

# **Signaling rate range for 100 Gb/s lanes**

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# Introduction

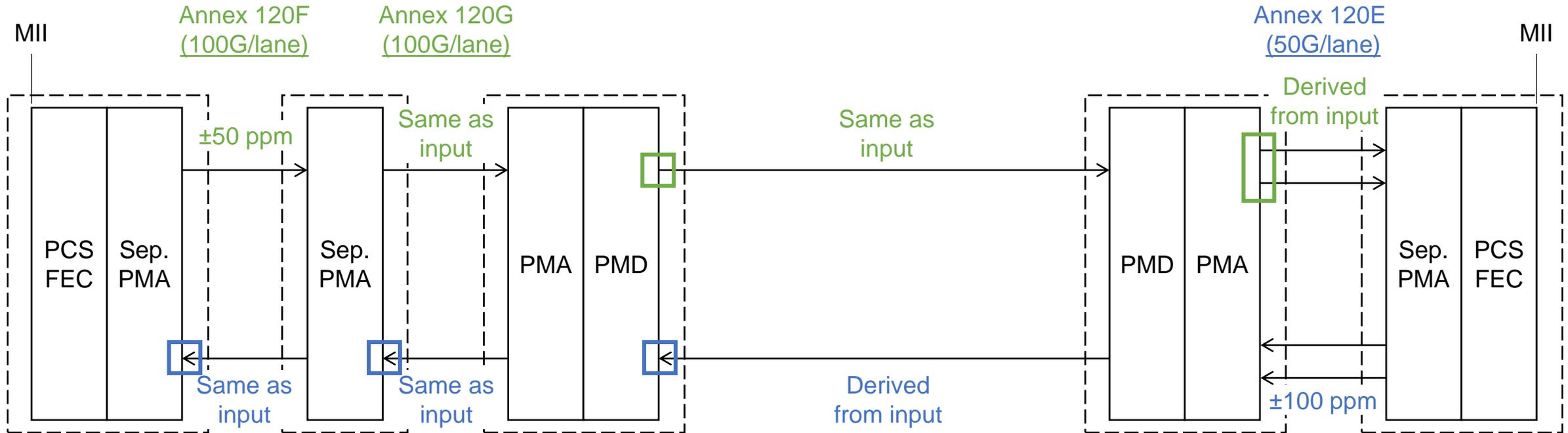
- IEEE P802.3ck has initiated a transition from the “traditional”  $\pm 100$  ppm signaling rate range to  $\pm 50$  ppm
- Smaller signaling rate range may be leveraged to improve performance margin (implementation-dependent)
- Smaller signaling rate range can be used without meaningful impact to cost
- See [healey\\_3ck\\_03\\_1020.pdf](#) for additional information

# Compatibility considerations

- 25 and 50 Gb/s per lane electrical interfaces, with a signaling rate range  $\pm 100$  ppm, are already defined for 100, 200, and 400 Gb/s Ethernet
- PMDs cannot change the signaling rate
- PMAs can only multiply the signaling rate by (input lanes / output lanes)
- Frequency differences can be reconciled at the MII (idle insert / delete)
- Therefore, the  $\pm 50$  ppm output requirement is conditional on what is in the same “package” as 100 Gb/s per lane PMA or PMD
- 100 Gb/s per lane PMAs and PMDs are required to support  $\pm 100$  ppm at their inputs

# Illustration of compatibility considerations

$\pm 50$  ppm outputs comply with  $\pm 100$  ppm requirements



$\pm 100$  ppm input tolerance ensures compatibility with "legacy" implementations

# Continue the transition

- A number of baseline proposals have been adopted for 800 Gb/s Ethernet interfaces and PMDs based on 100 Gb/s lanes
- These interface and PMDs should adopt  $\pm 50$  ppm signaling rate range to continue the transition initiated by IEEE P802.3ck
- There are no compatibility considerations for 800 Gb/s Ethernet (no 25 or 50 Gb/s per lane electrical interface objectives)
- Should the 8 lanes that constitute an 800 Gb/s “port” be “broken out” into multiple 100, 200, or 400 Gb/s “ports”, the compatibility considerations in IEEE P802.3ck apply

