Cl **00** *SC* *P* **1** *L* **1** # **1**

Swanson, Steven Corning Incorporated

Comment Type **TR** *Comment Status* **D**

The bulk of the work in 802.3aq to this point has centered on simulations; the technical feasibility of PMDs has not been demonstrated. A motion was passed at the November meeting requiring 802.3aq to demonstrate a 10-12 BER over the rated distance on a specified channel to show interoperability between PMDs of at least three vendors for 10GBASE-LRM to support technical feasibility.

Suggested Remedy

Demonstrate some preliminary level of confidence in interoperability across the compliant parameter space. Provide data from at least three implementers, compliant to measurement techniques specified in the draft standard that demonstrates interoperability with at least three samples per site. The data should prove that vendors who comply with the specified test methodology also comply with the BER and distance requirements per the 802.3aq objectives, PAR and 5 criteria.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **00** *SC* **30** *P* **4** *L* **4** # **2**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

P802.3am D2.1 is now available.

Suggested Remedy

Base future drafts on D2.1 and successors, and P802.3an and P802.3ap as appropriate.

Response *Response Status* **O**

Cl **01** *SC* **1.3** *P* **10** *L* **48** # **3**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

Need to add reference for IEC 61280-4-1, as below:

Suggested Remedy

IEC 61280-4-1 (2003), Fibre-optic communication subsystem test procedures - Part 4-1: Cable plant and links - Multimode fibre-optic cable plant attenuation measurement.

Response *Response Status* **O**

Cl **01** *SC* **1.3** *P* **14** *L* **21** # **4**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

Need to add reference for V.52. But V.52, Characteristics of distortion and error-rate measuring apparatus for data transmission, has been withdrawn and replaced by ITU-T O.153. So, add reference for O.153 as below:

Suggested Remedy

ITU-T Recommendation O.153, 1992 - Basic parameters for the measurement of error performance at bit rates below the primary rate.

Response *Response Status* **O**

Cl **44** *SC* *P* **7** *L* **23** # **5**

Swanson, Steven Corning Incorporated

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

Table 44-4 on Page 7, line 26 adds LRM to a Table from IS 11801; clarification is needed on the meaning of informative vs. normative in this Table.

Suggested Remedy

Clarify differences between the entries for SR, LX-4 and LRM.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **44** *SC* **5** *P* **6** *L* # **6**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

Compare table 44-4 (input as if for ISO/IEC 11801:1995) on p6 of P802.3aq/D1.1 with tables 44-4 and 44-5 of P802.3am/D2.1 (input as if for ISO/IEC 11801:2002). We may have to present our information in a different way, as well or instead of our table 44-4.

Suggested Remedy

Follow guidance from P802.3am.

Response *Response Status* **O**

Cl **68** *SC* *P* *L* # **7**

George, John OFS

Comment Type **TR** *Comment Status* **D**

The design philosophy used to date to calculate the parameters in clause 68 is intended to create a standard that assures 99% of installed fibers will support 10GBASE-LRM to 300 meters based on relaxation of 1 parameter, in this case PIE-D, to the 99% coverage level. However, the precedent of IEEE worst case design philosophy is that at least 99% of installed LINKS will support the standard to it's maximum rated reach, as was done in the following: 1BASE5 ? 99%, 10BASE-T ? 99%, 100BASE-T4 ? 99%, 10GBASE-S over OM3 ? 99.5% of fibers (0.995^2=99% of links). The current design philosophy of 10GBASE-LRM will only will only support 0.99 x 0.99 = 98% coverage.

Suggested Remedy

For all modeling and affected parameters in clause 68, adjust the 99% PIE-D values to assure 99% LINK coverage as required by IEEE worst case design philosophy precedents (10BASE-T, 10GBASE-SR, …….), which thus requires 99.5% coverage for each of the two fibers in the duplex link. For example, this will increase the PIE-D requirement by ~0.3dB for best launch according MC67YY with connectors.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* *P* **17** *L* **15** # **8**

George, John OFS

Comment Type **T** *Comment Status* **X**

It appears launches meeting the proposed center Launch EF specification of 86% within 11 micron radius and 30% within 5 micron radius could suffer >5 dB coupling loss penalty into the singlemode fiber of a mode conditioning patch cord and this should be accounted for in the budget.

Suggested Remedy

Increase Transmit OMA power in table 68-3 and/or decrease min received power OMA power in table 68-4 to account for > 5dB coupling loss of worst case center launch EF from MDI into single-mode fiber of mode conditioning patch cord.

Alternative remedy: For OM-3 optical launch specification in table 68-3 reduce EF 86% radius to <5 microns to minimize coupling loss from MDI into single-mode fiber of mode conditioning patch cord.

Response *Response Status* **O**

Cl **68** *SC* *P* **18** *L* **29** # **11**

George, John OFS

Comment Type **TR** *Comment Status* **D**

The OM1 fiber models (MC54, MC67 and 108) used to calculate the ISI values in table 68-4 are too optimistic compared to PIE-D calculated from real fiber data and will result failure to meet the 99% coverage requirement. Said models predict a 99% PIE-D penalty of 4.7 dB for best launch with connectors, while two independent large sets (>1000 fibers in each case) of real 500 MHz-km OFL compliant fiber data from two manufacturers were shown to have 99% PIE-D of 5.3 and 5.2 dB respectively. Furthermore, for both manufacturers said PIE-Ds calculated from real data are optimistic as the effects of connectors were not included, and the fibers were selected from the center portion of the preform/blank, which produces the highest bandwidth fibers.

Suggested Remedy

The ISI parameters in table 68-4 and figure 68-12 must be changed to reflect a 99% PIE-D calculated from the real fiber data to enable compliant receivers to support the 99% coverage requirment. PIE-D for 99% coverage with best launch must be increased to from 5.25 dB, for center launch to 6.8 dB and for offset launch to 6.2 dB. This is justified based on GT/OFS and Corning PIE-D analysis of randomly selected large data sets of ~1480 and ~1800 real FDDI compliant and randomly selected fibers manufactured in 1998 – 1999.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* *P* **18** *L* **29** # **10**

George, John OFS

Comment Type **TR** *Comment Status* **D**

In table 68.4 and figure 68-12, pre-cursor, post cursor, and symmetrical ISI parameters do not represent worst case finite equalizers and will result in compliance of receivers that will not support the 99% coverage requirement.

Suggested Remedy

Change ISI parameters in table 68.4 and figure 68-12 to those representing worst case impulse responses for finite equalizers to enable a valid compliance test, that assures compliant receivers support >=99% reliable operation over rated reach of installed MMF.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* *P* **18** *L* **29** # **9**

George, John OFS

Comment Type **TR** *Comment Status* **D**

The impulse response candidates used to calculate the ISI parameters in table 68-4 and figure 68.12 do not include any IPRs with > 3.6 dB ISI, resulting in a compliance test that does not support meeting the 99% coverage requirement.

Suggested Remedy

Include >3.6 dB ISI impulse responses in the sieve as these have been shown to exist in significant proportions (>1%) of fibers meeting the 500 MHz@ 1300 nm OFL bandwidth requirement.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **0** *P* **19** *L* # **12**

Pepeljugoski, Petar IBM

Comment Type **TR** *Comment Status* **D**

The specifications for the tarnsmitter and the receiver are based on the assumption that a DFE is used and the PIE-D is used to arrive at the specifications. Other equalizer implementations based on architectures different than that of DFE can potentially pass the comprehensive tests, but at higher failure rates.

Suggested Remedy

I would like to offer two solutions:
1. Preclude the use of architectures other than DFE
2. Show data that the comprehensive receiver tests will weed out receivers that have failure rate higher than the acceptable rate.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **1** *P* **12** *L* **12** # **13**

Gwinn, Joseph Raytheon

Comment Type **E** *Comment Status* **X**

The drawing shows the PMD as a gray shade, not with the claimed hatching.

Suggested Remedy

Change ""hatched"" to ""shaded"".

Response *Response Status* **O**

Cl **68** *SC* **10** *P* **34** *L* # **14**

Fitzgerald, Paul Circadiant Systems, In

Comment Type **E** *Comment Status* **X**

Duplication of footnote numbers:line 3 has reference ""1""; so does line 20.Notes for ""1"" are found in lines 30 and 53.

Suggested Remedy

Renumber references.Minimal replacement: line 3: ""...fiber)[sup]1"" --> ""...fiber)[sup]A"" and line 53: ""[sup]1..."" --> ""[sup]A..""

Response *Response Status* **W**

Cl **68** *SC* **10.3.4** *P* **37** *L* **24** # **15**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

As OM9 and the other OM9 are optional, there should be a 'No' option in the 'Support' column.

Suggested Remedy

Add 'No [ ] twice. Renumber second OM9 to OM10, OM10 to OM11.

Response *Response Status* **O**

Cl **68** *SC* **2** *P* **13** *L* **5** # **16**

Gwinn, Joseph Raytheon

Comment Type **E** *Comment Status* **X**

Sentence reads oddly, lacks a word.

Suggested Remedy

Change to read ""pause_quantum, while including two meters"", the word ""while"" being new.

Response *Response Status* **O**

Cl **68** *SC* **2** *P* **13** *L* **6** # **17**

Fitzgerald, Paul — Circadiant Systems, In

Comment Type **E** *Comment Status* **X**

""... more than 512 bit-times, or one pause_quantum, including two meters of fiber.""The above is unclear with reference to the two meters of fiber.

Suggested Remedy

End the sentence at the end of ""or one pause quantum.""
--- and ---
Append (Insert the sentence): ""This 512 bit-time delay includes the delay of the round-trip through 2 meters of fiber (4 meters of fiber will produce about 15 nanaoseconds of optical delay).""

Response *Response Status* **O**

Cl **68** *SC* **2** *P* **13** *L* **7** # **18**

Swanson, Steven — Corning Incorporated

Comment Type **E** *Comment Status* **X**

Editorial.

Suggested Remedy

Replace ""…for bit_times…"" with ""…for bit-times…""

Response *Response Status* **O**

Cl **68** *SC* **4** *P* **14** *L* **42** # **19**

Gwinn, Joseph — Raytheon

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

We require that there be ""adequate margin"", but fail to say how much margin is adequate.

Suggested Remedy

Provide a minimum margin numerical value, in decibels.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **4** *P* **18** *L* **29** # **20**

George, John — OFS

Comment Type **TR** *Comment Status* **D**

The OM1 fiber models (MC54, MC67 and 108) used to calculate the ISI values in table 68-4 are too optimistic compared to PIE-D calculated from real fiber data and will result failure to meet the 99% coverage requirement. Said models predict a 99% PIE-D penalty of 4.7 dB for best launch with connectors, while two independent large sets (1400 and 1800 fibers respectively) of real 500 MHz-km OFL compliant fiber data from two manufacturers were shown to have 99% PIE-D of 5.3 and 5.2 dB respectively. Furthermore, for both manufacturers said PIE-Ds calculated from real data are optimistic as the effects of connectors were not included, and the fibers were selected from the center portion of the preform/blank, which produces the highest bandwidth fibers.

Suggested Remedy

The ISI parameters in table 68-4 and figure 68-12 must be changed to reflect a 99% PIE-D calculated from the real fiber data to enable compliant receivers to support the 99% coverage requirment. PIE-D for 99% coverage with best launch must be increased to from 5.25 dB, for center launch to 6.8 dB and for offset launch to 6.2 dB. This is justified based on GT/OFS and Corning PIE-D analysis of randomly selected large data sets of ~1480 and ~1800 real FDDI compliant and randomly selected fibers manufactured in 1998 – 1999.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.
Duplicate comment?

