

# Experimental Demonstration of 56Gb/s NRZ for 400GbE PMD

Mizuki Shirao, Keisuke Kojima  
Mitsubishi Electric Corporation

**IEEE802.3bs 400GbE Task Force**

# Supporters

---

- Ram Rao, Oclaro
- Atsushi Takai, Oclaro
- Bill Brennan, Credo Semiconductor
- Haoli Qian, Credo Semiconductor
- Yoshikazu Tanaka, Mitsubishi Electric
- Atsushi Sugitatsu, Mitsubishi Electric

# Introduction

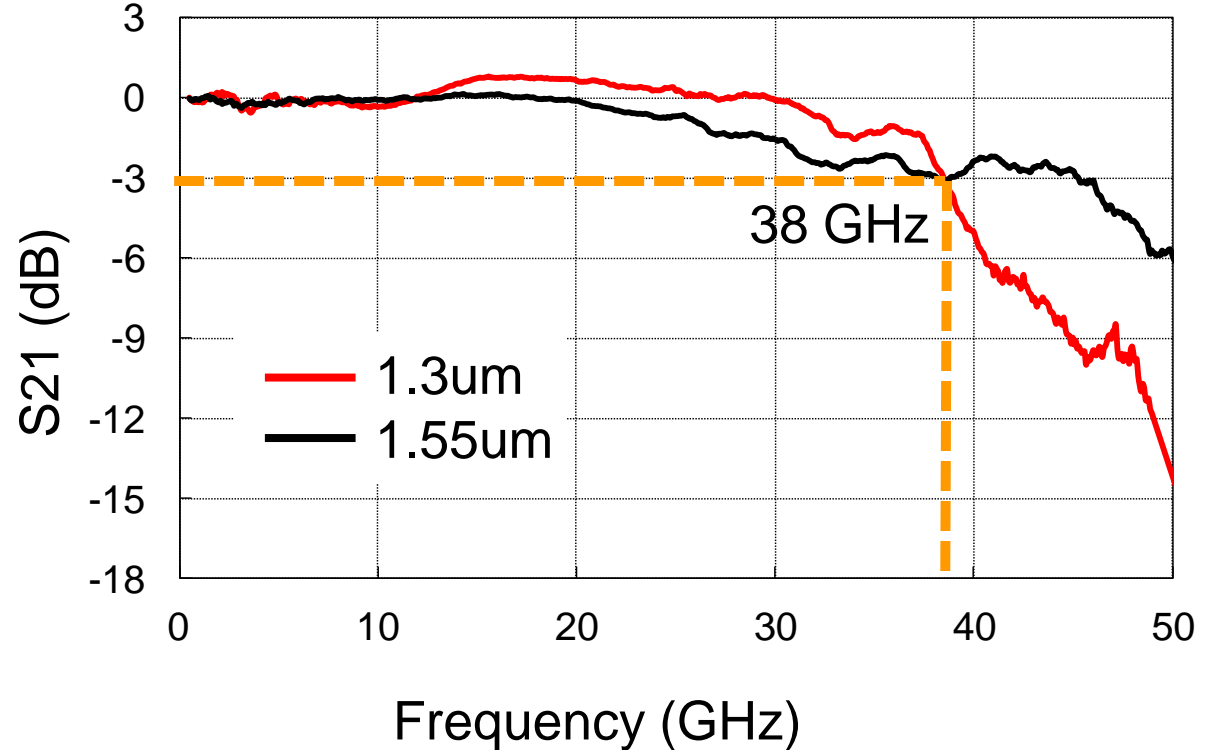
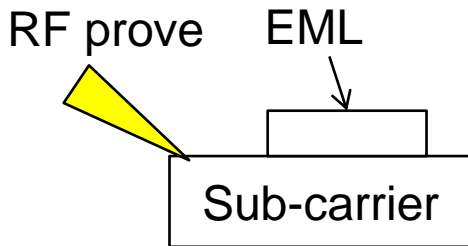
---

- 50G NRZ is considered to be a simpler, lower cost, and lower power alternative to 50GBaud PAM-4 for 400GbE-PSM4 applications
  - [cole\\_400\\_01\\_0114.pdf](#)
- This presentation is prepared to support 50G NRZ by demonstrating clear optical signal output from a mature modulator technology

