Cl **45** *SC* **45.2.1.158a.1** *P* **33** *L* **22** # I-121

Dawe, Piers J G NVIDIA

Comment Type **ER** *Comment Status* **A** *Number writing*

There are very many bit-based registers in Clause 45 in the base document, and "0b" never appears there. It is clear from the descriptions and contexts that they are bits. "0b0000" is not well defined in 802.3 and not normal notation. b means 11 in hex, as in 115A.1 for example, same as B does. This is a 4-bit field as the text makes clear, so a 6-digit value makes no sense anyway.
These subclauses 45.2.1.158a BASE-AU PMA/PMD control register (1.901) and 45.2.1.158a.1 Type selection (1.901.3:0) should be precisely aligned to 45.2.1.158 BASE-H PMA/PMD control register (Register 1.900) and 45.2.1.158.1, Type selection (1.900.3:0). Similarly, 45.2.3.90.1 Operation mode (3.2348.15:13) should be precisely aligned to 45.2.3.53.1 Operation mode (3.518.15:13).

SuggestedRemedy

Change 0b0000 to 0000, 0b0001 to 0001, 0b000, to "binary 000", and so on to match the base document.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.
Make the change and search for "0b" and substitute with "binary"

Cl **45** *SC* **45.2.3.91.12** *P* **39** *L* **38** # I-11

Rannow, R K Representing myself

Comment Type **TR** *Comment Status* **A** *EEE*

Ambiguous and inconsistent termination used throughout the document. This is just one example:

When read as one, bit 3.2349.2 indicates both that the remote PHY has the EEE ability and that the EEE advertisement is enabled. When read as zero,

SuggestedRemedy

Check all instances and confirm consistency and remove ambiguity.

When read as a one, bit 3.2349.2 indicates that the remote PHY has the EEE ability and that the EEE advertisement is enabled. When read as a zero, ..

Multiple instances on inconsistency. Add "a" as necessary for consistency and correctness.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.
Page 39 line 18: Substitute "read as one" with "read as a one". Substitute "read as zero" with "read as a zero".
Page 39 line 30: Substitute "read as one" with "read as a one". Remove "both".
Page 39 line 31: Substitute "read as zero" with "read as a zero".
Page 39 line 38: Substitute "read as one" with "read as a one". Remove "both".
Page 39 line 39: Substitute "read as zero" with "read as a zero".
Page 39 line 44: Substitute "read as one" with "read as a one".
Page 39 line 45: Substitute "read as zero" with "read as a zero".
Page 40 line 3: Substitute "read as one" with "read as a one".
Page 40 line 4: Substitute "read as zero" with "read as a zero".

Cl **66** *SC* **66.4.1** *P* **103** *L* **40** # I-179

Mcclellan, Brett — Marvell Semiconductor, Inc.

Comment Type **TR** *Comment Status* **R** *EEE*

The current definition of PHD.CAP.LPI does not preclude dynamic changing between 1 and 0. I don't believe this could actually work with dynamic changes while the link is up.

SuggestedRemedy

on page 103 line 40 insert the following text "The value of PHD.CAP.LPI shall not change."

Response *Response Status* **U**

REJECT.

The issue raised by the author of the comment is already covered by the current draft version.

In page 69, line 10:

"PHD.CAP.LPI is used by the PHY to advertise that Energy-Efficient Ethernet (EEE) is supported and that it is enabled."

In subclause 45.2.3.90.4 it is stated:

"Setting bit 3.2348.0 to one shall enable the advertisement of local PHY EEE ability (see 166.4). Setting bit 3.2348.0 to zero shall prevent establishment of EEE operation with the link partner. If the BASE-U PHY does not have EEE ability (bit 3.2349.0 = 0, see 45.2.3.91.14) setting bit 3.2348.0 has no effect. Changes in EEE advertisement enable value shall only take effect after a PMA reset (see 166.3.4.1). Bit 3.2348.0 has no specified default value."