Cl **68** *SC* **4.1** *P* **13** *L* **26** # **21**

Swanson, Steven — Corning Incorporated

Comment Type **TR** *Comment Status* **X**

The specification of two optical launch conditions that must be selected by the user in order to mitigate the risk of a link failing does not meet the level of quality and reliability associated with previous standards developed by 802.3.

Suggested Remedy

Replace the third sentence on line 26 with ""To ensure that the specifications of Table 68-3 are met on multimode fiber, the 10GBASE-LRM transmitter output shall be coupled through a single-mode fiber offset-launch mode-conditioning patch cord, as defined in 38.11.4.""
Delete the fourth sentence.

Response *Response Status* **O**

Cl **68** *SC* **4.1** *P* **13** *L* **26** # **22**

George, John OFS

Comment Type **TR** *Comment Status* **X**

Specifying two separate launches for each fiber grade, such launch selected by the user, requires the user to “tune” links to achieve 99% coverage and will lead to confusion and possible market failure. The end user will have to experiment with 4 possible transmitter configurations per link: OSL – OSL, CL – OSL, CL – CL, and OSL – OSL. OM1 and OM2 fibers have been shown by numerous contributions to have lowest PIE-D with OSL, and OM3 fiber has been shown to have lowest PIE-D with centered launch.

Suggested Remedy

Make all required changes to specify one optical launch per fiber type at TP2: For OM1 and OM2 – Offset launch using mode conditioning patch cord as specified in clause 38.11.4 and table 38-13, and for OM3 – centered launch directly into OM3 patch cord. Specifically, eliminate all parameters and associated references to alternative launch in 68.4.1 line 26, table 68-3 and associated footnotes.

Response *Response Status* **O**

Cl **68** *SC* **4.1** *P* **13** *L* **27** # **23**

Swanson, Steven Corning Incorporated

Comment Type **TR** *Comment Status* **D**

The success of 10GBASE-LRM as a standard is based on the ability of customers to purchase system components that meet the specifications in the standard, plug them together and have them work in a predictable, reliable and useful manner. This is often referred to as ""plug and play"" and means being able to replace any one component with another compliant component from another manufacturer and resume predictable, reliable and useful operation. The specification of two optical launch conditions that must be selected by the user in order to mitigate the risk of a link failing does not meet the level of quality and reliability associated with previous standards developed by 802.3. It is important that 802.3aq adhere to the long standing philosophy in 802.3 to employ worst case design values.

Suggested Remedy

Revise the specifications so that fiber, transceiver and launch conditioning methods assure reliable operation under worst case operating conditions. Specific recommendations include:

1. In 68.4.1 and Table 68-3, specify a single launch condition and adjust supportable link lengths accordingly. It is recommended that 802.3aq utilize the mode conditioning patch cord as specified in 38.11.4. This launch condition has proven sufficient for Gigabit Ethernet links and is the only known way to ensure adequate effective modal bandwidth on legacy fibers with laser-based optics. The alternative launch specified in Table 68-3 has proven to be insufficient for this purpose, particularly for OM1 and OM2 fibers. Note also that the current Monte Carlo sets were not designed to proportionally estimate issues with the center of the profile in installed base fibers because the FDDI specification placed virtually no restriction upon the center portion of the profile because the specification is based on an OFL bandwidth requirement for which the lowest order modes, those that travel near the center of the core and are most affected by central profile perturbations, only carry a small percentage of the total power.

2. Provide sufficient data to validate reliable system elements for LRM transceivers and installed optical fiber.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **4.4** *P* **14** *L* **50** # **24**

Fitzgerald, Paul — Circadiant Systems, In

Comment Type **T** *Comment Status* **X**

SIGNAL_DETECT is incompletely specified. Specifically, how quickly must it be able to update its value in response to changing average optical signal strength?

Suggested Remedy

Add sentence:""The SIGNAL_DETECT must assume its value within 1 millisecond at the limiting values specified in Table 68-1.""

Response *Response Status* **O**

Cl **68** *SC* **5** *P* **15** *L* **45** # **25**

Swanson, Steven — Corning Incorporated

Comment Type **T** *Comment Status* **X**

The specification of BER should specify the data pattern in order to be meaningful. Clarification of the term ""link"" is required.

Suggested Remedy

Replace sentence with ""A compliant 10GBASE-LRM link shall have a BER of no more than 10-12 using a PRBS31 data pattern. A link is defined as a specified length of duplex optical cable.""

Response *Response Status* **O**

Cl **68** *SC* **5** *P* **15** *L* **45** # **26**

Gwinn, Joseph — Raytheon

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

We say that the BER must not exceed 10^-12, but fail to say where this is to be measured. Although it is implied in various places, it should be specified, to prevent overly creative interpretations.

Suggested Remedy

Add words specifying, either directly or by normative reference, from where to where the BER is to be measured.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5** *P* **15** *L* **50** # **27**

Cunningham, David — Agilent

Comment Type **TR** *Comment Status* **X**

It is not clear that the PMD shall support all fibers types listed in Table 68-2 and also shall support both launch types of table 68-3.

Suggested Remedy

The PMD shall support all media types listed in Table 68-2 (i.e., 50 um and 62.5 um multimode fiber) according to the specifications defined in 68.8 and 68.9. The PMD shall support both default and alternative launch types listed in Table 68-3. The launches are selected by using either a regular multimode fiber patch cord or a single mode offset launch mode-conditioning patch cord between the MDI and TP2.

Also delete the following from footnote e of table 68-3: The PMD must support both the default and alternative launch types by the use of a single-mode offset-launch mode-conditioning patch cord or a regular multimode fiber patch cord between the MDI and TP2.

Response *Response Status* **O**

Cl **68** *SC* **5** *P* **16** *L* **1** # **28**

Swanson, Steven — Corning Incorporated

Comment Type **TR** *Comment Status* **X**

The current Table 68-2 is confusing and inaccurate.

Suggested Remedy

Separate the two 62.5um fibers into two rows similar to what has been done for 50um.
Attach footnote c to the 200/500 62.5um row, noting that this fiber is also designated OM1 fiber in IS 11801.
Attach footnote d to the 500/500 50um row, noting that this fiber is also designated OM2 fiber in IS 11801.
Attach footnote e to the 1500/500 50um row, noting that this fiber is also designated OM3 fiber in IS 11801.
Do not attach any footnote to 160/500 62.5um or 400/400 50um. Add another column to designate launch condtion; specify MCP as defined in 38.11.4 for 160/500 and 200/500 62.5um, MCP as defined in 38.11.4 for 400/400 and 500/500 50um and Center Launch for 1500/500 50um.

Response *Response Status* **O**

Cl **68** *SC* **5** *P* **16** *L* **20** # **29**

Gwinn, Joseph Raytheon

Comment Type **E** *Comment Status* **X**

For clarity, the ""for information"" note should be set apart from the normative text.

Suggested Remedy

Add a blank line between the first and second sentence (lines 20 and 21).

Response *Response Status* **O**

Cl **68** *SC* **5** *P* **16** *L* **5** # **30**

Pepeljugoski, Petar IBM

Comment Type **E** *Comment Status* **X**

The Channel insertion loss in Table 68-2 is given as a fixed value, not a range, although channels with smaller insertion loss are compliant.

Suggested Remedy

Change the column title to: Maximum channel insertion loss (dB)

Response *Response Status* **O**

Cl **68** *SC* **5** *P* **16** *L* **7** # **31**

Swanson, Steven Corning Incorporated

Comment Type **TR** *Comment Status* **D**

The specification of a single launch for each fiber type necessitates a recalculation of the operating range for the five fiber types.

Suggested Remedy

Insert correct distances in the operating range column based on the defined launch in Table 68-2.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5** *P* **17** *L* **1** # **32**

Pepeljugoski, Petar IBM

Comment Type **T** *Comment Status* **X**

In Table 68-3 the three quantities: Launch power in OMA, Extinction ratio and Average launch power (both minimum and maximum) is redundant, since they are related.

Suggested Remedy

Pick two of the quantities, and delete the last. Suggestion is to eliminate the Extinction ratio.

Response *Response Status* **O**

Cl **68** *SC* **5** *P* **17** *L* **1** # **33**

Pepeljugoski, Petar IBM

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

Table 68-3. I support the inclusion of alternative launch for the three fiber types. However, when the link performance is marginal (say at BER=1e-11), it is not clear how the final user will decide which one to use. From user's perspective, the link will seem to work, although in fact it is not meeting the BER target.

Suggested Remedy

I am not sure how this can be done, but we all need to think about a possible solution, short of having to test all links. Maybe run a link built-in test to flag BER >1e-12?

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5** *P* **18** *L* **1** # **34**

Pepeljugoski, Petar IBM

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

In Table 68-4 the noise bandwidth is given, and the ratio OMA/(2*rms noise). Replace the later with noise power spectral density, since it is a more accurate specification for the noise.

Suggested Remedy

Use noise power spectral density instead of the ratio OMA/(2*rms noise).

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5** *P* **18** *L* **54** # **35**

Swanson, Steven Corning Incorporated

Comment Type **TR** *Comment Status* **X**

All optical Ethernet standards provide a link power budget table. Without this information, the reader of the standard is lost.

Suggested Remedy

Add a Table for the link budget similar to 52-14. It should contain at a minimum the power budget, channel insertion loss, allocation for penalties, and margin. As an alternative, a figure similar to page 5 of http://www.ieee802.org/3/aq/public/nov04/lawton_1_1104.pdf may suffice.

Response *Response Status* **O**

Cl **68** *SC* **5** *P* **19** *L* **27** # **36**

Swanson, Steven Corning Incorporated

Comment Type **T** *Comment Status* **X**

A different test pattern is specified for TWDP and stressed receiver sensitivity.

Suggested Remedy

Specify ""1 or 3"" for both tests.

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **15** *L* **54** # **37**

Cunningham, David Agilent

Comment Type **TR** *Comment Status* **X**

It needs to be clear that the PMD shall support both launches for all fiber types with either a regular patch cord or a mode conditioning patch cord.

Suggested Remedy

The specifications at TP2 shall be met in all four patch cord cases; with a regular multimode patch cord for 62.5 um multimode fiber, with a regular multimode patch cord for 50 um multimode fiber, with an offset-launch mode-conditioning patch cord for 62.5 um multimode fiber and with an offset-launch mode-conditioning patch cord for 50 um multimode fiber.

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **17** *L* **13** # **38**

Swanson, Steven Corning Incorporated

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

The specification of RMS spectral width at 1355nm in Table 68-3 suggests that additional calculations may be necessary to verify assumed penalties.

Suggested Remedy

Run Monte Carlo simulations at 1355nm; the expectation is that the statistics will degrade.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5.1** *P* **17** *L* **15** # **39**

Dudek, Mike Picolight

Comment Type **T** *Comment Status* **X**

Referencing Table 68-3. With the requirement for launch power into the multi-mode fiber to be met with both the offset patch cord and direct launch the Tx output OMA/Power window is getting very small.

Suggested Remedy

Reduce the minimum OMA in Table 68-3 to -5.2dBm and increase the Maximum launch power to +2dBm.