# Small signal response of EML chip

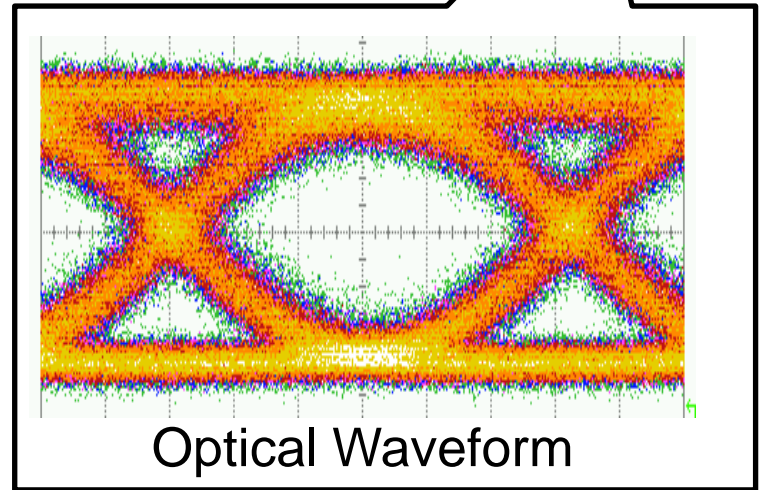
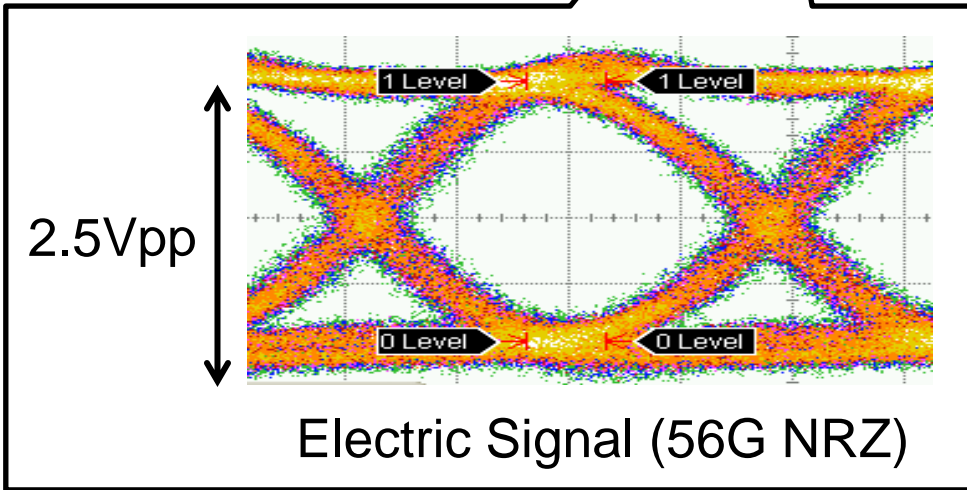
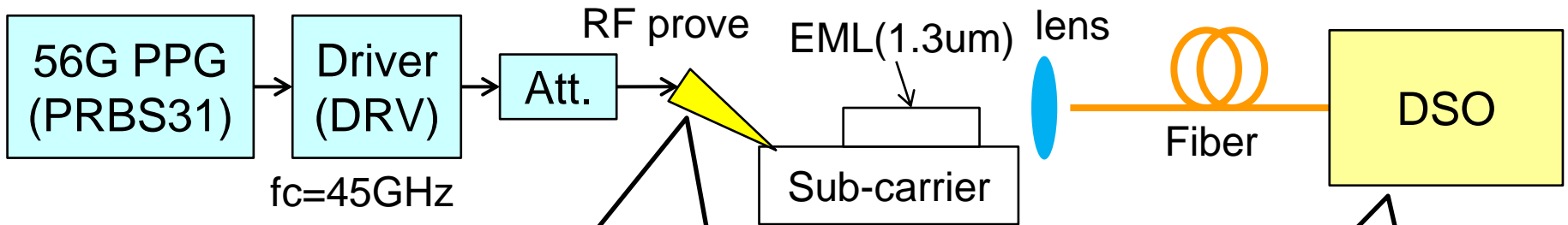
- In the following slides, two types of EMLs (1.3um and 1.55um) were used.

- ⇒ -Both EMLs showed 3dB bandwidth of >38GHz  
-More than sufficient for 56GBaud modulation.