Cl **131** *SC* **131.4** *P* **60** *L* **34** # I-131

Dawe, Piers J G — NVIDIA

Comment Type **TR** *Comment Status* **A** *50GBASE-AU delay increase*

The max PHY delay is 11,264 BT or 2.2 FEC blocks for the whole PHY, for all rates. At the highest rates, this is not reasonable for a range of implementations and not necessary. At the lowest rates, it could be tightened but this may not be necessary.
At 25G, this is 450.56 ns which is 40% of the allowance for 25GBASE-SR PCS and FEC with a similar FEC. At 50G, this is 225.28 ns which is 30% of the allowance for 50GBASE-SR PCS and FEC, again with a similar FEC. In both cases the allowance for this whole PHY is less than for those FECs alone.
The delay should allow for an FEC block (scales with MAC rate), some PMA and PMD functions (partially scale, much smaller) and FEC processing which relates to silicon process and FEC code, not MAC rate. This spec is asking for an aggressive design at 50G which is not necessary; the delay is significantly less than at 25G or slower anyway.

SuggestedRemedy

Increase the max PHY delay for 50GBASE_AU from 11264 BT, 22 PQ, 225.28 ns to 14848 BT, 29 PQ, 296.96 ns.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.
Change Table 166-24 and Table 131-4 accordingly.

Cl **166** *SC* **166.2** *P* **66** *L* # I-177

Mcclellan, Brett — Marvell Semiconductor, Inc.

Comment Type **TR** *Comment Status* **R** *Interfaces definition*

There is no definition for PMA interfaces to the PCS.
Without a definition of these interfaces, this specification is technically incomplete.

SuggestedRemedy

Insert a new subclause 166.2.1 Technology Dependent Interface with definitions for PMA interfaces.

Response *Response Status* **U**

REJECT.

This PHY specification makes use of service interfaces where needed for technical completeness and interoperability.

Inclusion of a PMA interface is not necessary for an implementer to build a compliant and interoperable PHY implementation.

Note that 802.3cz does not specify Autonegotiation, and therefore primitives specified in other clauses to support this feature (i.e, Clause 97 and 98) are not needed.

Cl **166** *SC* **166.2** *P* **66** *L* **1** # I-176

Mcclellan, Brett — Marvell Semiconductor, Inc.

Comment Type **TR** *Comment Status* **R** *Interfaces definition*

There is no definition for Technology Dependent Interfaces link_control and link_status which are used throughout Clause 166 without indicating where link_control comes from, or where link_status goes to.
Without a definition of these interfaces, this specification is technically incomplete.

SuggestedRemedy

Insert a new subclause 166.2.1 Technology Dependent Interface with definitions for link_control and link_status

Response *Response Status* **U**

REJECT.

This PHY specification makes use of service interfaces where needed for technical completeness and interoperability.

Autonegotiation, and therefore primitives specified in other clauses to support this feature (i.e, Clause 97 and 98) are not needed.

link_control and link_status are mapped in subclause 166.13 (Table 166-22) to MDIO register bits.

Cl **166** *SC* **166.2** *P* **66** *L* **1** # I-175

Mcclellan, Brett — Marvell Semiconductor, Inc.

Comment Type **TR** *Comment Status* **A** *Interfaces definition*

This PHY specification lacks a definition of service primitives and interfaces between sublayers.
Without a definition of these interfaces, this specification is technically incomplete.

SuggestedRemedy

Insert a new subclause 166.2 2.5GBASE-AU,
5GBASE-AU, 10GBASE-AU, 25GBASE-AU, and 50GBASE-AU service primitives and interfaces.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.

This PHY specification makes use of service interfaces where needed for technical completeness and interoperability.

However, the three first paragraphs of the subclause 166.2.1 can be changed to mirror other BASE-R clauses.

Page 66 lines 5 to 7,

Change "The 2.5GBASE-AU, 5GBASE-AU, or 10GBASE-AU PCS couples a 10 Gigabit Media Independent Interface (XGMII), see Clause 46, to the 2.5GBASE-AU, 5GBASE-AU, or 10GBASE-AU Physical Medium Attachment (PMA) sublayer."
to
"The PCS service interface of 2.5GBASE-AU, 5GBASE-AU, or 10GBASE-AU is the 10 Gigabit Media Independent Interface (XGMII), which is defined in Clause 46. The 2.5GBASE-AU, 5GBASE-AU, or 10GBASE-AU PCS provides all services required by the XGMII and couple it to the 2.5GBASE-AU, 5GBASE-AU, or 10GBASE-AU Physical Medium Attachment (PMA) sublayer."

Page 66 lines 9 to 10,

Change "The 25GBASE-AU PCS couples a Media Independent Interface for 25 Gb/s operation (25GMII), see Clause
106, to the 25GBASE-AU PMA sublayer."
to
"The 25GBASE-AU PCS service interface is the Media Independent Interface for 25 Gb/s operation (25GMII), which is defined in Clause 106. The 25GBASE-AU PCS provides all services required by the 25GMII and couple it to the 25GBASE-AU PMA sublayer."