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **17** *L* **30** # **40**

Swanson, Steven Corning Incorporated

Comment Type **TR** *Comment Status* **D**

The transmitter waveform and dispersion penalty (TWDP) is incorrect.

Suggested Remedy

Recalculate the TWDP and insert new value in Table 68-3. Based on actual DMD pulse data from two fiber manufacturers, the value needs to be at least 5.25 dB but it is believed that is also too low for the following reasons:
1. The number is calculated assuming the use of both a default and alternate launch condtion for FDDI fiber; the alternate launch cannot be recommended for FDDI fiber.
2. The number also utilized the Monte Carlo 67YY simulation data and discarded fibers whose ISI exceeded 3.6 dB; the rationale given is that this is the ISI value that is used for LX-4. However, this is not acceptable in that FDDI fiber is only specified using OFL bandwidth and the Monte Carlo distribution should only be truncated based on OFL bandwidth. In addition, several penalties built into the modeling of LX-4 are different than those assumed for LRM. Furthermore, the relationship between LX-4's offset launch bandwidth and ISI was based on modeling that has been shown to be insufficiently rigorous for 10GBASE-LRM and limited fiber index profile data supplied by one manufacturer. The new fiber data provided to 802.3aq is much more extensive and provides actual pulse responses from multiple manufacturers, not just index profiles. The present work cannot be held to assumptions based on inferior data and claim to meet the 5 Criteria.
3. It is not clear where the number comes from except that the example pulses in the Matlab code are the same as those in Table 68-4. Since TWDP is tested in software, it can be tested with a wider variety of pulses.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5.1** *P* **17** *L* **34** # **41**

Swanson, Steven — Corning Incorporated

Comment Type **TR** *Comment Status* **X**

Since a single launch is being specified at 1300nm, there is no need to distinguish between fibers.

Suggested Remedy

Combine the three rows specifying the optical launch into a single row stating: ""Optical launch specification for 50 and 62.5 um fiber"" in column one and ""Mode conditioning patch cord as specified in 38.11.4"" in column two.

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **17** *L* **34** # **42**

Swanson, Steven — Corning Incorporated

Comment Type **TR** *Comment Status* **X**

The specification of two optical launch conditions that must be selected by the user in order to mitigate the risk of a link failing does not meet the level of quality and reliability associated with previous standards developed by 802.3.

Suggested Remedy

Delete the alternative launch specifications for encircled flux (three places).

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **17** *L* **34** # **43**

Dawe, Piers — Agilent

Comment Type **T** *Comment Status* **X**

We need to mention the clause 58 version of the offset-launch mode-conditioning patch cord. The clause 38 version specifies SC connectors, which are not compatible with XFP, and also requires labeling which becomes superfluous if the two ends of the patch cord have different connectors (the wallplate is SC). Clause 58 removes these restrictions but keeps the same performance requirements.

Suggested Remedy

Change '... in 38.11.4' to '... in 38.11.4 or 59.9.5' three times in table 68-3, and once in 68.6.9.1.

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **17** *L* **46** # **44**

Ewen, John — JDS Uniphase

Comment Type **T** *Comment Status* **X**

Table 68-3. Simulations using the OM3 Monte Carlo model suggest there is little or no benefit obtained using the alternative launch. The simulated 99th percentiles of PIE-D for OM3 fiber, using a 1-1-300-1 link configuration with Rayleigh distributed connector offsets truncated at 7um is:center launch: 4.56 dBooffset launch: 6.48 dBo""best"" launch: 4.51 dBoThe improvement in PIE-D is < 0.05dB using the best of either center or offset launch relative to center launch alone.

Suggested Remedy

Delete line 46 from Table 68-3, i.e. delete the text""Alternative Launch"" and ""Mode conditioning patch cord as specified in 38.11.4""

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **17** *L* **49** # **45**

Dawe, Piers — Agilent

Comment Type **T** *Comment Status* **X**

The back reflection condition for RIN was copied from a single mode, highly coherent, PMD type and is not correct in our situation. (And for comparison, 10GBASE_S uses a different kind of launch and does not have a worst-polarization condition in its RIN test.) Only a small fraction of the light passing from the near single mode launch will be in the right MMF modes to be coupled back into the laser after it has travelled hundreds of meters. There are three cases to consider, all with a long link (as with a short link, although reflections could be higher, there is plenty of margin): Offset launch - only a tiny fraction will get back;Accurate center launch, good connectors - most back reflection but equalizer is not working hard; andImperfect center launch, bad connectors - intermediate back reflection, equalizer could be working at its spec limit. Considering the third case, the forward path will divide the light into say 3 mode-groups (6 modes), the receiver might reflect -12 dB, the reverse path will divide the light among a few more modes - say we have 9 modes after the return path. The state of polarization of the light will not be preserved, and only one of two polarization states can perturb the laser. Say 3 spatial modes can couple into the laser. Now, we emulate this with a single-mode, worst-polarization back reflection. The appropriate back reflection is 3/9 * -12 dB * 1/2 = -5-12-3=-20 dB. This is still a little more significant than the reflection from a nearby connector (-20 dB with much less derating for diversity).

Suggested Remedy

Change the Optical return loss tolerance from 12 to 20 dB. Change RIN12OMA to RIN20OMA.

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **17** *L* **53** # **46**

Dawe, Piers — Agilent

Comment Type **T** *Comment Status* **X**

Table 68-3 footnote b says '...TP2. This is after the patch cord, if one is used.' TP2 is always after a patch cord, although there is more than one type of patch cord.

Suggested Remedy

Change to '...TP2. This is after each type of patch cord.'

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **18** *L* **2** # **47**

Swanson, Steven — Corning Incorporated

Comment Type **TR** *Comment Status* **X**

The specification of two optical launch conditions that must be selected by the user in order to mitigate the risk of a link failing does not meet the level of quality and reliability associated with previous standards developed by 802.3.

Suggested Remedy

Delete footnote e.

Response *Response Status* **O**

Cl **68** *SC* **5.1** *P* **20** *L* **7** # **48**

Weiner, Nick — Phyworks

Comment Type **T** *Comment Status* **X**

Figure 68-3. Line indicating maximum allowed rms specral width shows 3.8nm for wavelengths of 1300 nm to 1355 mn. It should show 4nm.

Suggested Remedy

Correct the figure: Line indicating maximum allowed rms specral width to show 4nm for wavelengths of 1300 nm to 1355 mn.

Response *Response Status* **O**

Cl **68** *SC* **5.2** *P* **16** *L* **21** # **49**

Swanson, Steven — Corning Incorporated

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

The informative information on the time varying aspects of channel responses is inadequate.

Suggested Remedy

Provide additional information on the nature of the time varying channel responses.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5.2** *P* **18** *L* **17** # **50**

Dawe, Piers — Agilent

Comment Type **E** *Comment Status* **X**

I think that 'Received power in OMA (overload)' should be of type 'min' not 'max'. e.g. a higher overload performance would be OK.

Suggested Remedy

Change 'max' to 'min'.

Response *Response Status* **O**

Cl **68** *SC* **5.2** *P* **18** *L* **20** # **51**

Swanson, Steven — Corning Incorporated

Comment Type **TR** *Comment Status* **D**

In Table 68-4, clarification is needed on the comprehensive stressed receiver sensitivity.

Suggested Remedy

Recommend that text or a figure be added (see Comment 22) to clarify where this number comes from.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5.2** *P* **18** *L* **29** # **52**

Swanson, Steven — Corning Incorporated

Comment Type **TR** *Comment Status* **D**

Validation of the spacing of the pulses defining ISI generator response is needed.The values suggest that if the EDC chip can support these 3 cases, it can support 99% of the installed base. This seems implausible given the variety of structure that we see, particularly with small pre and post cursors which can be a variety of distances from the main peak.

Suggested Remedy

Verify that 99% of the fiber data set is covered by these three cases.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5.2** *P* **18** *L* **30** # **54**

Cunningham, David — Agilent

Comment Type **TR** *Comment Status* **D**

The three sets of ISI parameters need to be replaced by new ones. At the end of the last meeting it was generally agreed that they were approximate placeholders.In addition, the methodology used to select the ISI stressors is flawed because it does not take into account the purpose of project 10GBASE-LRM per the approved PAR (see text from PAR). The purpose of 10GBASE-LRM dictates a reasonable balance between the following: Support of FDDI-Grade fiber and lower-cost smaller form factor transceivers per the 10GBASE-LRM PAR parts 14 (see quote from PAR).The stress test stressors should not be based on PIE_D values of worst-case link scenarios. Rather to allow lower cost, lower power implementations the stressors should be back-off from the worst-case PIE_D values. This approach would mimic the proven methodology used by Gigabit Ethernet in the original development of SRS conformance tests for Ethernet.The objectives for the stress test should be:a) With reasonable confidence disallow poor EDC implementations (e.g.: insufficiently long FFE in a DFE, very noisy optical-equalizer combinations).b) Ensure that a compliant receiver can recover valid but highly stressed signals. In common with Gigabit Ethernet the LRM stress signals should not be worst-case stress signals.A non-objective for the stress test should be:1) Guarantee conformance to the optical power budget with all noise terms and penalty terms emulated at the worst-case theoretical power budget values in the test.The current stressors and stress test seem to be following the non-objective. As such they are forcing LRM into an impractical, higher cost, non-small form factor compatible manufacturing space. This is not consistent with the PAR.Quote from the 10GBASE-LRM PAR:14. Purpose of Proposed Project:This project will define a lower-cost, 10Gb/s serial PHY that supports a link distance of at least 220m over installed FDDI-grade multimode fiber. The specification should enable migration to smaller form factor pluggable modules.14a. Reason for the standardization project:This project will define a lower-cost, 10Gb/s serial PHY that supports a link distance of at least 220m over installed FDDI-grade multimode fiber. The specification should enable migration to smaller form factor pluggable modules.

Suggested Remedy

I expect three sets of ISI parameters consistent with the 10GBASE-LRM PAR to be documented in a presentation for the meeting.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5.2** *P* **18** *L* **30** # **53**

Dawe, Piers — Agilent

Comment Type **TR** *Comment Status* **D**

The three sets of ISI parameters need to be replaced by new ones for at least four reasons: The three test cases were based on the old Gen54 Monte Carlo model output set, not the current Gen67 one; The test cases were based on offset launch only, not offset and center launch; Our appreciation of the effects of finite equalizers has improved and should be taken into account; Our assumptions about connectors and connector loss were not fully considered in the calculations leading to D1.1.

Suggested Remedy

Three sets of ISI parameters, based on Gen67, offset and center launch, will be documented in a presentation for the meeting. Use these parameters. Revise the TWDP code (p23 line 52 to p24 line 1), figure 68-12 and table 68-6 to match.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **5.2** *P* **18** *L* **30** # **55**

Ewen, John — JDS Uniphase

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

The values of the ISI parameters in Table 68-4 are based on outdated targets. The target values need to be updated to reflect the Gen67YY Monte Carlo delay set. Also, simulation results have shown that the effects of finite equalizers need to be considered when choosing the candidate pulse responses for choosing the ISI parameters.

Suggested Remedy

Update the ISI parameter values in Table 68-4 based on the latest simulation results using Gen67YY and including a consideration of finite EQ performance.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6** *P* **16** *L* **25** # **56**

Swanson, Steven — Corning Incorporated

Comment Type **TR** *Comment Status* **D**

Clause 68.6 contains several new test methods used to validate the performance of a compliant link. To date, it is not clear that 802.3aq has proven the viability of these new optical test methods. In addition, all specified measurements should reference a standardized test procedure.

