap tail root-sum-of-squares limit	σ_{tmax}	0.02	—
DFE floating tap tail starting position	N_{ts}	25	—

Comment #156

Cl **163** *SC* **163.9.2.3** *P* **181** *L* **53** # 156

Ran, Adee

Intel

Comment Type **T** *Comment Status* **D** *RITT*

The Rx test channel is calculated excluding the Rx device package model, and with a transition time filter with Tr=TBD. In 802.3cd this Tr was based on measurement at TP0, which may be after a package of a compliant device (this may be more representative than an instrument-grade transmitter).

The measured transition time at TP0 does not represent all the signal integrity effects of 100G packaged devices and test fixtures. Omitting a package model altogether and using only the transition time filter and ideal termination would not model internal reflections or reflection of signal returning from the test channel. This would lead to an optimistic COM result which may require addition of noise.

If the signal source does include a package or any other discontinuity then in practice there will be reflections and the signal will be worse than what COM (without package) predicts, resulting in overstressed test.

In the test method of annex 93C, this issue has been addressed by the statement "… the transmitter package model is included only if a compliant transmitter with a similar termination is used. If a transmitter with high quality termination is used... the termination is modeled as ideal and a Gaussian low pass filter is added". But later KR clauses (starting at 111) removed this condition and required using only a transition time filter, with value calculated from a measurement at TP0a. This may not be justifiable anymore with 100G devices.

If the signal source used in a test is a device which has known internal discontinuities modeled as s-parameters (e.g. from extraction, s-parameter measurement, or calculation from measured Tx output) then these s-parameters should be included in the calculated test channel.

SuggestedRemedy

Replace item d with the following:

d) In the calculation of COM (list item 7 in 93A.2), if the transmitter is a device with known s-parameters and transition time, these parameters should be used instead of the transmitter package model in 93A.1.2. If the transmitter is a packaged device with unknown parameters, then the package model in 93A.1.2 is used, with zp of test 1 in Table 163–10 and Tr as specified in 163.10. If a calibrated instrument-grade transmitter is used, the transmitter termination is modeled as ideal and a Gaussian low pass filter is added as defined in 93A.2.

Similar changes may also be required for clause 162 and annex 120F, with possible modifications as necessary.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement suggested remedy.

For task force disussion.

Comment #38 discusses the same topic.

Comment #156

Spec under discussion

163.9.2.3 Receiver interference tolerance

Receiver interference tolerance is defined by the procedure in Annex 93C with the exception that transmitter equalization is configured by management (see 120D.3.2.3) to the settings that provide the lowest FEC symbol error ratio. The receiver on each lane shall meet the FEC symbol error ratio requirement with channels matching the Channel Operating Margin (COM) and loss parameters for Test 1 and Test 2 in Table 163–8. The following additional considerations apply to the interference tolerance test.

a) The test transmitter is constrained such that for any transmitter equalizer setting the differential peak-to-peak voltage (see 93.8.1.3) is less than or equal to 800 mV.

b) The return loss of the test setup in Figure 93C–4 measured at TP5 replica towards TPt meets the requirements of Equation (163–2).

c) The lower frequency bound for the noise spectral density constraints, f_{NSD1}, is 1 GHz.

d) The transmitter device package model $S^{(tp)}$ is omitted from Equation (93A–3) in the calculation of COM. The filtered voltage transfer function $H^{(k)}(f)$ calculated in Equation (93A–19) uses the filter $H_t(f)$ defined by Equation (93A–46), where T_r is calculated as Tr = TBD ps and T_{rm} is the measured 20% to 80% transition time of the signal at TP0a. T_{rm} is measured using the method in 120E.3.1.5. T_{rm} is measured with transmitter equalizer turned off.

$$S_p^{(k)} = \text{cascade}(\text{cascade}(S^{(tp)}, S^{(k)}), S^{(rp)}) \quad (93A–3)$$

$$H^{(k)}(f) = H_{ffe}(f)H_t(f)H_{21}^{(k)}(f)H_r(f)H_{ctf}(f) \quad (93A–19)$$

$$H_t(f) = \exp(-2(\pi f T_r/1.6832)^2) \quad (93A–46)$$

Possible Response

Change bullet d) to:

