

# 100G BASE-KP4 Interference tolerance ad hoc

2013 January 22

Mike Dudek      Qlogic

Charles Moore   Avago

1. Summary of activity
2. Response to comment 224 and related comments
3. Responses to other comments

# 1. Summary of activity

Four phone conferences were held. The following attended one or more meetings:

|                    |          |                     |                |
|--------------------|----------|---------------------|----------------|
| Adam Healey        | LSI      | Adee Ran            | Intel          |
| Ali Ghiasi         | Broadcom | Beth Kochuparambili | Cisco          |
| Charles Moore      | Avago    | Chung-Jue Chen      | Broadcom       |
| Magesh Valliappan  | Broadcom | Jeff Slavick        | Avago          |
| Liav Ben-Artzi     | Marvell  | Matt Brown          | APM            |
| Megha Shanbhag     | TE       | Mike Dudek          | QLogic         |
| Mike Li            | Altera   | Piers Dawe          | IPtronics      |
| Rich Mellitz       | Intel    | Rick Rabinovich     | Alcatel-Lucent |
| Vasu Parthasarathy | Broadcom | Wheling Cheng       | Juniper        |
| Will Bliss         | Broadcom |                     |                |

# 1. Summary of activity

- Discussion of adding low frequency jitter tolerance measurement at several meetings with growing support. See comments 109, 133, and 140.
- Discussion of form of Tx SNDR calibration noise source, leading to general agreement to do away with PRBS and sinusoid components and use only Gaussian noise, see comments 269 and 270
- Discussion of Use of COM to calibrate noise level in interference tolerance test, see comments 19, 21, and 34
- Other discussion including response to comment 224

## 2. Response to Comment 224

This comment asks us to respond to the editor's note in 94.3.13.4 Receiver interference tolerance test method, quoted below:

*“The Frequency dependent attenuation should be at least two different channels one long, one short. It should include degradations that will require a reasonable amount of equalization.*

*The test setup does not include jitter generation, but instead relies upon the additive noise sources to emulate jitter.*

*Discussion regarding the inclusion and form of various impairments is ongoing.*

*The method for calibration of the channel interferer is required as COM does not provide this.”*

Comment 224 suggested no specific remedy but comments by members of the group proposed remedies which cover these points:

## 2. Response to Comment 224 (continued)

*“The Frequency dependent attenuation should be at least two different channels one long, one short. It should include degradations that will require a reasonable amount of equalization.”*

The ad hoc responds

“Comment 20 addresses this with descriptions of two channels and values for COM as tested.

In addition comment 33 specifies added impairments which test operation of receiver DFE equalization although the specified remedy may be insufficiently complete without additional supporting material.

Comment 223 also raises this issue but without specific remedy.”

## 2. Response to Comment 224 (continued)

*“The test setup does not include jitter generation, but instead relies upon the additive noise sources to emulate jitter.”*

The ad hoc responds:

“COM, which is used to calibrate the additive noise, models jitter as noise scaled to signal amplitude. See equation 93A-23 and 93A-26. The values  $\sigma_{RJ}$  and  $A_{DD}$  normally represent worst case RJ and DJ, respectively. When annex 93A is used to calibrate COM for interference tolerance testing we could use:

$$\begin{aligned}\sigma_{RJ} &= RJ_{RMS\_actual} \\ A_{DD} &= 0.5 * DJ_{peak-peak\_actual}\end{aligned}$$

to make a reasonable allowance for jitter. Comment 21 could be hijacked to add this. (note: values subscripted “actual” are measured values for Tx actually used in test. These values are used in lieu of worst case jitter values used in computing COM for channels.) This change does not fully answer the note but does put the jitter emulation in line with what is used in COM.

Also comments 109, 133, and 140 propose low frequency Jitter tolerance specification/testing.”

## 2. Response to Comment 224 (continued)

*“Discussion regarding the inclusion and form of various impairments is ongoing.”*

The ad hoc responds:

“Several comments were submitted which act upon this ongoing discussion:

Comments 109, 133, and 140 cover low frequency jitter tolerance.

Comment 33 covers channel reflection tolerance.

Comment 270 removes the Sine interferer and 1G PRBS based on the ad hoc discussions.

Comment 269 clarifies the purpose of the Gaussian noise source.”



## 2. Response to Comment 224 (continued)

*“The method for calibration of the channel interferer is required as COM does not provide this.”*

The ad hoc responds:

“Comment 21 describes how COM can be modified to provide interferer calibration, and comment 19 describes how the interfering signal can be specified to justify the calibration method defined by comment 21.”

# 3. Responses to other comments

The ad hoc continues:

“In addition:

Comment 32 proposes making the test more realistic by testing all 4 channels at once and measuring BER at the MAC interface.”