Suggested Remedy

The following test procedures should be satisfactorily demonstrated in at least three organizations with a high level of confidence in the repeatability and the correlation from site to site:68.6.6 Transmitter waveform and dispersion penalty (TWDP) measurement procedure68.6.8 Transmitter uncorrelated jitter68.6.9 Comprehensive stressed receiver sensitivity and overload

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6** *P* **16** *L* **27** # **57**

Swanson, Steven — Corning Incorporated

Comment Type **E** *Comment Status* **X**

Editorial.

Suggested Remedy

Reword the sentence to read: ""The following definitions and measurement methods apply for the…."

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **16** *L* **38** # **58**

Gwinn, Joseph — Raytheon

Comment Type **E** *Comment Status* **X**

The syntax of the note is a bit strange, appearing to be the splice of two unrelated sentences.

Suggested Remedy

Change note to read: ""Test patterns for specific optical tests are designed to emulate system operation, using standardized data patterns to represent valid 10BASE-R data.""

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **17** *L* **53** # **59**

Zivny, Pavel Tektronix

Comment Type **T** *Comment Status* **X**

The footnote (b) ends with ""These OMA specifications apply at TP2. This is after the patch cord, if one is used."" I believe that the patch cord is not optional.

Suggested Remedy

remove the ""if one is used."" part of the footnote.

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **19** *L* **16** # **60**

Zivny, Pavel Tektronix

Comment Type **T** *Comment Status* **X**

In the table 68.5: The square wave specified is ranging from anything between 4 and 11 UI at each level (most lines of this table) ""to Square, 10 ONEs and 10 ZEROs"".(a) For consistency of result we should agree on one number for all places.(b) For simplicity of design & setup we should agree on one number for all places.(c) Numbers other than 4 and 8 are a problem for a scope with an CR followed by a pre-scaler (most designs; workarounds are possible but not always cheap & easy).(d) Older CRs have a problem locking on the slower square-waves.

Suggested Remedy

Recommend 8 ONEs and 8 ZEROs everywhere. Optionally if this is a legacy issue allow other numnbers for legacy only.

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **19** *L* **41** # **61**

Pepeljugoski, Petar IBM

Comment Type **T** *Comment Status* **X**

In Table 68-5, footnote a), the last sentence says that a balanced pattern is also acceptable. Although small, the unbalance in the PRBS pattern 2^9-1 can cause variety of measurement problems. Those who wish to spend time debugging measurements can continue using the suggested pattern, make the balanced pattern preferable.

Suggested Remedy

Rerplace the last word of the last sentence in footnote a) of Table 68-5 from ""acceptable"" to ""preferred"".

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **19** *L* **5** # **62**

Gwinn, Joseph Raytheon

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

Note ""g"" of Table 68-5 contradicts itself. First it says that the minimum average receive power number is informative, and then it says that one cannot comply with 802.3aq without at least this sensitivity. Yes, but no..? The problem is that notes to tables are normative unless otherwise specified, so this note leaves the reader unclear as to the status of the minimum average receive power. I would guess that this note is the committee's considered opinion on the practical possibility of meeting the normative parts of 802.3aq without at least this sensitivity, but some clarification is needed.

Suggested Remedy

Make note ""g"" informative, and expand it a bit, to fully convey the opinion of the committee.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6** *P* **21** *L* **35** # **63**

Pepeljugoski, Petar IBM

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

The specification for ""the central 0.2 UI..."" is insufficient. It does not specify what is start and end of interval, not to mention that the measured waveform may have duty cycle distortion, in addition to jitter.

Suggested Remedy

Define the center of the eye relative to some markers (can choose for example the mean or median of the signal zero crossings).

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6** *P* **21** *L* **39** # **64**

Pepeljugoski, Petar IBM

Comment Type **T** *Comment Status* **X**

The sentence ""The frequency response of the measurement instrument (e.g. osilloscope) should extend to suitably low frequencies."" does not specify the low frequency cut-off of the instrument. A value should be inserted or acceptable range specified.

Suggested Remedy

Specify the acceptabel range of low frequency cut-off frequencies for the instrument (like 0-30 kHz).

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **21** *L* **41** # **65**

Pepeljugoski, Petar IBM

Comment Type **E** *Comment Status* **X**

The sentence "" A DC coupled instrument is convenient"" should be more informative to the user.

Suggested Remedy

Replace the word ""convenient"" with ""preferable"".

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **21** *L* **49** # **66**

Pepeljugoski, Petar IBM

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

The hit ratio requirement is not suufficient, since it can be achieved with a small number of waveforms, leading to large confidence intervals. As written, one can have only 35 waveforms with one hit and meet the specification.

Suggested Remedy

In addition to the hit ratio, specify the number of waveforms to reduice the confidence intervals of the measurement.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6** *P* **23** *L* **28** # **67**

Gwinn, Joseph Raytheon

Comment Type **TR** *Comment Status* **D**

It's a very bad idea to make computer code written in a non-standardized language normative, because not everybody will know such a language, or run it on an available computer platform, and because the computer language may change and/or the vendor or product or both may vanish over the expected lifetime of the standard.

Suggested Remedy

Make section 68.6.6.2 informative, not normative. Add a normative section that mathematically defines (either directly or by normative reference) the TWDP signal processing algorithm, so that it can be understood by all, and coded in any available language. Description of the algorithm in some kind of simple pseudocode may also be provided, but only the mathematical definition should be normative, to prevent conflicts. It's also useful to provide a worked numerical example, to be used to validate the code, whatever the language.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6** *P* **28** *L* **17** # **68**

Pepeljugoski, Petar IBM

Comment Type **E** *Comment Status* **X**

the expression ""ratio of OMA/(2*rms noise) ratio of the test..."" has some extra words. Rephrase.

Suggested Remedy

Replace to ""... ratio OMA/(2*\sigma_{n}) of the test..."". Instead of rms noise use \sigma_{n}, where \sigma_{n} is teh noise rms amplitude.

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **28** *L* **21** # **69**

Gwinn, Joseph Raytheon

Comment Type **TR** *Comment Status* **X**

The requirement ""the ~ shall be 3.5 dB"" is physically impossible to meet, because no tolerance is specified.

Suggested Remedy

Provide a numerical tolerance range, such as ""3.5 dB, plus or minus 0.1 dB"".

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **29** *L* **23** # **70**

Pepeljugoski, Petar IBM

Comment Type **TR** *Comment Status* **D**

The sentence ""A BER of better than 1e-12 shall be achieved for each case"" is not specific enough. The main question is WHEN and HOW this measurement is done with respect to the internal state of the equalizer (initial coefficient values). The comprehensive test does not have a test for the adaptation algorithm.

Suggested Remedy

The comprehensive test should be rewritten with more rigor.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6** *P* **29** *L* **4** # **71**

Pepeljugoski, Petar IBM

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

The signals shown on Figure 68-12 can be generated exactly only on a computer. No practical signal can meet tyhe specification as written. A mask showing acceptable departures from the waveforms is needed.

Suggested Remedy

Define a mask that the brackets the three signals, so that the implemented signals can pass the specification.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6** *P* **29** *L* **47** # **72**

Gwinn, Joseph Raytheon

Comment Type **E** *Comment Status* **X**

The last line of the title of Figure 68-12 makes no sense to me; perhaps the wrong word was used, or a critical verb is missing. It currently says ""Arbitrary time values and offset for clarity"".

Suggested Remedy

Change to read ""For clarity, arbitrary time values are used, and the curves are offset from one another"". This may be too many words for a figure title, and could be made into a note in the main text.

Response *Response Status* **O**

Cl **68** *SC* **6** *P* **30** *L* **3** # **73**

Gwinn, Joseph Raytheon

Comment Type **E** *Comment Status* **X**

In Table 68-6, there are two ""post-cursor"" columns, which cannot be correct, and ""symmetric"" is missing.

Suggested Remedy

Change ""post-cursor"" in the third column (first ""post-cursor"") to ""symmetric"".

Response *Response Status* **O**

Cl **68** *SC* **6.1** *P* **16** *L* **35** # **74**

Swanson, Steven Corning Incorporated

Comment Type **T** *Comment Status* **X**

Clarification is need on test patterns, specifically why are we specifying a PRBS9 pattern?

Suggested Remedy

Utilize test patterns in 52.9.1.2.

Response *Response Status* **O**

Cl **68** *SC* **6.1** *P* **19** *L* **16** # **75**

Weiner, Nick Phyworks

Comment Type **T** *Comment Status* **X**

No test pattern specified for calibration of noise for comprehensive receiver tests.

Suggested Remedy

New row in Table 68-5: ""Calibration of noise for receiver tests"" ""Square, ten ONEs and ten ZERO's"" ""68.6.9""

Response *Response Status* **O**

Cl **68** *SC* **6.1** *P* **19** *L* **19** # **76**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

In Table 68-5, restricting the measurement of Transmitter uncorrelated jitter is probably unnecessary and there may be practical reasons to prefer another pattern. Although for consistency we might recommend measuring on a transition which is at least 2 UI away from other transitions. I think pattern 3 (PRBS31) might not be wrong in principle but would be too slow for practical use.

Suggested Remedy

Change 'Square' to '1, 2, PRBS9 or square'. Delete 'square wave' twice in 68.6.8.

Response *Response Status* **O**

Cl **68** *SC* **6.1** *P* **19** *L* **27** # **77**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

Judging by the very sparse use of # in 802.3, it seems to be regarded as informal. We don't need it here.

Suggested Remedy

Remove two #s in this table.

Response *Response Status* **O**

Cl **68** *SC* **6.1** *P* **19** *L* **31** # **78**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

In Table 68-5, Pattern 1 subsequence key, there's a typo. The key, 15 bits long, starts 16 bits before its immediate successor. I believe (committee should check) that the right solution is as below. Possibly the more helpful fix, in a binary world, would be to insert the bit (0 or 1) immediately before the present key.

Suggested Remedy

Insert the preceding bit. If this is not known, change '#3242"" to ""#3243"".

Response *Response Status* **O**

Cl **68** *SC* **6.1** *P* **19** *L* **31** # **79**

Ewen, John JDS Uniphase

Comment Type **T** *Comment Status* **X**

The starting bit location for the Pattern 1 subsequence key is incorrect. The key subsequence is 15 bits long and is correct. The pattern starting bit is correct (bit #3258), therefore the starting bit location is incorrect.

Suggested Remedy

Replace ""bit #3242"" with ""bit #3243""

Response *Response Status* **O**

Cl **68** *SC* **6.1** *P* **19** *L* **40** # **80**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

Footnote a of table 68-5 refers to V.52, which has been replaced by O.153. It's worth asking, is PRBS9 defined in any of our other references (see 1.3)?

Suggested Remedy

Assuming it isn't, replace 'V.52' by 'O.153'.

Response *Response Status* **O**

Cl **68** *SC* **6.1** *P* **19** *L* **42** # **81**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

To avoid a Babel of slightly different patterns, we should give more specific guidance in note a to Table 68-5.

Suggested Remedy

Change 'A balanced pattern with one additional bit is also acceptable.' to 'A balanced pattern with one additional zero added to the run of eight zeros is also acceptable.'