Page 66 lines 12 to 13,

Change "The 50GBASE-AU PCS couples a Media Independent Interface for 50 Gb/s operation (50GMII), see Clause
132, to the 50GBASE-AU PMA sublayer."

to: "The 50GBASE-AU PCS service interface is the Media Independent Interface for 50 Gb/s operation (50GMII), which is defined in Clause 132. The 50GBASE-AU PCS provides all services required by the 50GMII and couple it to the 50GBASE-AU PMA sublayer."

Cl **166** *SC* **166.5.4** *P* **109** *L* **38** # I-79

Wienckowski, Natalie General Motors Company

Comment Type **TR** *Comment Status* **A** *EZ-Pull to discuss*

The current text makes no sense. I'm not sure if my interpretation is correct, but this was the only thing I could think that it meant.

SuggestedRemedy

Change: The initial values of the bit sequence A are an 8-bit sequence of 0s, 1, an 11-bit sequence of 0s, 1,
To: The initial values of the bit sequence A are an 8-bit sequence of 0s, a single bit of 1, an 11-bit sequence of 0s, a single bit of 1,
The same issue can be found in 166.5.5, the initial values of A1 and A2.
The other option is to write out all the bits as is done for A3.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.
Page 109 line 38,

Change "The initial values of the bit sequence A are an 8-bit sequence of 0s, 1, an 11-bit sequence of 0s, 1,"
to
"The first 33 bits of the bit sequence A are an 8-bit sequence of 0s, a single bit of 1, an 11-bit sequence of 0s, a single bit of 1,"

Page 109 line 44

Change "The initial values"
to
"The first 78 bits"

Page 109 line 52

Change "The initial values"
to
"The first 28 bits"

Page 110 line 39

Change "The initial values of the bit sequence A1 are a 29-bit sequence of 0s, 1, a 27-bit sequence of 0s, 1, 0,
0, 1, and a 24-bit sequence of 0s."
to "The first 85 bits of the bit sequence A1 are a 29-bit sequence of 0s, a single bit of 1, a 27-bit sequence of 0s, a single bit of 1, a single bit of 0, a single bit of 0, a single bit of 1, and a 24-bit sequence of 0s."

Page 110 line 46,
Change "The initial values of the bit sequence A2 are 0, 1, 1, 0, 1, a 9-bit sequence of 0s, 1, 0, 0, and a 10-bit

sequence of 1s."
to
"The first 27 bits of the bit sequence A2 are a single bit of 0, a 2-bit sequence of 1s, a single bit of 0, a single bit of 1, a 9-bit sequence of 0s, a single bit of 1, a 2-bit sequence of 0s, and a 10-bit
sequence of 1s."

Cl **166** *SC* **166.6.3.2** *P* **116** *L* **40** # I-107

Murty, Ramana — Broadcom Inc.

Comment Type **TR** *Comment Status* **R** *Wavelength*

Center wavelength (range) is defined over the narrow range of 970 - 990 nm. The justification for not accepting other source wavelengths, such as the one given in perezaranda_3cz_01b_080621_vcsel_reliability.pdf, are erroneous. The wavelength range should be expanded to allow a wide range of suppliers to participate.

SuggestedRemedy

Expand the center wavelength range to 840 - 990 nm.

Response *Response Status* **U**

REJECT.
There is no consensus to make a change.

The following is background on multiple hours of discussion on comments #i-107 and #i-108 within the P802.3cz Task Force (acting as the comment resolution group).

[begin proposed response to #i-107]

Proposal already discussed at Montreal plenary meeting (July 2022). Consensus to modify wavelength range was not reached (see https://www.ieee802.org/3/cz/public/jul_2022/Minutes_3cz_01_0722.pdf Motion #3 and comment #32 to P802.3cz/D2.1).