d) In the calculation of COM, if the transmitter is a device with known s-parameters and transition time Tr, these parameters should be used instead of the transmitter package model in 93A.1.2. If the transmitter is a packaged device with unknown parameters, then the package model in 93A.1.2 is used with parameters as specified in 163.10 and zp of test 1 in Table 163–10 and. If a calibrated instrument-grade transmitter is used, The transmitter device package model *S*(*tp*) is omitted from Equation (93A–3) in the calculation of COM. The filtered voltage transfer function *H*(*k*)(*f*) calculated in Equation (93A–19) uses the filter *Ht*(*f*) defined by Equation (93A–46), where *Tr* is calculated as Tr = 1.09*Trm-4.32 ps and *T*rm is the measured 20% to 80% transition time of the signal at TP0a. *T*rm is measured using the method in 120E.3.1.5. *T*rm is measured with transmitter equalizer turned off.

Apply the change to 120F.

Comment #38

Cl **162** *SC* **163.9.2.3** *P* **181** *L* **53** # 38

Ben Artsi, Liav Marvell Technology

Comment Type **T** *Comment Status* **D**

Stating that the transmitter device package model S(tp) is omitted from Equation (93A–3) in the calculation of COM practically penalizes cases which use "golden device" as the transmitter for interference tolerance testing

SuggestedRemedy

Change the sentence to:
"It is the test implementor's responsibility to adjust Tx package parameters to best match the actual driver package used for testing alongside parameters which will calibrate tx waveform to match the one supplied at TP0v, orelse transmitter device package model S(tp) should be omitted from Equation (93A–3) in the calculation of COM

Proposed Response *Response Status* **W**

PROPOSED ACCEPT

[Editor's note: The subclause was changed from 163.9.2.3.]

Resolve using the response to comment #156.

Comment #157

Cl **163** SC **163.9.2.3** P **182** L **49** # **157**

Ran, Adee Intel

Comment Type **T** *Comment Status* **D** *TF RL*

"The return loss of the test setup in Figure 93C–4 measured at TP5 replica towards TPt meets the
requirements of Equation (163–2)."

Equation (163–2) is the reference return loss of a transmitter test fixture. It is irrelevant here, as the test channel at TP5 is a channel, not a transmitter.

The channel has ERL requirements, and no RL requirements.

SuggestedRemedy

Change the quoted sentence to

"The effective return loss of the test setup in Figure 93C–4 measured at TP5 replica towards TPt meets the
requirements of 163.10.2."

Proposed Response *Response Status* **W**

PROPOSED REJECT.

For task force discussion whether RL should be replaced by ERL for replica channels.

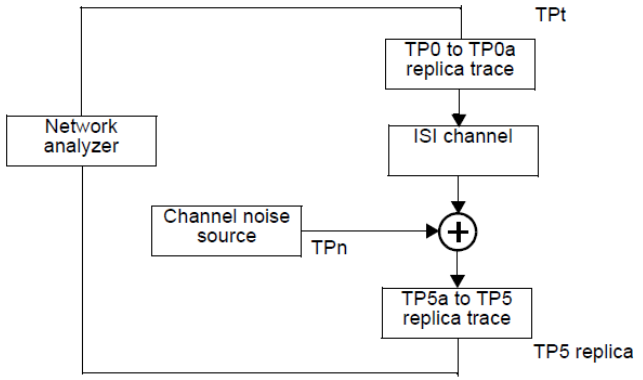

Figure 93C–4—Interference tolerance channel s-parameter test setup

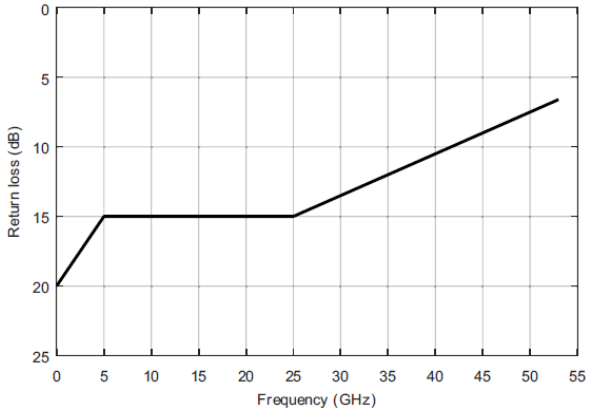

Figure 163–5—Test fixture reference return loss limit

Spec under discussion

163.10.2 Channel ERL

ERL of the channel at TP0 and at TP5 are computed using the procedure in 93A.5 with the values in Table 163–11. Parameters that do not appear in Table 163–11 take values from Table 163–10. The value of T_{fx} is 0.