Response *Response Status* **O**

Cl **68** *SC* **6.2** *P* **16** *L* **43** # **82**

Zivny, Pavel Tektronix

Comment Type **T** *Comment Status* **X**

Refers to Figure 68-4 on Page 20. Figure 68-4 duplicates a figure already in 802.3ae ""Figure 52–6—Optical modulation amplitude waveform measurement"". Also: Figure 68-4 has the histogram boxes in the wrong place.

Suggested Remedy

(a) Delete figure 68-4.and
(b) Replace references to this figure by reference to the 802.3ae ""Figure 52–6—Optical modulation amplitude waveform measurement"".Alternatively if there's a consensus that the Fig. 52-6 is too unclear then fix it (correct the Fig. 68-4 and put it in as an update for Fig. 52-6).

Response *Response Status* **O**

Cl **68** *SC* **6.2** *P* **16** *L* **43** # **83**

Dawe, Piers — Agilent

Comment Type **T** *Comment Status* **X**

While we use OMA we agreed to stick with the definition in 52. The mean logic ONE and logic ZERO values are NOT measured over flat (steady state) regions of the square wave. Per 52.9.5, OMA is defined over the center 20% of the time interval where the signal is in the high/low state. (See Figure 52–6.)

Suggested Remedy

Change 'Using histograms, the mean logic ONE and logic ZERO values are measured over flat (steady state) regions of the square wave.' to 'Using histograms, the mean logic ONE and logic ZERO values are measured over the center 20% of each of the two time intervals of the square wave.'. Or, delete this sentence and the following one, 'The OMA is the difference between these two means.' In Figure 68-4, show the correct histograms for measuring OMA as well as the flat-region histograms for measuring noise.

Response *Response Status* **O**

Cl **68** *SC* **6.5** *P* **20** *L* **51** # **84**

Swanson, Steven — Corning Incorporated

Comment Type **T** *Comment Status* **X**

Clarification needed for the statement ""Compliance is to be assured during system operation."" Also, clarify the meaning of ""…are likely to give very similar results."".

Suggested Remedy

Modify sentences two and three to read: "" Compliance is to be assured with a BER=10-12 using a PRBS31 data pattern.

Response *Response Status* **O**

Cl **68** *SC* **6.5** *P* **21** *L* **35** # **85**

Zivny, Pavel — Tektronix

Comment Type **T** *Comment Status* **X**

Line starting at line 34 reads: 0 and 1 on the unit interval scale are determined by the eye crossing means.Eye crossing means is a vague term.

Suggested Remedy

Change to Unit interval boundary is determined as the mean of a horizontal histogram at AOP.

Response *Response Status* **O**

Cl **68** *SC* **6.5** *P* **21** *L* **37** # **86**

Zivny, Pavel — Tektronix

Comment Type **T** *Comment Status* **X**

The CR loop BW specification reads:""It should have a high frequency corner bandwidth of 4 MHz and a slope of -20 dB/decade.""Nothing has BW of 4MHz, exactly. Saying ""4MHz or less"" (as done in 802.3ae) is more specific.

Suggested Remedy

Replace by""It should have a high frequency corner bandwidth of 4 MHz or less and a slope of -20 dB/decade.""

Response *Response Status* **O**

Cl **68** *SC* **6.5** *P* **21** *L* **43** # **87**

Abbott, John — Corning Incorporated

Comment Type **T** *Comment Status* **X**

This paragraph mentions the 4th order Bessel-Thompson filter and references STM-64 in ITU-T G 691. There is an explicit description of the filter in 802.3z/D5.0 section 38.6.5 giving H(p) = 105 / [105 + 150y + 45y^2 + 10y^3 + y^4] etc. Is suggested to (a) on line 43 refer to this not as ""a"" 4th order BT filter but as ""the"" 4th BW filter and (b) refer to this other section in the 802.3 document or give the filter explicitly somewhere in clause 68.

Suggested Remedy

(a) change ""a fourth-order"" to ""the fourth-order"" in line 43
(b) refer to section 38.6.5 if that is the same 4th order filter we are considering.
(c) give the explicit definition of the filter somewhere in clause 68.

Response *Response Status* **O**

Cl **68** *SC* **6.5.2** *P* **18** *L* **26** # **88**

Weiner, Nick Phyworks

Comment Type **T** *Comment Status* **X**

The terms ""OMA:(2 x rms noise)"" and ""OMA:(2 x rms noise) ratio"" are used within the document as the name of a signal to noise ratio parameter. This is a very cumbersome name.

The paramter differs from that widely used Q only in the patern used for its measurement. We measure the OMA and noise on the flat potions of a square wave, as opposed to the central portions of an eye created using a PRBS. Thanks to Piers for clarifying this for me.

Suggested Remedy

1)Replace the term ""OMA:(2 x rms noise) ratio"" in Table 68-4 with the symbol Qsq (the sq being a subscript).
2)Add a new footnote to this table entry, with the text ""Qsq = the ratio OMA:(2 x rms noise), calibrated using a square wave, as described in 68.6.9.3.
3)In Table 68-4, footnote d, replace OMA:(2 x rms noise) ratio with Qsq.
4)Page 25, line 38: Replace ""The OMA:(2 x rms noise) ratio is given by:"" with ""Qsq is given by:"".
5)Page 25, equation 68-2: Replace OMA:(2 x rms noise) with Qsq
6)After equation 28-2 include ""where Qsq is the ratio OMA:(2 x rms noise), measured using a square wave, as described here"".
7)Page 25, Equation 68-3: Replace ""OMA:(2 x rms noise)"" with ""Qsq""
8) Page 25, Line 54: Replace ""The OMA:(2 x rms noise) ratio may be .."" with ""Qsq may be .."".
9)Page 26, Equation 68-4: Replace ""OMA:(2 x rms noise) ="" with ""Sqs =""
10)68.6.9.2, page 28, line 18: Replace ""the OMA:(2 x rms noise) ratio of the test signal.."" with ""Qsq of the test signal..""
11)68.6.9.2, page 28, line 38: Replace ""such that the ratio OMA:(2 x rms noise) is that given in Table 68-4."" with ""such that Qsq is that given in Table 68-4.""

Response *Response Status* **O**

Cl **68** *SC* **6.6** *P* **22** *L* **46** # **89**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

Tautology

Suggested Remedy

Shorten the subclause title to 'Transmitter waveform and dispersion penalty (TWDP)'

Response *Response Status* **O**

Cl **68** *SC* **6.6** *P* **22** *L* **51** # **90**

Swanson, Steven Corning Incorporated

Comment Type **TR** *Comment Status* **D**

The first sentence notes that TWDP is measured with ""...standard emulated multimode fibers….""

Suggested Remedy

It is not clear that the 3 typical cases specified are enough to ensure that this is the case; more study is needed.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.6** *P* **22** *L* **52** # **91**

Lindsay, Tom ClariPhy Communicati

Comment Type **E** *Comment Status* **X**

Unnecessary words.

Suggested Remedy

Remove short sentence at end of this line.

Response *Response Status* **O**

Cl **68** *SC* **6.6** *P* **23-5** *L* # **92**

Fitzgerald, Paul Circadiant Systems, In

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

In section 68.6.6.1 there is reference to ""three penalty results"" (page 23, line 26).However the TWDP only computes one result (page 25, line 22).

Suggested Remedy

Somewhere explain that 68.6.6.2 needs to be run three times for coverage of the three cases being compared. The difference in each run is achieved by changing the choice of PCoefs in page 24, line 2.[This is upon visual inspection of the program; I have not run it.]

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.6.1** *P* **19** *L* # **93**

Weiner, Nick Phyworks

Comment Type **T** *Comment Status* **X**

Table 68-5. No test pattern specified for receiver jitter tolerance test. Same patterns as simple receiver test proposed.

Suggested Remedy

New row for Table 68-5:"Receiver jitter tolerance"" ""1 or 3"" ""68.6.11""

Response *Response Status* **O**

Cl **68** *SC* **6.6.1** *P* **23** *L* **26** # **94**

Swanson, Steven Corning Incorporated

Comment Type **E** *Comment Status* **D**

References for Annex 68A are needed.

Suggested Remedy

Include references for Annex 68A to the extent that the Matlab code is emulating a standard procedure.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.6.1** *P* **24** *L* **2** # **95**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

The program presented doesn't calculate for three emulated channels as advertised. Also, the fprintf instruction at the last line is unnecessary and being language specific, hinders the portability of this code. I don't see any ambiguity in what is meant, so I have classed this as an editorial comment.

Suggested Remedy

Delete line 2, 'PCoefs = FiberResp(:, 2);'
At line 15, change 'yout = load(MeasuredWaveformFile);' to 'yout0 = load(MeasuredWaveformFile);'
Just after 'Fgrid = ...', insert two new lines:
'for i=1:3
PCoefs = FiberResp(:,i);'
Change line 23 to:
'yout = real(ifft(fft(yout0).*Hx));'
At the end of the program, replace 'fprintf(1,'TP2 penalty equals %5.4f dB\n', RefSNR-10*log10(Q));' by: ' TrialTWDP(i) = RefSNR-10*log10(Q)); end TWDP = max(TrialTWDP) % End of program

Response *Response Status* **O**

Cl **68** *SC* **6.6.2** *P* **23** *L* **30** # **96**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

MATLAB code was initially written for folks to try it and test it. It should be adapted to better fit the standard.

Suggested Remedy

The comments are not meant to be technical, but since it involves a technical section, I have marked it as such.See separate document ""Tom Lindsay TWDP code comments for D1.1.doc"". Use a fixed pitch font in the standard, as it will greatly improve readability.

Response *Response Status* **O**

Cl **68** *SC* **6.6.2** *P* **23** *L* **52** # **97**

Swanson, Steven Corning Incorporated

Comment Type **TR** *Comment Status* **D**

Matlab code improvements are needed.

Suggested Remedy

Since the matlab code includes values from Table 68-4, there should be a note added to the code that if the values in Table 68-4 change, the code changes. Also, it is believed that a broader variety of fibers should be tested rather than limiting the pulses to a limited set of delta t spacing.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.7** *P* **25** *L* **27** # **98**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

We MUST choose which of these two competing ways of measuring a sort-of signal-to-noise ratio is normative, as there are likely to be discernible differences in results from the two techniques. My vote is for the traditional method, although in practice I might like to use the scope method and correlate across.

Suggested Remedy

Change to 'The system under test shall meet the RINxOMA specification given in Table 68–3, when measured using the procedure given in 58.7.7. A different measurement procedure for the same quantity (which may give approximately the same results) uses the setup shown in Figure 68–8 and proceeds as follows:

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **32** # **100**

Zivny, Pavel Tektronix

Comment Type **T** *Comment Status* **X**

2nd problem in this line is at the end of it.""Using the same square wave, measure the rms noise with a 1 UI histogram in the center, flat region of the logic ONE and logic ZERO portions of the square wave, as indicated in Figure 68–4, compensating for noise in the measurement system.""Compensating for noise in the measurement system is too broad; a noisy system will provide wildly varying answer till enough data is collected.A check for the validity of the result would help.

Suggested Remedy

append to read as this:""Using the same square wave, measure the rms noise with ... histogram in the center, flat region of the logic ONE and logic ZERO portions of the square wave, as indicated in Figure 68–4, compensatingfor noise in the measurement system; acquire enough points to get a result with std. dev. of 100nW or less.""This takes care of both (a) the amount of noise in the module being different one scope to another, and (b) the (related) question of how many points to acquire. The 100nW is simply approx. 1/10th of the measured limit. As an example, I found that on equiplment we (Tek) recommend for this measurement 10k points is enough for a result (the rms noise value) which has std. dev. less than 100nW; on the other hand 2k points was not enough for a reasonaly stable result (deviation of more than 200nW).