Range of +/- 10 nm is consistent with other projects that use different nominal center wavelength, i.e. C/138 138.7.1, Table 138-8. C/95 95.7.1, Table 95-6. C/52 52.5.1, Table 52-7.
The TX and RX characteristics have been derived with margin considering real 980nm device samples operating in a range of backside temperature between -40ºC and +125ºC and bias current of up to 8 mA. It was demonstrated during the project that required wear-out reliability cannot be achieved with 850nm VCSEL devices using similar current densities. It was also demonstrated that in order to marginally meet the wear-out reliability requirements, the bias current should be reduced < 5 mA in high temperature, therefore reducing the speed and optical power and increasing the RIN of the VCSEL devices, hence making much more difficult the PHY implementation. On top of that, it was also demonstrated that 980nm devices are much less dependent with temperature, so they present a much more uniform threshold current between -40 and 125ºC. 850nm devices could be optimized for high temperature, but degrading (or making impossible) operation at low temperature and viceversa.
Technology for manufacturing 980nm VCSEL devices is widely available. It was developed during last decade for sensor devices. Producing reliable, high speed, low noise, and efficient VCSELs at 980nm is much easier than at 850nm. This will allow to expand the availability of manufacturers that can supply photonics for BASE-AU PHYs in automotive industry.

[end proposed response to #i-107]

Two presentations on the VCSEL reliability were made during comment resolution discussion (see https://www.ieee802.org/3/cz/public/oct_2022/murty_3cz_01_1022.pdf and https://www.ieee802.org/3/cz/public/oct_2022/perezaranda_3cz_02_1022_vcsel_rel.pdf), in addition to an in-depth discussion of the impact on system technology and testing when the wavelength range is extended as proposed in #i-107 and #i-108.

Straw Poll (all individuals attending allowed to vote) to accept the above proposed response result: Yes 19 No 5 Abstain 8.
Motion (only 802.3 voting members allowed to vote) to accept the above proposed response failed: Yes 13 No 6 Abstain 5.

There was no other proposal for a response to the comment. Therefore it was concluded that there is no consensus to make the change proposed by the comment.

Cl **166** *SC* **166.6.3.2** *P* **117** *L* **16** # I-163

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **A** *50GBASE-AU extinction ratio*

The extinction ratio spec should make allowance for laser speed, the wide temperature range and the extra accuracy desired when using PAM4. This has 4 dB at all rates, 50GBASE-SR has 3 dB. With further study, 3.5 dB might be feasible.

SuggestedRemedy

For 50GBASE-AU, change 4 dB to 3 dB.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.

Reference receiver of 50GBASE-SR is different of 50GBASE-AU.

Feasibility of min 4 dB has been determined based on measurements at extreme temperatures. See examples in contribution perezaranda_3cz_01_221011_comment_i_163.pdf).

Decreasing min ER impacts the receiver sensitivity in 0.2 dB when we decrease ER from 4 dB to 3 dB in 50 Gb/s operation.

Page 117 line 16
Table 166-9
Change "Extincition ratio (min) 4"
to
"Extinction ratio (min) 3.5" for 50GBASE-AU.

Cl **166** *SC* **166.6.3.3** *P* **117** *L* **40** # I-108

Murty, Ramana Broadcom Inc.

Comment Type **TR** *Comment Status* **R** *Wavelength*

Center wavelength (range) is defined over the narrow range of 970 - 990 nm. "Rainbow" photodetectors that can detect a wide range of wavelengths have been widely used in datacom.

SuggestedRemedy

Expand the center wavelength range to 840 - 990 nm.

Response *Response Status* **U**

REJECT.
There is no consensus to make a change.

The following is background on multiple hours of discussion on comments #i-107 and #i-108 within the P802.3cz Task Force (acting as the comment resolution group).

[begin proposed response to #i-108]

Proposal already discussed at Montreal plenary meeting (July 2022). Consensus to modify wavelength range was not reached (see https://www.ieee802.org/3/cz/public/jul_2022/Minutes_3cz_01_0722.pdf Motion #3 and comment #32 to P802.3cz/D2.1).

Expanding the center wavelength range to 840 - 990nm will imply that all the components between light emission and reception, including the photodetector, have to be validated and qualified to meet all the requirements for the full range of spectrum. This includes coupling optics in TX and RX as well as inline connections and fiber. Assuming butt-coupling and physical contact connectivity, which can be wavelength agnostic, as a feasible solution for automotive application just because it is used in data-centers may be an erroneous assumption.
Expanded beam optics, physical contact, and air gap connections are under consideration by connector makers to supply a robust, low cost, and fully automated terminated optical connectivity technology to automotive industry based on OM3 fiber. In the implementation of optical coupling, lenses and EBO connections, wavelength dependent refractive index and absorption of used materials needs to be considered. If same materials have to support reflow soldering, automotive environmental and mechanical conditions and perform well in a much wider range of wavelengths, then we are imposing constraints that will limit the solutions and will finally increase the cost without necessity.
Transceiver is not only affected by the materials used for optical coupling but also photodetector.