# Proposal

- This proposal suggests modifications to the adopted baseline proposals to set the signaling rate range to  $\pm 50$  ppm for 800 Gb/s Ethernet
- Example implementations of the proposed changes are provided
- Implementations assume existing clauses and annexes will be amended to add 800 Gb/s PMDs and interfaces

# 800GBASE-DR and 800GBASE-DR-2

## Proposed Transmitter Specifications

Description	800G-DR8	800G-DR8(+)	Unit
Signaling rate, each lane (Range)	$53.125 \pm 100$ ppm	$53.125 \pm 100$ ppm	GBd

## Proposed Receiver Specifications

Description	800G-DR8	800G-DR8(+)	Unit
Signaling rate, each lane (Range)	$53.125 \pm 100$ ppm	$53.125 \pm 100$ ppm	GBd

- Reference: [welch\\_3df\\_01a\\_220222.pdf](#)
- Proposal: Change “Signaling rate, each lane (range)” to  $53.125 \pm 50$  ppm

# 800GBASE-VR8 and 800GBASE-SR8

## 800 GbE Multimode Links

- Propose to add 800GBASE-VR8 (50 m reach) and 800GBASE-SR8 (100 m reach) to the content of Clause 167 by adopting the transmit, receive, and power budget specifications therein.

— Update related text, figures, and tables with editorial license

— Stay aligned with the latest P802.3db draft

- Reference: [murty\\_3df\\_01a\\_220315.pdf](#)
- Proposal: Set “Signaling rate, each lane (range)” to  $53.125 \pm 50$  ppm for 800GBASE-VR8 and 800GBASE-SR8 (with editorial license)

# Possible implementation: 800GBASE-VR8, 800GBASE-SR8

Table 167-7-Transmit characteristics

Description	100GBASE-VR1 200GBASE-VR2 400GBASE-VR4 <u>800GBASE-VR8</u>	100GBASE-SR1 200GBASE-SR2 400GBASE-SR4 <u>800GBASE-SR8</u>	Units
Signaling rate, each lane (range) <a href="#">800GBASE-VR8, 800GBASE-SR8</a> <a href="#">Other PMDs</a>	$53.125 \pm 50 \text{ ppm}$ $53.125 \pm 100 \text{ ppm}$		GBd

Table 167-8-Receive characteristics

Description	100GBASE-VR1 200GBASE-VR2 400GBASE-VR4 <u>800GBASE-VR8</u>	100GBASE-SR1 200GBASE-SR2 400GBASE-SR4 <u>800GBASE-SR8</u>	Units
Signaling rate, each lane (range) <a href="#">800GBASE-VR8, 800GBASE-SR8</a> <a href="#">Other PMDs</a>	$53.125 \pm 50 \text{ ppm}$ $53.125 \pm 100 \text{ ppm}$		GBd

# 800GBASE-CR8

100 Gbps/lane

## 800GbE (8x100) – Copper cable

- Copper cable
  - Align to the latest version of IEEE P802.3ck Clause 162, Annex 162A, Annex 162B, Annex 162C, Annex 162D
    - Note: Signaling rate, each lane (range) = 53.125 GBd
- Reference: [lusted\\_3df\\_01a\\_220315.pdf](#)
- Proposal: Set “Signaling rate, each lane (range)” to  $53.125 \pm 50$  ppm for 800GBASE-CR8 (with editorial license)

# Possible implementation: 800GBASE-CR8

Table 162–11–Summary of transmitter specifications at TP2

Parameter	Subclause reference	Value	Units
Signaling rate, each lane (range)	<del>162.9.4.1</del>	53.125 ± 50 ppm <sup>a</sup>	GBd

<sup>a</sup> For [an 800GBASE-CR8 PMD or for a 100GBASE-CR1, 200GBASE-CR2, or 400BASE-CR4](#) PMD in the same package as the PCS sublayer. In other cases, the signaling rate is derived from the input to the PMD transmit function provided by the adjacent PMA sublayer.