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **32** # **99**

Zivny, Pavel Tektronix

Comment Type **T** *Comment Status* **X**

The line specifying the histogram for a noise measurements says:""Using the same square wave, measure the rms noise with a 1 UI histogram in the center, flat region of the logic ONE and logic ZERO portions of the square wave"".This is too specific, and 1 UI wide histogram is arbitrary. Implementations with a very flat waveform can pass with wider histogram; their test time will be shorter - more power to them. Implementer with wrinkles in the waveform would not pass this test - but they should, we are not to say that wrinkles in the wfm fail the SNR spec.

Suggested Remedy

Changel to: ""Using the same square wave, measure the rms noise with a histogram in the center, flat region of the logic ONE and logic ZERO portions of the square wave"".

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **32** # **102**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

Per comment 95 from Vancouver, we agreed to different wording on the histogram width.

Suggested Remedy

Change 1st sentence of paragraph to ""... the rms noise with histograms in the logic ONE..."". Insert a new sentence after the 1st sentence: ""The measurement histograms should be applied over flat regions of the waveform.""

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **32** # **101**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

Contradiction: do we measure in the center region or the flat region? The flattest region is likely to be to the right of center.

Suggested Remedy

Delete 'center, '.

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **38** # **103**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

Crosstalk from Rx could affect the result.

Suggested Remedy

Add a new sentence at the end of the paragaph: ""If it affects the results, the receiver of the system under test should be operational with asynchronous traffic during this test.""

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **39** # **104**

Dawe, Piers — Agilent

Comment Type **T** *Comment Status* **X**

Our notation 'OMA:(2 x rms noise)' though precise is pretty ugly. It would be nicer if we had a neater acronym or a symbol for it. We could use 'SNR/sub/OMA/sub/' meaning like a real SNR but OMA based, or any meaningless letter - suggestions?

Suggested Remedy

Change 'OMA:(2 x rms noise) to 'SNR/sub/OMA/sub/' multiple times, here and in table 68-4.

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **43** # **105**

Lindsay, Tom — ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

TP2 calls agreed that a description is required to suggest how to compensate for scope noise.

Suggested Remedy

Add a sentence just before ""The optical path and detector..."". The new sentence should be ""The method for compensation of measurement system noise should be a simple subtraction of the square of the measurement system noise (with no optical input) from the square of the total measurement noise. This compensation is allowed provided the rms measurement system noise is less than the final rms result.""

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **51** # **107**

Zivny, Pavel — Tektronix

Comment Type **T** *Comment Status* **X**

The line reads:""For the specified measurement setup, the noise bandwidth is approximately 7.5 x 109 Hz.""In this case the measurement setup is a scope with a 7.5GHz BT filter. Such filter has a BW of approx. 10GHz. (for historical reasons the 7.5GHz nr. is really a -1.5dB BW)

Suggested Remedy

Change to read:""For the specified measurement setup, the noise bandwidth is considered to be 10GHz."".(10GHz is a round nr. within 2% of the truth).

Response *Response Status* **O**

Cl **68** *SC* **6.7** *P* **25** *L* **51** # **106**

Lindsay, Tom — ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

DC blocking is recommended to avoid 1/f noise, power supply noise, etc. that will be rejected in normal operation by AC coupling in receivers.

Suggested Remedy

Add and modify words from 802.3ae. Line 51 should be ""...high pass bandwidth due to a DC blocking capacitor. The low-frequency cutoff is recommended to be 1 MHz.""

Response *Response Status* **O**

Cl **68** *SC* **6.8** *P* **26** *L* **26** # **108**

Lindsay, Tom — ClariPhy Communicati

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

The TP2 group has decided that a mixed data pattern is better for this measurement because it is difficult to find and/or build a tracking CRU that will work appropriately on a low frequency square wave.

Suggested Remedy

Change the second sentence in this paragraph to: ""Any edge of Pattern 1 or the PRBS9 test patterns should be used for this test, as specified in Table 68-5.""Also, Table 68-5 should change the patterns for the uncorrelated jitter test to reflect this change, if accepted.Nick - I will generate a new waveform sketch for this, if accepted.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.8** *P* **26** *L* **28** # **109**

Zivny, Pavel — Tektronix

Comment Type **T** *Comment Status* **X**

The specification of the jitter measurement reads:""The uncorrelated jitter is the standard deviation of the distribution. The measurement should be compensated for jitter in the measurement system.""Similarly as with the noise measurement, this measurement also, when ""compensated for jitter in the measurement system"", will produce wild results (passing the bad, failing the good, then vice versa, etc.) till enough data is collected. And again, the 'enough' depends on the intrinsic jitter of the setup.

Suggested Remedy

Append to read""The uncorrelated jitter is the standard deviation of the distribution. The measurement should be compensated for jitter in the measurement system; acquire enough points to get a result with std. dev. of 330fs or less.""Again the std. dev. of the results (another std. dev.) solves the issue; again the std. dev. maximum is 1/10th of the limit itself (the limit is 0.033 UI).

Response *Response Status* **O**

Cl **68** *SC* **6.8** *P* **26** *L* **29** # **111**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

Need a description on how to compensate for scope jitter.

Suggested Remedy

Add a sentence at the end of the paragraph: ""The method for compensation of measurement system jitter should be a simple subtraction of the square of the measurement system jitter (with an ideal input with no jitter) from the square of the total measurement jitter. This compensation is allowed provided the rms measurement system jitter is less than the final rms result.""

Response *Response Status* **O**

Cl **68** *SC* **6.8** *P* **26** *L* **29** # **110**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

We need clock recovery in general for this measurment, but particulary, it is important to specify the tracking performance to avoid an overly pessismistic jitter result.

Suggested Remedy

From 802.3ae, add ""A clock recovery unit (CRU) should be used to trigger the oscilloscope for jitter measurements as shown in Figure 52-9. It should have a high frequency corner bandwidth of 4 MHz and a slope of -20 dB/decade. The CRU tracks acceptable levels of low frequency jitter and wander.""

Response *Response Status* **O**

Cl **68** *SC* **6.8** *P* **26** *L* **29** # **112**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

Crosstalk from Rx could affect the result.

Suggested Remedy

Add a new sentence a the end of the paragaph: ""If it affects the results, the receiver of the system under test should be operational with asynchronous traffic during this test.""

Response *Response Status* **O**

Cl **68** *SC* **6.9** *P* **18** *L* **28** # **113**

Lingle, Jr., Robert OFS

Comment Type **TR** *Comment Status* **D**

The IPRs selected for the comprehensive stressed receiver tests, parameterized in Table 68-4, were selected by the ""sieve"" method described in bhoja_1_0105 and mcvey_1_0105. The three IPRs are intended to represent three broad classes of IPRs characterized by a specified range of PIE-D values. It is necessary that both more and less complex equalizers be adequately challenged by the IPRs brought forward by the sieve. However the finite-length implementation penalty is larger on average and has greater variability for less complex equalizers (e.g. shorter DFE) compared to more complex equalizers (e.g. longer DFE). Therefore it is not the case that all IPRs entering the sieve are equivalent with respect to testing the performance of a less complex equalizer. The IPRs in Table 68-4 (also Figure 68-12 and Table 68-6) may allow an equalizer to pass that will not perform as intended.

Suggested Remedy

The IPR selection procedure (sieve) outlined in mcvey_1_0105, page 3 should include an additional step. After selecting IPRs within a specified range of PIE-D (step2) but before sorting (step3), we should rank order the IPRs by the ideal, finite equalizer penalty incurred by a relatively short DFE such as a 6(T/2)+3, 7(T/2)+2, or 8(T/2)+3 architecture and retain only those in the top quarter of difficulty. Althought vendors may build any type of equalizer in fulfillment of the standard, the 802.3aq group has chosen to use the language and metrics (e.g. PIE-D) associated with the DFE architecture to characterize equalizer performance. Therefore it is natural to use a finite length DFE penalty to approximate the performance of the general non-ideal equalizer of limited complexity.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.9** *P* **18** *L* **28** # **114**

Lingle, Jr., Robert OFS

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

The IPRs selected for the comprehensive stressed receiver tests, parameterized in Table 68-4, were selected by the ""sieve"" method described in bhoja_1_0105 and mcvey_1_0105. The first step is to select IPRs from the offset launch Monte Carlo set with connectors that fall within a +/- 0.25dB range of a fixed PIE-D value. For the three IPRs parameterized in Table 68-4, the PIE-D range was 4.75 +/- 0.25 dB.Recent work on measured fiber DMD data has shown that the 99th% coverage value for PIE-D using the best of center or offset launch is ~ 5.2 dB (balemarthy_1_0105). The PIE-D range from which TP3 test IPRs are selected should run just up to that limit, rendering the center point at 4.95 dB.

Suggested Remedy

Re-run the sieve on the MC set with connectors in the offset launch range using 4.7 to 5.2 dB as the selected PIE-D range.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.9** *P* **18** *L* **28** # **115**

Lingle, Jr., Robert OFS

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

The IPRs selected for the comprehensive stressed receiver tests, parameterized in Table 68-4, were selected by the ""sieve"" method described in bhoja_1_0105 and mcvey_1_0105. One criterion used in selecting the IPR's currently parameterized in the Table 68-4 was to retain in the sieve only those IPRs having ISI penalty less than 3.6dB (see bhoja_1_0105).Sufficient justification has not been brought forward showing that FDDI fibers cannot have ISI penalty greater than 3.6dB. Given that the set of IPRs was previously selected according to their ability to be equalized within a specified PIE-D range, it is not justified to further reject potentially difficult IPRs based on ISI penalty. To do so may remove from consideration IPRs that are within the 99% coverage range, but which may prove difficult for real, finite equalizers.

Suggested Remedy

The sieve procedure should be run again without screening IPRs based on a criteria that ISI must be < 3.6dB. It is possible that this remedy could result in retaining IPRs which are better fit by five peaks rather than four (pepescu_1_0105).

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.9** *P* **26** *L* **54** # **116**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

The description of the stressed receiver method is ambiguous and occasionally inaccurate as sometimes it is describing the ideal-component concepts and sometimes describing implementation options. Editorial: 'are meant to suggest' sounds bad; standards don't 'mean to suggest' they can just say things.

Suggested Remedy

Add another sentence 'The following subclauses describe a conceptual implementation using ideal components. In practice, the frequency responses of all components need to be considered, and alternative implementations are acceptable.' p27 line 10, delete ', as needed,' p27 line 19, change 'are meant to suggest' to 'describe'p27 line 23, delete 'optional'.p27 line 33 figure 68-10, delete 'optional'.

Response *Response Status* **O**

Cl **68** *SC* **6.9.1** *P* **27** *L* **24** # **117**

Fitzgerald, Paul Circadiant Systems, In

Comment Type **TR** *Comment Status* **X**

More explanation of variations possible in the measurement configuration.

Suggested Remedy

Add sentence:""The order of elements in the signal generation path can be altered within the test implementation.""[see later comments of revision of Figure 68-10]

Response *Response Status* **O**

Cl **68** *SC* **6.9.1** *P* **27** *L* **54** # **118**

Swanson, Steven Corning Incorporated

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

The tabulated amplitudes and time values must be verified.