[end proposed response to #i-108]

Two presentations on the VCSEL reliability were made during comment resolution discussion (see https://www.ieee802.org/3/cz/public/oct_2022/murty_3cz_01_1022.pdf and https://www.ieee802.org/3/cz/public/oct_2022/perezaranda_3cz_02_1022_vcsel_rel.pdf), in

addition to an in-depth discussion of the impact on system technology and testing when the wavelength range is extended as proposed in #i-107 and #i-108.

Straw Poll (all individuals attending allowed to vote) to accept the above proposed response result: Yes 19 No 5 Abstain 8.
Motion (only 802.3 voting members allowed to vote) to accept the above proposed response failed: Yes 13 No 6 Abstain 5.

There was no other proposal for a response to the comment. Therefore it was concluded that there is no consensus to make the change proposed by the comment.

Cl **166** *SC* **166.7.8.2** *P* **125** *L* **7** # I-168

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **A** *Antialiasing filters*

is composed by the concatenation of two first-order low-pass filter with -3 dB bandwidth of S × 26.5625 / 2 GHz - not clear if that's each or in combination

SuggestedRemedy

Please clarify

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.
Change "For BASE-AU with G = 2, the antialiasing filter is composed by the concatenation of two first-order
low-pass filter with −3 dB bandwidth of S × 26.5625 / 2 GHz."
to
"For BASE-AU with G = 2, the antialiasing filter is composed of the concatenation of two first-order low-pass filter with −3 dB bandwidth of S × 26.5625 / 2 GHz each one."

Cl **166** *SC* **166.9.2.1** *P* **135** *L* **33** # I-170

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **A** *Connections*

Up to 10 dB of connector loss! This looks like a modal noise problem, unless there is something that ensures that most of this loss is NOT mode selective - which I don't see.

SuggestedRemedy

Reduce the maximum total connection insertion loss or provide rules for what sort of loss is allowed.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.

10 dB is max connections insertion loss for 10, 5 and 2.5 Gb/s. Part of this insertion loss is attributed to be mode selective, therefore, to cause modal noise. In Table 166-11, channel insertion loss is consistent with Table 166-21. Channel insertion loss of Table 166-11 considers 0.1 dB max (0.08 rounded) fiber attenuation and allocation of 0.4 dB for cable attenuation penalty due to aging.
Contribution
https://www.ieee802.org/3/cz/public/3_aug_2021/perezaranda_3cz_01a_030821_link_budget_proposal.pdf shows:

* Modal noise impact in receiver sensitivity at several rates
* Modal noise vs mode selective loss based on
https://www.ieee802.org/3/cz/public/15_jun_2021/pinzon_3cz_01_150621.pdf
* Calculation of min non-MSL IL for inline connections and therefore max MN, and RX sensitivity as a function of MSL IL

Based on this, allocation for modal noise is calculated for all the data-rates

The 802.3cz project has considered much higher insertion loss in the inline connections than the BASE-SR projects. Reasons behind:

* It is not clear that physical contact connection will be able to meet environmental (e.g. grease, dust conditions, metallic particles, in car automated assembly plant, or a garage) and mechanical (e.g. vibrations, scoop proof) requirements with the cost constraints of automotive application.
* During more than two decades, SI-POF has been used in automotive applications (e.g. MOST, 1000BASE-RHC), implementing butt-coupling with air-gap in inline connections to avoid end face surfaces of fiber are damaged by mechanical and environmental conditions.
* Expanded beam optics, physical contact, and air gap connections are under consideration by connector makers to supply a robust, low cost, and fully automated terminated optical connectivity technology to automotive industry based on OM3 fiber.
* 802.3cz PHYs support the highest technically feasible insertion loss that enable OM3 can be accepted by the automotive industry in terms of performance, environmental and mechanical conditions, and cost.

In Table 166-11, the row of allocation for penalties includes modal noise plus macro-

bending loss (0.2 dB).

Page 118 line 49:

Change footnote c: "Link penalties are used for link budget calculations. They are not requirements and are not meant to be tested."
to "The allocation for penalties considers addition of two factors, the receiver sensitivity loss caused by modal noise and the macro-bending loss. Maximum macro-bending loss budgeted is 0.2 dB."