Table 162–15–Summary of receiver specifications at TP3

Parameter	Subclause reference	Value	Units
Signaling rate, each lane (range) <a href="#">100GBASE-CR1, 200GBASE-CR2, or 400GBASE-CR4</a> <a href="#">800GBASE-CR8</a>	162.9.5.1	53.125 ± 100 ppm <a href="#">53.125 ± 50 ppm</a>	GBd

## 162.9.5.1 Receiver signaling rate

A PHY shall comply with the receiver requirements of 162.9.5.2, 162.9.5.3 and 162.9.5.4 for any signaling rate in the range ~~53.125 GBd ± 100 ppm~~[specified in Table 162–15](#).

# 800GBASE-KR8

100 Gbps/lane

## 800GbE (8x100) - Backplane

- Backplane
  - Align to the latest version of IEEE P802.3ck Clause 163
    - Note: Signaling rate, each lane (range) = 53.125 GBd

- Reference: [lusted\\_3df\\_01a\\_220315.pdf](#)
- Proposal: Set “Signaling rate, each lane (range)” to  $53.125 \pm 50$  ppm for 800GBASE-KR8 (with editorial license)

# Possible implementation: 800GBASE-KR8

- Change to Table 163–5 footnote “a” to what is proposed for Table 162–11 footnote “a”
- Apply proposed modification to Table 162–15 to Table 163–8
- In addition...

## 163.9.3.1 Receiver signaling rate

A PHY shall comply with the receiver requirements of 163.9.3.5 and 163.9.3.6 for any signaling rate in the range specified in Table 163–8.

NOTE—Although the [100GBASE-KR1, 200GBASE-KR2, or 400GBASE-KR4](#) PMD transmitter is specified with a signaling rate range of  $\pm 50$  ppm when in the same package as the PCS sublayer, the signaling rate range may be  $\pm 100$  ppm when derived from an intermediate interface (e.g., 100GAUI-4, [200GAUI-4, or 400GAUI-8](#)).

# 800GAUI-8

100 Gbps/lane

## 800GbE (8x100) - AUI

- AUI C2M
  - Align to the latest version of IEEE P802.3ck Annex 120G
    - Note: Signaling rate, each lane (range) = 53.125 GBd
- AUI C2C
  - Align to the latest version of IEEE P802.3ck Annex 120F
    - Note: Signaling rate, each lane (range) = 53.125 GBd

- Reference: [lusted\\_3df\\_01a\\_220315.pdf](#)
- Proposal: Set “Signaling rate, each lane (range)” to  $53.125 \pm 50$  ppm for 800GAUI-8 (with editorial license)

# Possible implementation: 800GAUI-8 C2C

**Table 120F–1—Transmitter electrical characteristics at TP0v**

Parameter	Reference	Value	Units
Signaling rate, each lane (range)		53.125 ± 50 ppm <sup>a</sup>	GBd

<sup>a</sup> For [an 800GBASE-CR8 PMA or for a 100GBASE-CR1, 200GBASE-CR2, or 400BASE-CR4](#) PMA in the same package as the PCS sublayer. In other cases, the signaling rate is derived from the signaling rate presented to the input lanes (see Figure 135–3 and Figure 120–3) by the adjacent PMD, PMA, or FEC sublayers.

**Table 120F–4—Receiver characteristics at TP5v**

Parameter	Subclause reference	Value	Units
Signaling rate, each lane (range) <a href="#">100GAUI-1, 200GAUI-2, 400GAUI-4</a> <a href="#">800GAUI-8</a>	120F.3.2.1	53.125 ± 100 ppm <a href="#">53.125 ± 50 ppm</a>	GBd

## 120F.3.2.1 Receiver signaling rate

The receiver shall comply with the requirements of 120F.3.2.4 and 120F.3.2.5 for any signaling rate in the range ~~53.125 GBd ± 100 ppm~~ [specified in Table 120F–4](#).

## Possible implementation: 800GAUI-8 C2M

- Change to Table 120G–1 (Host output characteristics) footnote “a” to what is proposed for Table 120F–1 footnote “a”.
- No change to Table 120G–3 (Module output characteristics)
- Apply proposed modification to Table 120F–4 to Table 120G–7 (Host input characteristics) and Table 120G–9 (Module input characteristics)

# Summary

- IEEE P802.3df should continue the transition to a  $\pm 50$  ppm signaling rate initiated by IEEE P802.3ck
- Minor modifications to adopted 800 Gb/s Ethernet baselines are proposed