Suggested Remedy

More study is needed.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.9.1** *P* **27** *L* **9** # **119**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

This thing called 'intersymbol interference (ISI)' or 'ISI generator' already has a proper name; it's a transversal filter.

Suggested Remedy

Change multiple occurrences of 'intersymbol interference (ISI)' or 'ISI generator' to 'transversal filter' or 'four-tap transversal filter'. Also in table 68-4.

Response *Response Status* **O**

Cl **68** *SC* **6.9.2** *P* **28** *L* **14** # **120**

Fitzgerald, Paul Circadiant Systems, In

Comment Type **E** *Comment Status* **X**

spelling of ""funtion""

Suggested Remedy

Replace ""funtion"" with ""function""

Response *Response Status* **O**

Cl **68** *SC* **6.9.2** *P* **28** *L* **19** # **121**

Lindsay, Tom — ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

The document allows implementation variations that distribute the stress between the ISI generators and filter(s), so we need to define the noise in a manner that is reasonably independent of this.

Suggested Remedy

Modify to: ""... due to the ISI generator and optional pulse shaping filter, if used, is the value...".Also, add another sentence: ""Refer to clause 68.6.7 for additional guidance on this calibration measurement.""

Response *Response Status* **O**

Cl **68** *SC* **6.9.2** *P* **28** *L* **26** # **122**

Dawe, Piers — Agilent

Comment Type **T** *Comment Status* **X**

This sentence needs its terminology bringing in line with table 68-4, where we went out of our way to say that minimum receiver power is not necessarily the receiver sensitivity (although in the present draft it is). We can be more prescriptive than 'given by'. To address Tom's concern against D1.0, insert 'limit'.

Suggested Remedy

Change to: 'Finally, the OMA of the test signal is set at the limit of comprehensive stressed receiver sensitivity in OMA given in Table 68–4 for the sensitivity tests and at the limit of the received power in OMA (overload) given in Table 68–4 for the overload tests.

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **28** *L* **31** # **123**

Zivny, Pavel — Tektronix

Comment Type **T** *Comment Status* **X**

The line starting with""The test signal may be calibrated using the following steps..."" is vague. 'May' doesn't belong in the standard.Using 'shall' is right.

Suggested Remedy

Change to read""The test signal shall be calibrated using the following steps..""

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **28** *L* **34** # **124**

Dawe, Piers — Agilent

Comment Type **T** *Comment Status* **X**

This way of setting extinction ratio will give a lower extinction ratio than any compliant signal. Editorials: no need to give the same spec three times in three different places, 68.6.3 is not a table.

Suggested Remedy

Change 'The extinction ratio of the optical output with no impairments should be adjusted to a value of 3.5 dB as defined in Table 68.6.3.' to 'The extinction ratio of the optical output with Gaussian filter but without transversal filter should be adjusted to the minimum specified in Table 68-3.'

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **28** *L* **37** # **125**

Zivny, Pavel — Tektronix

Comment Type **T** *Comment Status* **X**

The Gaussian noise generator (and the chain afterwards) is not specified as to the width of its Gaussian-ness. Every realized Gaussian generator clips the tails of the distribution somewhere - e.g. very few systems can support 10 sigma tails, but e.g. five sigma is a sensible requirement. Gaussian generator with very clipped tails (e.g. 3 sigma) will pass this measurement, but not stress the receiver properly.

Suggested Remedy

Add this sence:""The gaussian noise should be sufficently wide that noise levels at 6 StdDev shall be within 50% of their ideal levels.""

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **28** *L* **38** # **126**

Weiner, Nick — Phyworks

Comment Type **T** *Comment Status* **X**

Need to refer to a test pattern for calibration of noise for receiver tests. Also ""level of the Gaussian noise generator .."" is imprecise.

Suggested Remedy

Change ""Without ISI impairment due to the ISI generator, the level of the Gaussian noise generator should be adjusted such that the ratio OMA:(2 x rms noise) is that given in Table 68–4."" to ""Without ISI impairment due to the ISI generator, and using the test pattern specified in Table 68-5, the level of the Gaussian noise should be adjusted such that the ratio OMA:(2 x rms noise) is that given in Table 68–4.""

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **28** *L* **40** # **127**

Zivny, Pavel — Tektronix

Comment Type **T** *Comment Status* **X**

The specification for measuring the noise of the Stressed Eye Generator is too vague:""The measurement should be compensated for noise in the measurement system.""(a) ""should"" is not strong enough; a ""shall"" is necessary here because not doing this results in an optimistic result.(b) The measurement again should be qualified as to its statistical validity.(c) another 'should' ought to be replaced by 'shall' in line 43.

Suggested Remedy

Chage to:""The measurement shall be compensated for noise in the measurement system; enough data will be acquired for the result's standard deviation to be less than 1/10th of measured value.""And in line 43, change""should"" to ""shall"".

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **28** *L* **41** # **128**

Lindsay, Tom — ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

Need to explain compensation for instrumentation noise. Should be consistent with method used in TP2 RIN test.

Suggested Remedy

Add a sentence at end of paragraph: ""The method for compensation of measurement system noise should be a simple subtraction of the square of the measurement system noise (with no optical input) from the square of the total measurement noise. This compensation is allowed provided the rms measurement system noise is less than the final rms result.""

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **28** *L* **52** # **129**

Dawe, Piers — Agilent

Comment Type **T** *Comment Status* **X**

Confusion between ideal components defining waveform and actual components.

Suggested Remedy

Change 'Scal is the calibration test signal from the pattern generator' to 'Scal is an ideal NRZ calibration test signal'. Change 'The bandwidth of, or ...' to 'In practice, the bandwidth of, or ...'.

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **29** *L* **25** # **130**

Dawe, Piers — Agilent

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

These waveforms have been normalised to a peak of 1, giving three different OMAs. It would be more useful to normalise to an OMA of 1.

Suggested Remedy

When calculating the waveforms for the new stressors, normalise to an OMA of 1.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **6.9.3** *P* **29** *L* **4** # **131**

Zivny, Pavel — Tektronix

Comment Type **T** *Comment Status* **X**

The distortion generation has no tollerance. Only the nominal is described - in this:""Figure 68–12 shows the required measured test signals for each of the three cases specified in Table 68–4, where the test signal, Scal, is a single ONE bit (rectangular pulse with 1 UI width) surrounded by ZEROs. Table 68–6 gives the tabulated amplitude vs. time for the curves in Table 68–12.""

Suggested Remedy

Add a tollerance to the signal description. Start with 'all vertical values are withing (10% of PkPk) from nominal' is a proposal to be verified.

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **29** *L* **6** # **133**

Fitzgerald, Paul — Circadiant Systems, In

Comment Type **E** *Comment Status* **X**

Reference to ""Table 68-12""

Suggested Remedy

Replace ""Table 68-12"" with ""Figure 68-12"".

Response *Response Status* **O**

Cl **68** *SC* **6.9.3** *P* **29** *L* **6** # **132**

Dudek, Mike — Picolight

Comment Type **E** *Comment Status* **X**

There is not a Table 68-12. Fig 68-12 appears to be the correct reference

Suggested Remedy

Replace Table 68-12 with Fig 68-12

Response *Response Status* **O**

Cl **68** *SC* **68.5** *P* **16** *L* **8** # **160**

Kolesar, Paul — Systimax Solutions

Comment Type **TR** *Comment Status* **D**

The maximum operating range for 50 um fibers with 500/500 and 400/400 MHz-km modal bandwidths have not beeen substantiated by simulation or experimental data. The properties of populations of these fibers are substantially different from 62.5 um and OM3 fibers so that they must be analized independently for each 50 um fiber type. For example, all specifications for operation on 62.5 and OM3 fibers were based on analysis with fibers having no less than 500 MHz-km bandwidth at 1300 nm. In addition the installed base of 50 um fibers with 500/500 bandwidth has a distincly different bandwidth distribution than that of 62.5 um fibers.

Suggested Remedy

Perform necessary analysis and experiments to determine actual range limnits.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **68.5.1** *P* **17** *L* **44** # **161**

Kolesar, Paul — Systimax Solutions

Comment Type **T** *Comment Status* **X**

The encircled flux specifcation does not explicitly define the fiber type into which the launch must comply.

Suggested Remedy

Change first column entry to: ""Encircled flux into OM3 fiber for default launch""

Response *Response Status* **O**

Cl **68** *SC* **68.5.1** *P* **17** *L* **44** # **162**

Kolesar, Paul — Systimax Solutions

Comment Type **T** *Comment Status* **X**

Encircled flux spec lacks clarity and a reference to a measurement procedure.

Suggested Remedy

Add a footnote to following the term Encircled flux in the first column that states: ""The encircled flux specification defines the native launch directly into an OM3 patch cord when measured per IEC 61280-1-4 or ANSI/TIA/EIA-455-203-2001.""

Response *Response Status* **O**

Cl **68** *SC* **8** *P* **32** *L* **42** # **134**

Dawe, Piers — Agilent

Comment Type **TR** *Comment Status* **X**

The fiber optic cabling model very clearly shows two connections away from the PMD - so there is only one before the long run of building cable. Following precedent, we have added words that allow more connections as long as they meet e.g. overall loss budget, and some concern was expressed at the last meeting as to the wisdom of this. I think in the past, the additional connections might have been cable joints rather than re-mateable connectors. Now, we are learning that, more than recognised for any previous optical PMD, performance is connector limited. The two-connector model is what building wiring standards now recommend, also. This leads us to question to what extent we are burdening the vast majority of users with a concession of interest to only a small minority. The cost of the burden may be made clearer by presentations at the meeting. In practice, because MMF performance covers such a wide range, most 3-connector links are going to work anyway. But we should not over-engineer the PMD spec to indulge them. Maybe a specific better grade of connector can be recommended for such use.

Suggested Remedy

If after review, the situation is as I describe, change 'A channel may contain additional connectors or other optical elements as long as the optical characteristics of the channel, such as attenuation, dispersion, reflections,modal bandwidth and total connector loss meet the specifications.' to 'A compliant channel may not contain additional connectors or other optical elements, although channels with additional elements where the optical characteristics of the channel, such as attenuation, dispersion, reflections,modal bandwidth and total connector loss, meet the specifications, may be found satisfactory. If additional connectors are required, attention should be paid to connector quality.' ; and
In table 68-7, change 'all connectors' to 'two connectors'; and Change 68.9 to 'The fiber optic cabling consists of one or more sections of fiber optic cable and up to two intermediate connections required to connect sections together.'.

Response *Response Status* **O**

Cl **68** *SC* **8** *P* **32** *L* **46** # **135**

Pepeljugoski, Petar IBM

Comment Type **T** *Comment Status* **X**

The insertion loss measurements of installed multimode fibers using listed methods can report loss values that are different than the actual MMF losses when the actual center launch or offsetr launch is used. I do not have a proposal rith now, but this should be flagged as an issue.

Suggested Remedy

Just as a placeholder I propose the following: ""use center launch or offset launch to record the loss values of the multimode fiber"".

Response *Response Status* **O**

Cl **68** *SC* **8** *P* **33** *L* **3** # **136**

Pepeljugoski, Petar IBM

Comment Type **T** *Comment Status* **X**

In Table 68-7 both the fiber insertion loss and the connector loss are given. In fact, only the total loss of the link is required. This will allow links with more connectors if the loss is smaller.