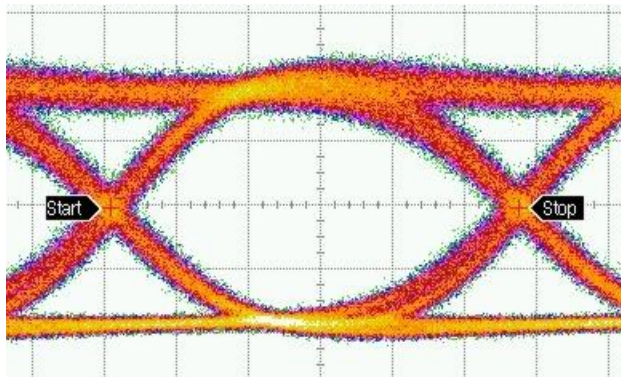
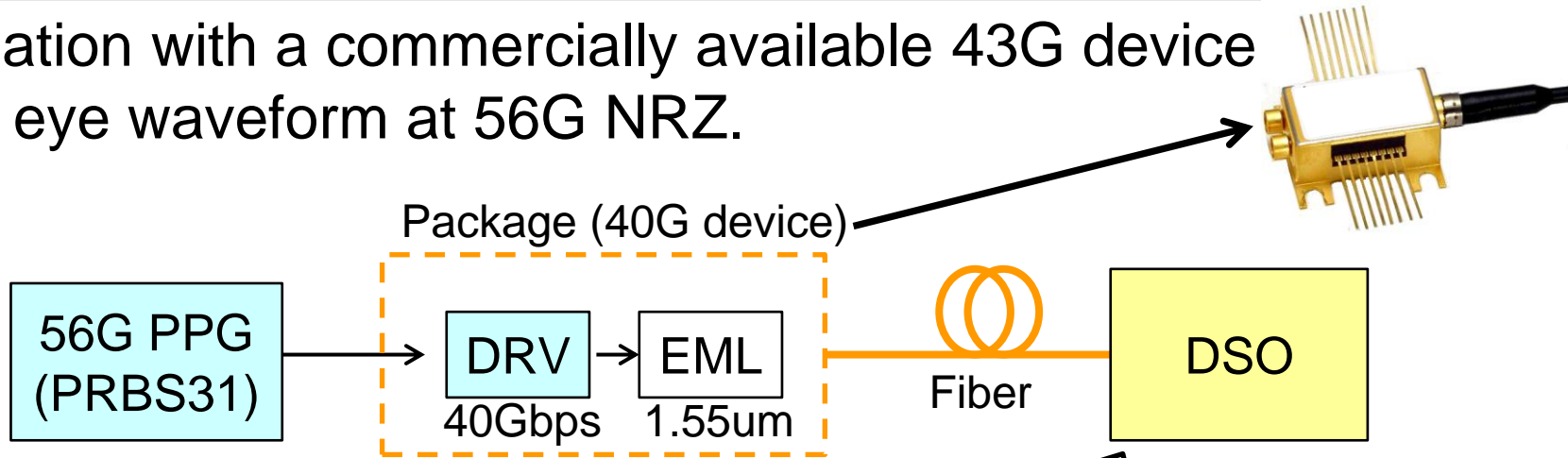
# Eye evaluation of EML chip

-Fine eye waveform at 56G NRZ.

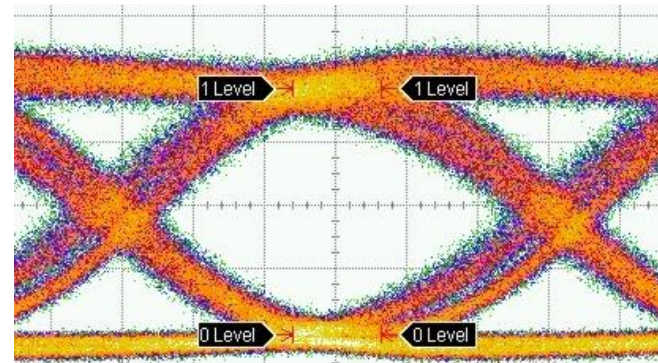


# Eye evaluation of EML with integrated DRV

- Evaluation with a commercially available 43G device
- Clear eye waveform at 56G NRZ.



43Gbps  
Extinction ratio: 12.0dB



56Gbps  
Extinction ratio: 10.4dB

## **Optical signal generation of 56G NRZ modulation was successfully demonstrated**

- EML chip bandwidth
  - Estimated 3dB bandwidth: 38 GHz
  - Large enough for 56GBaud modulation
- Eye waveform evaluation
  - Clear NRZ optical waveform using a 43G EML device

56G NRZ is clearly a very strong candidate for 400GbE PMD