Suggested Remedy

Replace the two rows in Table 68-7 with one row that lists the Total insertion loss for the fiber and all co9nnectors, and use 2 dB as the limit, consistent with Table 68-2

Response *Response Status* **O**

Cl **68** *SC* **8** *P* **33** *L* **7** # **137**

Gwinn, Joseph Raytheon

Comment Type **T** *Comment Status* **X**

The description ""Losses of all connectors"" is incomplete, and conflicts with lines 39-40, where it speaks of ""total connector and splice loss"".

Suggested Remedy

Change description to read ""Total loss of all connectors and splices"".

Response *Response Status* **O**

Cl **68** *SC* **9.2.** *P* **33** *L* **48** # **138**

Dawe, Piers Agilent

Comment Type **E** *Comment Status* **X**

It would be helpful to have some text about patch cords, as people used to clause 38 or 58 will expect it.

Suggested Remedy

Add a new subclause:
68.9.3 Single-mode fiber offset-launch mode-conditioning patch cord for 10GBASE-LRM
Single-mode fiber offset-launch mode-conditioning patch cords shall satisfy the requirements of 38.11.4 or 59.9.5.

Revise PICS FO3.

Response *Response Status* **O**

Cl **68** *SC* **9.2.1** *P* **33** *L* **44** # **139**

Dawe, Piers Agilent

Comment Type **T** *Comment Status* **X**

We seem to have mislaid our spec on discrete reflectance (formerly described by connection return loss). The suggested remedy is copied from 52.14.2.2.

Suggested Remedy

Insert new subclause:
68.9.2.2 Maximum discrete reflectance
The maximum discrete reflectance for 10GBASE-S shall be less than –20 dB.

Response *Response Status* **O**

Cl **68** *SC* **Figure 68-10** *P* **27** *L* # **140**

Fitzgerald, Paul Circadiant Systems, In

Comment Type **TR** *Comment Status* **X**

The order of ISI production, optical pulse shaping, and conversion to the optical domain is not important for the conceptual models and (as noted) what is important is the result seen in the optical domain. See previous comment.

Suggested Remedy

Indicate in this figure a ""subassembly"" to be entitled ""Signal Formation Chain"" that contains the ISI generator, optional pulse-shaping filter, and E/O converter (3 items).

Response *Response Status* **O**

Cl **68** *SC* **Figure 68-10** *P* **27** *L* **44** # **141**

Fitzgerald, Paul — Circadiant Systems, In

Comment Type **TR** *Comment Status* **X**

The title to Figure 68-10 has the word ""normative"". This word is not used in referencing this figure. It is understood from other text that the receiver must be able to pass the ""comprehensive stressed receiver and overlaod test"". It is also understood that the measurement configuration can be physically realized with many possible variations.

Suggested Remedy

Remove the superfluous word, ""normative"", here.

Response *Response Status* **O**

Cl **68** *SC* **Table 68-2** *P* **16** *L* **1** # **143**

Fitzgerald, Paul — Circadiant Systems, In

Comment Type **T** *Comment Status* **X**

The entries in ""Channel Insertion Loss"" should have more significant places.

Suggested Remedy

(4 places): replace ""2"" with ""2.0""

Response *Response Status* **O**

Cl **68** *SC* **Table 68-2** *P* **16** *L* **1** # **142**

Fitzgerald, Paul — Circadiant Systems, In

Comment Type **T** *Comment Status* **X**

Why specify operating ranges for 850 nm? (This LRM specification is for the 1310 nm range.)

Suggested Remedy

Remove material for 850 nm; specifically remove:
(1) Second column title reference to 850 nm
(2) In the entries the first of the two numbers and the ""/""
(3) The footnote ""a"" (and reorder the remaining footnotes)

Response *Response Status* **O**

Cl **68** *SC* **Table 68-3** *P* **17** *L* # **144**

Fitzgerald, Paul — Circadiant Systems, In

Comment Type **T** *Comment Status* **X**

For consistancy and significant figures: nm spectral widths, dispersion penalties and loss limits should be indicated with a decimal point and tenth.

Suggested Remedy

in lines 12, 13 replace ""4"" with ""4.0""
in line 30 replace ""5"" with ""5.0""
in line 49 replace ""12"" with ""12.0""
in line 51 replace ""-12"" with ""-12.0""

Response *Response Status* **O**

Cl **68** *SC* **Table 68-3** *P* **17** *L* **28** # **145**

Lindsay, Tom — ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

The eye mask constrains waveforms that can reduce TWDP results and improve SNR. Pre-emphasis is a specific example of this.

Suggested Remedy

Eliminate the eye mask. This also applies to clause 68.6.5, the eye mask test method details.An alternative is to reduce X1 to 0.40.

Response *Response Status* **O**

Cl **68** *SC* **Table 68-3** *P* **17** *L* **30** # **146**

Bhoja, Sudeep — Big Bear Networks

Comment Type **T** *Comment Status* **X**

The 5dB value for the Transmitter Waveform Dispersion Penalty needs to be changed. Previous contributions such as lindsay_3_1104 have shown that TP2 & TP3 tests and limits should be linked. The PIE-D value for 99% coverage based on a 47.1ps reference Tx and Gen67YY fiber model with connectors is 4.5dB. This number is lower than the 5dB limit.

Suggested Remedy

Change the 5dB value to 4.5dB

Response *Response Status* **O**

Cl **68** *SC* **Table 68-3** *P* **17** *L* **32** # **147**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

The value for rms jitter is too high. If purely Gaussian, the pk-pk jitter could be close to 0.5 UI. Even if not purely Gaussian, it is still much higher than allocated for uncorrelated jitter by other standards.The concern is that this much jitter will cause unnecessary stress and penalty on receivers in a link where they already have tough challenges from the dispersion.The current value is also greater than what transmitters typically generate today.

Suggested Remedy

Reduce to 2 ps rms.

Response *Response Status* **O**

Cl **68** *SC* **Table 68-3** *P* **17** *L* **53** # **148**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

I believe a patchcord is part of the definition of TP2 - it is not optional.

Suggested Remedy

Remove 2nd sentence in note b.

Response *Response Status* **O**

Cl **68** *SC* **Table 68-4** *P* **18** *L* **30** # **149**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

To be consistent with Monte Carlo and Cambridge fiber models, normalize the cursor amplitude values to add to 1.0.

Suggested Remedy

Change values to
0.280 0.216 0.392 0.112
0.359 0.237 0.363 0.041
0.204 0.356 0.116 0.324
If the current channel values change, follow the recommendation to normalize.

Response *Response Status* **O**

Cl **68** *SC* **Table 68-4** *P* **18** *L* **3034** # **150**

Bhoja, Sudeep Big Bear Networks

Comment Type **TR** *Comment Status* **D**

The Pre-Cursor, Symmetrical & Post-Cursor values needs to be updated. The PIE-D for these 3 cases are 5.09, 4.88 & 5.11dB respectively. These number exceed the 99th percentile PIE-D value of 4.5dB for a composite launch based on Gen67YY fiber model and hence do not constitute reasonable worst case. Furthermore, the use of the 3.6dB ISI penalty criteria used to derive these parameters while based on previous 802.3ae work may not be valid due to the weak correlation between ISI penalty and bandwidth as shown by the TIA OM3 work. Also, no consideration was given to finite length equalizers in deriving these numbers.

Suggested Remedy

Three IPR's based on discussions in the TP3 adhoc group should be inserted here.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68** *SC* **Table 68-4** *P* **18** *L* **52** # **151**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

I am confused by ""Received power in OMA (min) is used in the signal detect function specification. It does not define receiver sensitivity."" I'm okay with the first part, but the value is called by the Rx sensitivity test.

Suggested Remedy

Change 2nd sentence of note b to ""It is also used for the comprehensive stressed receiver test.""The rest of the note is okay.

Response *Response Status* **O**

Cl **68** *SC* **Table 68-4** *P* **19** *L* **2** # **152**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

The standard allows implementation variations that distribute the stress between the ISI generators and filter(s), so we need to define the noise in a manner that is reasonably independent of this.

Suggested Remedy

Add to the end of the note: ""... due to the ISI generator and optional pulse shaping filter, if used.""

Response *Response Status* **O**

Cl **68** *SC* **Table 68-5** *P* **19** *L* **31** # **153**

Lindsay, Tom ClariPhy Communicati

Comment Type **T** *Comment Status* **X**

Error in offset key value.

Suggested Remedy

Key should start at bit 3243, not 3242.

Response *Response Status* **O**

Cl **68A** *SC* *P* **39** *L* **1** # **154**

Swanson, Steven Corning Incorporated

Comment Type **E** *Comment Status* **D**

Clarification needed.

Suggested Remedy

The processing algorithm in Annex 68A is standard and each equation should be referenced to a standard paper where possible.

Response *Response Status* **W**

PROPOSED REJECT. Suggested remedy not complete.

Cl **68A** *SC* **1** *P* **39** *L* **28** # **155**

Fitzgerald, Paul Circadiant Systems, In

Comment Type **E** *Comment Status* **X**

""Q"" is not a multiplicative factor here but a function.

Suggested Remedy

Remove the multiplicative ""dot"" the follows the ""Q"".

Response *Response Status* **O**

Cl **68A** *SC* **2** *P* **41** *L* **3** # **156**

Gwinn, Joseph Raytheon

Comment Type **E** *Comment Status* **X**

The last sentence ends too soon, having the period before the rest of the sentence, which is the equation on lines 7-9.

Suggested Remedy

Delete period at end of line 2, or replace it with a colon.

Response *Response Status* **O**

Cl **68A** *SC* **2** *P* **41** *L* **7** # **157**

Gwinn, Joseph Raytheon

Comment Type **E** *Comment Status* **X**

There is a stray hat (^) symbol way above the letter ""k"" in ""z(k)"", just under the letter ""r"" in the word ""feedforward"" (line 6).

Suggested Remedy

Delete stray hat symbol.

Response *Response Status* **O**

Cl **68A** *SC* **A.1** *P* *L* # **158**

Pepeljugoski, Petar IBM

Comment Type **E** *Comment Status* **X**

Instead of using the Q function, please use the erfc function, since it is the most common way of expressing the BER.

Suggested Remedy

Use erfc function instead of the Q function. Give reference to the erfc function (for example Abramowitz and Stegun).

Response *Response Status* **O**

Cl **68A** *SC* **several** *P* *L* # **159**

Lindsay, Tom ClariPhy Communicati

Comment Type **E** *Comment Status* **X**

Editorial changes.

Suggested Remedy

Page 39
Line 8
Change to ""…dispersion penalty (TWDP) test."".
Line 10
Change to ""…outlines the TP2 test …"".Line 52Eliminate ""or eight"" to be consistent with standard.
Page 40
Line 4
Change back to 2/T. Symbol is referring to frequency, not sample spacing.
Line 4
Should be ""TP2"" in transmitter response block.
Line 13
Out-dent line.
Line 15
Change to ""…waveform is typically sampled 16 times per bit…"".
Line 20
This should be defined better. No promises, but I'll see what I can come up with. This could be a technical comment if it comes.
Line 33
Insert ""typically"" as first word in line (before ""100"").Line 42Remove 2nd instance of ""transmitter"".Line 45Should be ""…propagation in order to …"".

Response *Response Status* **O**